

# 线性代数

## 第一单元：矩阵及其运算

### 习题（） 答

州学 数学与统计学



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1. )

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$$\text{tr}A = a_{11} + a_{22} + \cdots + a_{nn};$$



习题1.1( $P_{30} - P_{32}$ )

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$$\text{tr}A = a_{11} + a_{22} + \cdots + a_{nn}; \quad \text{tr}B = b_{11} + b_{22} + \cdots + b_{nn},$$



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$$\text{tr}A = a_{11} + a_{22} + \cdots + a_{nn}; \quad \text{tr}B = b_{11} + b_{22} + \cdots + b_{nn},$$

以

$$\text{tr}A + \text{tr}B =$$



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$$\text{tr}A = a_{11} + a_{22} + \cdots + a_{nn}; \quad \text{tr}B = b_{11} + b_{22} + \cdots + b_{nn},$$

以

$$\begin{aligned}\text{tr}A + \text{tr}B &= (a_{11} + a_{22} + \cdots + a_{nn}) + (b_{11} + b_{22} + \cdots + b_{nn}) \\ &= \end{aligned}$$



习题1.1( $P_{30} - P_{32}$ )

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$$\text{tr}A = a_{11} + a_{22} + \cdots + a_{nn}; \quad \text{tr}B = b_{11} + b_{22} + \cdots + b_{nn},$$

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$$\begin{aligned}\text{tr}A + \text{tr}B &= (a_{11} + a_{22} + \cdots + a_{nn}) + (b_{11} + b_{22} + \cdots + b_{nn}) \\ &= (a_{11} + b_{11}) + (a_{22} + b_{22}) + \cdots + (a_{nn} + b_{nn}) \\ &= \end{aligned}$$



习题1.1( $P_{30} - P_{32}$ )

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$$\operatorname{tr} A = a_{11} + a_{22} + \cdots + a_{nn}; \quad \operatorname{tr} B = b_{11} + b_{22} + \cdots + b_{nn},$$

以

$$\begin{aligned}\operatorname{tr} A + \operatorname{tr} B &= (a_{11} + a_{22} + \cdots + a_{nn}) + (b_{11} + b_{22} + \cdots + b_{nn}) \\ &= (a_{11} + b_{11}) + (a_{22} + b_{22}) + \cdots + (a_{nn} + b_{nn}) \\ &= \operatorname{tr}(A + B);\end{aligned}$$



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2.) 比对图中各位置对应的像 值，可得图1.1的像  $\hat{Y}$  阵为

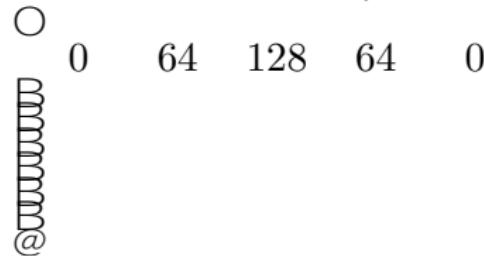
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2.) 比对图中各位置对应的像 值, 可得图1.1的像  $\hat{Y}$  阵为

|   |    |     |     |     |    |
|---|----|-----|-----|-----|----|
| ○ | 0  | 64  | 128 | 64  | 0  |
| ■ | 64 | 128 | 192 | 128 | 64 |
| ◎ |    |     |     |     |    |
| @ |    |     |     |     |    |

习题1.1( $P_{30} - P_{32}$ )

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|      |     |     |     |     |     |
|------|-----|-----|-----|-----|-----|
| ○    | 0   | 64  | 128 | 64  | 0   |
| ■    | 64  | 128 | 192 | 128 | 64  |
| ■■■■ | 128 | 192 | 255 | 192 | 128 |

@

### 习题1.1( $P_{30} - P_{32}$ )

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$$trA = a_{11} + a_{22} + \cdots + a_{nn}; \quad trB = b_{11} + b_{22} + \cdots + b_{nn},$$

以

$$\begin{aligned}
 trA + trB &= (a_{11} + a_{22} + \cdots + a_{nn}) + (b_{11} + b_{22} + \cdots + b_{nn}) \\
 &= (a_{11} + b_{11}) + (a_{22} + b_{22}) + \cdots + (a_{nn} + b_{nn}) \\
 &= tr(A + B):
 \end{aligned}$$

2.) 比对图中各位置对应的像 值, 可得图1.1的像  $\hat{Y}$  阵为

C

$$0 \quad 64 \quad 128 \quad 64 \quad 0$$

$\text{B} \quad 64 \quad 128 \quad 192 \quad 128 \quad 64$

128 192 355 192 128

128 192 255 192 128



### 习题1.1( $P_{30} - P_{32}$ )

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 \end{aligned}$$

2.) 比对图中各位置对应的像 值, 可得图1.1的像  $\hat{Y}$  阵为

|   |     |     |     |     |     |   |
|---|-----|-----|-----|-----|-----|---|
| O | 0   | 64  | 128 | 64  | 0   | 1 |
| B | 64  | 128 | 192 | 128 | 64  | C |
| B | 128 | 192 | 255 | 192 | 128 | C |
| @ | 64  | 128 | 192 | 128 | 64  | A |
| O | 0   | 64  | 128 | 64  | 0   |   |



习题1.1( $P_{30} - P_{32}$ )

3. )



习题1.1( $P_{30} - P_{32}$ )

3.) 比 $\text{图1.2}$ , 其对应的关é 阵为

$$G_1 = \begin{pmatrix} \textcircled{O} \\ 2 & 1 & 1 & 1 & 0 \\ @ \\ @ \end{pmatrix}$$



习题1.1( $P_{30} - P_{32}$ )

3.) 比 $\text{图1.2}$ , 其对应的关é 阵为

$$G_1 = \begin{pmatrix} & & & & \\ & 2 & 1 & 1 & 1 & 0 \\ & 0 & 1 & 1 & 0 & 0 \\ & @ & & & & \end{pmatrix}$$



习题1.1( $P_{30} - P_{32}$ )

3.) 比 $\text{图1.2}$ , 其对应的关é 阵为

$$G_1 = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ @0 \end{matrix} \begin{matrix} 2 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ @0 & 0 & 0 & 1 & 1 \end{matrix}$$



习题1.1( $P_{30} - P_{32}$ )

3.) 比 $\text{图1.2}$ , 其对应的关é Y 阵为

$$G_1 = \begin{matrix} & \textcircled{O} & & & & 1 \\ & 2 & 1 & 1 & 1 & 0 \\ \textcircled{B} & 0 & 1 & 1 & 0 & 0 \\ @ & 0 & 0 & 0 & 1 & 1 \\ & 0 & 0 & 0 & 0 & 1 \end{matrix} \text{A}^{\text{C}}$$



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3.) 比 $\text{图1.2}$ , 其对应的关é Y 阵为

$$G_1 = \begin{array}{ccccc} \textcircled{O} & & & & 1 \\ \textcircled{B} & 2 & 1 & 1 & 1 & 0 \\ \textcircled{C} & 0 & 1 & 1 & 0 & 0 \\ \textcircled{C} & @0 & 0 & 0 & 1 & 1 \\ \textcircled{A} & 0 & 0 & 0 & 0 & 1 \end{array} :$$

比 $\text{图1.3}$ , 其对应的关é Y 阵为

$$G_2 = \begin{array}{cccccc} \textcircled{O} & & & & & & \\ \textcircled{B} & 1 & 0 & 0 & 0 & 0 & 1 \\ \textcircled{C} & @ & & & & & \end{array}$$

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3.) 比 $\text{图1.2}$ , 其对应的关é Y 阵为

$$G_1 = \begin{array}{ccccc} \textcircled{O} & & & & 1 \\ \textcircled{B} & 2 & 1 & 1 & 1 & 0 \\ \textcircled{C} & 0 & 1 & 1 & 0 & 0 \\ \textcircled{C} & @0 & 0 & 0 & 1 & 1 \\ \textcircled{A} & 0 & 0 & 0 & 0 & 1 \end{array} :$$

比 $\text{图1.3}$ , 其对应的关é Y 阵为

$$G_2 = \begin{array}{cccccc} \textcircled{O} & & & & & & \\ \textcircled{B} & 1 & 0 & 0 & 0 & 0 & 1 \\ \textcircled{B} & 1 & 1 & 1 & 1 & 0 & 0 \\ @ & & & & & & \end{array}$$

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3.) 比 $\text{图1.2}$ , 其对应的关é Y 阵为

$$G_1 = \begin{array}{ccccc} \textcircled{O} & & & & 1 \\ \textcircled{B} & 2 & 1 & 1 & 1 & 0 \\ \textcircled{C} & 0 & 1 & 1 & 0 & 0 \\ \textcircled{C} & @0 & 0 & 0 & 1 & 1 \\ \textcircled{A} & 0 & 0 & 0 & 0 & 1 \end{array} :$$

比 $\text{图1.3}$ , 其对应的关é Y 阵为

$$G_2 = \begin{array}{cccccc} \textcircled{O} & & & & & & \\ \textcircled{B} & 1 & 0 & 0 & 0 & 0 & 1 \\ \textcircled{C} & 1 & 1 & 1 & 1 & 0 & 0 \\ \textcircled{C} & @0 & 1 & 0 & 0 & 1 & 0 \end{array}$$

### 习题1.1( $P_{30} - P_{32}$ )

3.) 比图1.2, 其对应的关éÝ阵为

$$G_1 = \begin{pmatrix} O & & & & & 1 \\ & 2 & 1 & 1 & 1 & 0 \\ B & & 1 & 1 & 0 & 0 \\ @ & 0 & 0 & 0 & 1 & 1 \\ @ & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

比图1.3, 其对应的关éÝ阵为

$$G_2 = \begin{matrix} O \\ \text{---} \\ 1 & 0 & 0 & 0 & 0 & 1 \\ \text{---} \\ 1 & 1 & 1 & 1 & 0 & 0 \\ @0 & 1 & 0 & 0 & 1 & 0 \\ \text{---} \\ 0 & 0 & 1 & 1 & 1 & 1 \end{matrix}$$



习题1.1( $P_{30} - P_{32}$ )

4.(1))

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4.(1)) 是 梯形 $\mathbf{Y}$ 阵;











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4.(1)) 是 梯形 $\mathbf{Y}$ 阵；也是规范 梯形 $\mathbf{Y}$ 阵；

4.(2)) 是 梯形 $\mathbf{Y}$ 阵；不是规范 梯形 $\mathbf{Y}$ 阵.第二行主3的列有别的非零 ；











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4.(1)) 是 梯形 $\backslash$ 阵；也是规范 梯形 $\backslash$ 阵；

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4.(3)) 不是 梯形 $\backslash$ 阵；不是规范 梯形 $\backslash$ 阵.因第二行、第三行主 3同一列，不是 梯形，也不是规范形；

4.(4))

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5.) 有8种不同的( 果.

$$\begin{matrix} \textcircled{O} & & 1 \\ & 4 & 3 & 8 \\ \textcircled{B} & @9 & 5 & 1 \textcircled{A} \\ & 2 & 7 & 6 \end{matrix}$$

习题1.1( $P_{30} - P_{32}$ )

4.(1)) 是 梯形 $\tilde{Y}$ 阵；也是规范 梯形 $\tilde{Y}$ 阵；

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5.) 有8种不同的(果.

$$\begin{array}{ccc} \textcircled{1} & \textcircled{1} & \textcircled{1} \\ \begin{matrix} 4 & 3 & 8 \\ @9 & 5 & 1 \end{matrix} & \begin{matrix} 8 & 3 & 4 \\ @1 & 5 & 9 \end{matrix} & \begin{matrix} 2 & 7 & 6 \\ 6 & 7 & 2 \end{matrix} \end{array}$$



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$$\begin{array}{ccccccccc} \textcircled{O} & & 1 & \textcircled{O} & & 1 & \textcircled{O} & & 1 \\ 4 & 3 & 8 & 8 & 3 & 4 & 6 & 1 & 8 \\ \textcircled{B} @ 9 & 5 & 1 \textcircled{A} & \textcircled{B} @ 1 & 5 & 9 \textcircled{A} & \textcircled{B} @ 7 & 5 & 3 \textcircled{A} \\ 2 & 7 & 6 & 6 & 7 & 2 & 2 & 9 & 4 \end{array}$$



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$$\begin{array}{ccccccccc} \textcircled{O} & & \textcircled{O} & & \textcircled{O} & & \textcircled{O} & & \textcircled{O} \\ 4 & 3 & 8 & 1 & 8 & 3 & 4 & 1 & 6 \\ \textcircled{B} @9 & \textcircled{B} @1 & \textcircled{B} @7 & \textcircled{B} @3 & \textcircled{B} @5 & \textcircled{B} @3 & \textcircled{B} @7 & \textcircled{B} @3 & \textcircled{B} @5 \\ 5 & 1 & 9 & 5 & 9 & 5 & 3 & 5 & 7 \\ 2 & 7 & 6 & 6 & 7 & 2 & 9 & 4 & 9 \\ & & & & & & 4 & 2 & \end{array}$$



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5.) 有8种不同的(果.

$$\begin{array}{ccccccccc}
 & & 1 & & 1 & & 1 & & 1 \\
 \textcircled{O} & 4 & 3 & 8 & \textcircled{O} & 8 & 3 & 4 & \textcircled{O} & 6 & 1 & 8 & \textcircled{O} & 8 & 1 & 6 \\
 & \textcircled{B} @9 & 5 & 1 & \textcircled{B} @1 & 5 & 9 & \textcircled{B} @7 & 5 & 3 & \textcircled{B} @3 & 5 & 7 & \textcircled{C} \\
 & 2 & 7 & 6 & 1 & 6 & 7 & 2 & 2 & 9 & 4 & 4 & 9 & 2 \\
 & \textcircled{O} & 4 & 9 & 2 & & & & & & & & & & \\
 & \textcircled{B} @3 & 5 & 7 & \textcircled{C} & & & & & & & & & & \\
 & 8 & 1 & 6 & & & & & & & & & & & 
 \end{array}$$

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$$\begin{array}{ccccccccc}
 & & 1 & & 1 & & 1 & & 1 \\
 \textcircled{O} & 4 & 3 & 8 & \textcircled{O} & 8 & 3 & 4 & \textcircled{O} & 6 & 1 & 8 & \textcircled{O} & 8 & 1 & 6 \\
 & @9 & 5 & 1 & \textcircled{C} & @1 & 5 & 9 & \textcircled{C} & @7 & 5 & 3 & \textcircled{C} & @3 & 5 & 7 & \textcircled{C} \\
 & 2 & 7 & 6 & 1 & 6 & 7 & 2 & 1 & 2 & 9 & 4 & 4 & 9 & 2 \\
 & 4 & 9 & 2 & & 2 & 9 & 4 & & & & & & & & \\
 & \textcircled{B} & @3 & 5 & 7 & \textcircled{C} & @7 & 5 & 3 & \textcircled{C} & & & & & & \\
 & 8 & 1 & 6 & & 6 & 1 & 8 & & & & & & & & 
 \end{array}$$

习题1.1( $P_{30} - P_{32}$ )

4.(1)) 是 梯形 $\tilde{Y}$ 阵；也是规范 梯形 $\tilde{Y}$ 阵；

4.(2)) 是 梯形 $\tilde{Y}$ 阵；不是规范 梯形 $\tilde{Y}$ 阵.第二行主3的列有别的非零；

4.(3)) 不是 梯形 $\tilde{Y}$ 阵；不是规范 梯形 $\tilde{Y}$ 阵.因第二行、第三行主 3同一列，不是 梯形，也不是规范形；

4.(4)) 是 梯形 $\tilde{Y}$ 阵；是规范 梯形 $\tilde{Y}$ 阵.

5.) 有8种不同的(果.

$$\begin{array}{ccccccccc}
 & & 1 & & 1 & & 1 & & 1 \\
 \textcircled{O} & 4 & 3 & 8 & \textcircled{O} & 8 & 3 & 4 & \textcircled{O} & 6 & 1 & 8 & \textcircled{O} & 8 & 1 & 6 \\
 & @9 & 5 & 1 & \textcircled{C} & @1 & 5 & 9 & \textcircled{C} & @7 & 5 & 3 & \textcircled{C} & @3 & 5 & 7 & \textcircled{C} \\
 & 2 & 7 & 6 & 1 & 6 & 7 & 2 & 1 & 2 & 9 & 4 & 1 & 4 & 9 & 2 \\
 & 4 & 9 & 2 & & 2 & 9 & 4 & & 6 & 7 & 2 & & & & \\
 & @3 & 5 & 7 & \textcircled{C} & @7 & 5 & 3 & \textcircled{C} & @1 & 5 & 9 & \textcircled{C} & & & \\
 & 8 & 1 & 6 & & 6 & 1 & 8 & & 8 & 3 & 4 & & & &
 \end{array}$$



习题1.1( $P_{30} - P_{32}$ )

4.(1)) 是 梯形 $\tilde{Y}$ 阵；也是规范 梯形 $\tilde{Y}$ 阵；

4.(2)) 是 梯形 $\tilde{Y}$ 阵；不是规范 梯形 $\tilde{Y}$ 阵.第二行主3的列有别的非零；

4.(3)) 不是 梯形 $\tilde{Y}$ 阵；不是规范 梯形 $\tilde{Y}$ 阵.因第二行、第三行主 3同一列，不是 梯形，也不是规范形；

4.(4)) 是 梯形 $\tilde{Y}$ 阵；是规范 梯形 $\tilde{Y}$ 阵.

5.) 有8种不同的(果.

|   |  |  |  |
|---|--|--|--|
| $\begin{array}{ccc} \textcircled{1} & 4 & 3 \\ @ & 9 & 5 \end{array}$ | $\begin{array}{ccc} \textcircled{1} & 8 & 3 \\ @1 & 5 \end{array}$ | $\begin{array}{ccc} \textcircled{1} & 6 & 1 \\ @7 & 5 \end{array}$ | $\begin{array}{ccc} \textcircled{1} & 8 & 1 \\ @3 & 5 \end{array}$ |
| $\begin{array}{ccc} 8 & 3 & 4 \\ @ & 9 & 7 \end{array}$               | $\begin{array}{ccc} 6 & 2 & 4 \\ @7 & 5 \end{array}$               | $\begin{array}{ccc} 2 & 7 & 2 \\ @1 & 5 \end{array}$               | $\begin{array}{ccc} 4 & 9 & 2 \\ @9 & 5 \end{array}$               |
| $\begin{array}{ccc} 1 & 6 & 8 \\ @3 & 5 & 8 \end{array}$              | $\begin{array}{ccc} 1 & 8 & 3 \\ @ & 1 & 6 \end{array}$            | $\begin{array}{ccc} 1 & 4 & 3 \\ @ & 1 & 8 \end{array}$            | $\begin{array}{ccc} 1 & 6 & 8 \\ @ & 7 & 9 \end{array}$            |

习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。



习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。

6.)

### 习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。

6.) 由图1.5可以得到  $A =$

|    |   |   |   |   |
|----|---|---|---|---|
| O  |   |   |   | 1 |
| 0  | 1 | 1 | 1 | C |
| 1  | 0 | 0 | 0 | C |
| @0 | 1 | 0 | 0 | A |
| 1  | 0 | 1 | 0 |   |



习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。

$$6.) \text{ 由图1.5可以得到 } A = \begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}$$

$$\text{由题中 给法K计 , 得 } B = A^2 = \begin{pmatrix} 1 & 0 & 1 & 0 \\ 2 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 2 & 1 & 1 \end{pmatrix}$$



习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。

$$6.) \text{ 由图1.5可以得到 } A = \begin{pmatrix} & & & 1 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ @0 & 1 & 0 & 0 \end{pmatrix}$$

$$\text{由题中给法计，得 } B = A^2 = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 \\ 2 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 \\ @1 & 0 & 0 & 0 & 0 \\ 0 & 2 & 1 & 1 & 1 \end{pmatrix}$$

矩阵B中  $b_{kl}$  的意义是：一次中转由  $k$  到  $l$  的航线数。

习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。

$$6.) \text{ 由图1.5可以得到 } A = \begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}$$

$$\text{由题中给法计算, 得 } B = A^2 = \begin{pmatrix} 1 & 0 & 1 & 0 \\ 2 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

$$0 \quad 2 \quad 1 \quad 1$$

矩阵B中  $b_{kl}$  的意义是: 从一次中转由k到l的航线数。如  $b_{11} = 2$ , 意思是由1出发, 一次中转到1的航线数是2, 是1

习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。

$$6.) \text{ 由图1.5可以得到 } A = \begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}$$

$$\text{由题中 给法K计 , 得 } B = A^2 = \begin{pmatrix} 1 & 0 & 1 & 0 \\ 2 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

$$0 \quad 2 \quad 1 \quad 1$$

矩阵B中  $b_{kl}$  的意义是: 从一次中转由k到l的航线数。如  $b_{11} = 2$ , 意思是由1出发, 一次中转到1的航线数是2, 是1 → 4

习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。

$$6.) \text{ 由图1.5可以得到 } A = \begin{pmatrix} & & & 1 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ @0 & 1 & 0 & 0 \end{pmatrix}$$

$$\text{由题中 给法K计 , 得 } B = A^2 = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 \\ 2 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 \\ @1 & 0 & 0 & 0 & 0 \\ 0 & 2 & 1 & 1 & 1 \end{pmatrix}$$

矩阵B中  $b_{kl}$  的意义是: 从一次中转由k到l的航线数。

如  $b_{11} = 2$ , 意 由1出发, 一次中转到1的航线数

是2, 是  $1 \rightarrow 4 \rightarrow 1$ ;

习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。

$$6.) \text{ 由图1.5可以得到 } A = \begin{pmatrix} & & & 1 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ @0 & 1 & 0 & 0 \end{pmatrix}$$

$$\text{由题中 给法K计 , 得 } B = A^2 = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 \\ 2 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 \\ @1 & 0 & 0 & 0 & 0 \\ 0 & 2 & 1 & 1 & 1 \end{pmatrix}$$

矩阵B中  $b_{kl}$  的意义是: 从一次中转由k到l的航线数。

如  $b_{11} = 2$ , 意 由1出发, 一次中转到1的航线数

是2, 是  $1 \rightarrow 4 \rightarrow 1$ ; 1

习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。

$$6.) \text{ 由图1.5可以得到 } A = \begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}$$

$$\text{由题中给法计算, 得 } B = A^2 = \begin{pmatrix} 1 & 0 & 1 & 0 \\ 2 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

$$0 \quad 2 \quad 1 \quad 1$$

矩阵B中  $b_{kl}$  的意义是: 从一次中转由k到l的航线数。

如  $b_{11} = 2$ , 意思是由1出发, 一次中转到1的航线数

是2, 是  $1 \rightarrow 4 \rightarrow 1; 1 \rightarrow 2$

习题1.1( $P_{30} - P_{32}$ )

观察 的关系，会发现 之间的行、列互换和转置关系。

$$6.) \text{ 由图1.5可以得到 } A = \begin{pmatrix} & & & 1 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ @0 & 1 & 0 & 0 \end{pmatrix}$$

$$\text{由题中 给法K计 , 得 } B = A^2 = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 \\ 2 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 \\ @1 & 0 & 0 & 0 & 0 \\ 0 & 2 & 1 & 1 & 1 \end{pmatrix}$$

阵B中  $b_{kl}$  的意义是: 2 一次中转由 k 到 l 的航线数 .

如  $b_{11} = 2$ , 意 是由 1 出发, 2 一次中转到 1 的航线数

是 2, 是  $1 \rightarrow 4 \rightarrow 1; 1 \rightarrow 2 \rightarrow 1;$

习题1.1( $P_{30} - P_{32}$ )

如 $b_{42} = 2$ , 意  $\bigcirc$ 是由4出发,  $\square$ 一次中转到2的航线数是2,  $\blacksquare$ 是4



习题1.1( $P_{30} - P_{32}$ )

如 $b_{42} = 2$ , 意  $\bigcirc$ 是由4出发,  $\square$  一次中转到2的航线数是2,  $\blacksquare$  是4  $\longrightarrow 1$



习题1.1( $P_{30} - P_{32}$ )

如 $b_{42} = 2$ , 意  $\bigcirc$ 是由4出发,  $\square$ 一次中转到2的航线数是2,  $\blacksquare$ 是 $4 \rightarrow 1 \rightarrow 2$ ;



习题1.1( $P_{30} - P_{32}$ )

如 $b_{42} = 2$ , 意  $\bigcirc$ 是由4出发,  $\square$ 一次中转到2的航线数是2,  $\blacksquare$ 是 $4 \rightarrow 1 \rightarrow 2; 4$



习题1.1( $P_{30} - P_{32}$ )

如 $b_{42} = 2$ , 意  $\bigcirc$ 是由4出发,  $\square$ 一次中转到2的航线数是2,  $\blacksquare$ 是 $4 \rightarrow 1 \rightarrow 2; 4 \rightarrow 3$



习题1.1( $P_{30} - P_{32}$ )

如 $b_{42} = 2$ , 意  $\bigcirc$ 是由4出发,  $\square$ 一次中转到2的航线数是2,  $\blacksquare$ 是 $4 \rightarrow 1 \rightarrow 2; 4 \rightarrow 3 \rightarrow 2$ .



习题1.2( $P_{33} - P_{36}$ )

1.(1))



习题1.2( $P_{33} - P_{36}$ )

1.(1))  $= \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \\ 23 & 4 \end{matrix};$

习题1.2( $P_{33} - P_{36}$ )

$$1.(1)) = \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \\ 23 & 4 \end{matrix}; \quad 1.(2))$$

习题1.2( $P_{33} - P_{36}$ )

$$1.(1)) = \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \\ 23 & 4 \end{matrix}; \quad 1.(2)) = \begin{matrix} \textcircled{O} & a_1 + a_2 + a_3 & 1 \\ \textcircled{B} & @b_1 + b_2 + b_3 & \textcircled{C} \\ c_1 + c_2 + c_3 \end{matrix};$$

习题1.2( $P_{33} - P_{36}$ )

$$1.(1)) = \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \\ 23 & 4 \end{matrix}; \quad 1.(2)) = \begin{matrix} \textcircled{O} & a_1 + a_2 + a_3 & 1 \\ \textcircled{B} & @b_1 + b_2 + b_3 & \textcircled{C} \\ c_1 + c_2 + c_3 \end{matrix};$$

1.(3))

习题1.2( $P_{33} - P_{36}$ )

$$1.(1)) = \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \\ 23 & 4 & & \end{matrix}; \quad 1.(2)) = \begin{matrix} \textcircled{O} & a_1 + a_2 + a_3 & 1 \\ \textcircled{B} & @b_1 + b_2 + b_3 & \textcircled{C} \\ c_1 + c_2 + c_3 & & \end{matrix};$$

$$1.(3)) = 27 ;$$

习题1.2( $P_{33} - P_{36}$ )

$$1.(1)) = \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \\ 23 & 4 \end{matrix}; \quad 1.(2)) = \begin{matrix} \textcircled{O} & a_1 + a_2 + a_3 & 1 \\ \textcircled{B} & @b_1 + b_2 + b_3 & \textcircled{C} \\ c_1 + c_2 + c_3 \end{matrix};$$

$$1.(3)) = 27; \quad 1.(4))$$

习题1.2( $P_{33} - P_{36}$ )

$$\begin{array}{l}
 \text{1.(1)) } = \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \end{matrix}; \quad \text{1.(2)) } = \begin{matrix} \textcircled{O} & a_1 + a_2 + a_3 & 1 \\ \textcircled{B} & @b_1 + b_2 + b_3 & \textcircled{C} \end{matrix}; \\
 \text{1.(3)) } = \begin{matrix} 23 & 4 \\ 4 & 7 & 9 \\ 4 & 7 & 9 \end{matrix}; \quad \text{1.(4)) } = \begin{matrix} \textcircled{O} & c_1 + c_2 + c_3 & 1 \\ \textcircled{B} & @8 & 14 & 18 & \textcircled{C} \end{matrix};
 \end{array}$$

习题1.2( $P_{33} - P_{36}$ )

$$\begin{array}{l}
 \text{1.(1)) } = \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \end{matrix}; \quad \text{1.(2)) } = \begin{matrix} \textcircled{O} & a_1 + a_2 + a_3 & 1 \\ \textcircled{B} & @b_1 + b_2 + b_3 & \textcircled{C} \end{matrix}; \\
 \text{1.(3)) } = \begin{matrix} 23 & 4 \\ 4 & 7 & 9 \\ 4 & 7 & 9 \end{matrix}; \quad \text{1.(4)) } = \begin{matrix} \textcircled{O} & c_1 + c_2 + c_3 & 1 \\ \textcircled{B} & @8 & 14 & 18 & \textcircled{C} \end{matrix};
 \end{array}$$

1.(5))

习题1.2( $P_{33} - P_{36}$ )

$$1.(1)) = \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \end{matrix}; \quad 1.(2)) = \begin{matrix} \textcircled{O} & a_1 + a_2 + a_3 & 1 \\ \textcircled{B} & @b_1 + b_2 + b_3 & \textcircled{C} \end{matrix};$$

$$1.(3)) = \begin{matrix} 23 & 4 \\ 27 & \end{matrix}; \quad 1.(4)) = \begin{matrix} \textcircled{O} & c_1 + c_2 + c_3 & 1 \\ \textcircled{B} & 4 & 7 & 9 \\ @8 & 14 & 18 & \textcircled{C} \end{matrix};$$

$$\begin{matrix} 4 & 7 & 9 \end{matrix}$$

$$1.(5)) = \begin{matrix} & & ! \\ 6 & -7 & 8 \\ 20 & -5 & -6 \end{matrix};$$





习题1.2( $P_{33} - P_{36}$ )

$$1.(1)) = \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \end{matrix}; \quad 1.(2)) = \begin{matrix} \textcircled{O} & a_1 + a_2 + a_3 & 1 \\ \textcircled{B} & @b_1 + b_2 + b_3 & \textcircled{C} \end{matrix};$$

$$1.(3)) = \begin{matrix} 23 & 4 \\ 27 & \end{matrix}; \quad 1.(4)) = \begin{matrix} \textcircled{O} & c_1 + c_2 + c_3 & 1 \\ \textcircled{B} & 4 & 7 & 9 \\ @8 & 14 & 18 & \textcircled{C} \end{matrix};$$

$$1.(5)) = \begin{matrix} 6 & -7 & 8 \\ 20 & -5 & -6 \end{matrix}!; \quad 1.(6)) = \begin{matrix} \textcircled{O} & 4 & 7 & 9 & 1 \\ \textcircled{B} & 7 & 28 & 67 \\ @0 & 40 & 104 & \textcircled{C} \\ 0 & 0 & 72 & \end{matrix};$$

1.(7))



习题1.2( $P_{33} - P_{36}$ )

$$1.(1)) = \begin{matrix} \textcircled{O} & 12 & 26 & 1 \\ \textcircled{B} & @-27 & 2 & \textcircled{C} \end{matrix}; \quad 1.(2)) = \begin{matrix} \textcircled{O} & a_1 + a_2 + a_3 & 1 \\ \textcircled{B} & @b_1 + b_2 + b_3 & \textcircled{C} \end{matrix};$$

$$1.(3)) = \begin{matrix} 23 & 4 \\ 27 & \end{matrix}; \quad 1.(4)) = \begin{matrix} \textcircled{O} & c_1 + c_2 + c_3 & 1 \\ \textcircled{B} & 4 & 7 & 9 \\ @8 & 14 & 18 & \textcircled{C} \end{matrix};$$

$$1.(5)) = \begin{matrix} 6 & -7 & 8 \\ 20 & -5 & -6 \end{matrix}!; \quad 1.(6)) = \begin{matrix} \textcircled{O} & 4 & 7 & 9 & 1 \\ \textcircled{B} & 7 & 28 & 67 \\ @0 & 40 & 104 & \textcircled{C} \\ 0 & 0 & 72 & \end{matrix};$$

$$1.(7)) = \begin{matrix} \textcircled{O} & d_1 a_1 & d_1 a_2 & d_1 a_3 & 1 \\ \textcircled{B} & d_2 b_1 & d_2 b_2 & d_2 b_3 & \textcircled{C} \\ @d_3 c_1 & d_3 c_2 & d_3 c_3 & \end{matrix};$$

习题1.2( $P_{33} - P_{36}$ )

1.(8))



习题1.2( $P_{33} - P_{36}$ )

$$1.(8)) = \begin{matrix} \textcircled{O} & d_1a_1 & d_2a_2 & d_3a_3 & 1 \\ \textcircled{B} & @d_1b_1 & d_2b_2 & d_3b_3 \textcircled{C} \\ \textcircled{A} & d_1c_1 & d_2c_2 & d_3c_3 \end{matrix};$$



习题1.2( $P_{33} - P_{36}$ )

$$1.(8)) = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ \textcircled{A} \end{matrix} \begin{matrix} d_1a_1 & d_2a_2 & d_3a_3 \\ d_1b_1 & d_2b_2 & d_3b_3 \\ d_1c_1 & d_2c_2 & d_3c_3 \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix}; \quad 1.(10))$$



习题1.2( $P_{33} - P_{36}$ )

$$1.(8)) = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ \textcircled{A} \end{matrix} \begin{matrix} d_1a_1 & d_2a_2 & d_3a_3 \\ d_1b_1 & d_2b_2 & d_3b_3 \\ d_1c_1 & d_2c_2 & d_3c_3 \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix}; \quad 1.(10)) = 19;$$



习题1.2( $P_{33} - P_{36}$ )

$$1.(8)) = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ \textcircled{A} \end{matrix} \begin{matrix} d_1a_1 & d_2a_2 & d_3a_3 \\ d_1b_1 & d_2b_2 & d_3b_3 \\ d_1c_1 & d_2c_2 & d_3c_3 \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix}; \quad 1.(10)) = 19;$$

1.(9))

习题1.2( $P_{33} - P_{36}$ )

$$\begin{aligned}
 & \text{1.(8)) } = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ \textcircled{C} \end{array} \begin{array}{ccc} d_1a_1 & d_2a_2 & d_3a_3 \\ d_1b_1 & d_2b_2 & d_3b_3 \\ d_1c_1 & d_2c_2 & d_3c_3 \end{array} ; \quad \text{1.(10)) } = 19 ; \\
 & \text{1.(9)) } = a_{11}x^2 + 2a_{12}xy + 2a_1x + a_{22}y^2 + 2a_2y + a_0 ;
 \end{aligned}$$



习题1.2( $P_{33} - P_{36}$ )

$$\begin{array}{c}
 \textcircled{O} & d_1a_1 & d_2a_2 & d_3a_3 & 1 \\
 1.(8)) = \textcircled{B} @ d_1b_1 & d_2b_2 & d_3b_3 \textcircled{C} ; & 1.(10)) = 19 ; \\
 & d_1c_1 & d_2c_2 & d_3c_3 \\
 1.(9)) = a_{11}x^2 + 2a_{12}xy + 2a_1x + a_{22}y^2 + 2a_2y + a_0 ;
 \end{array}$$

2.)

习题1.2( $P_{33} - P_{36}$ )

$$1.(8)) = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ @ \end{matrix} \begin{matrix} d_1a_1 & d_2a_2 & d_3a_3 \\ d_1b_1 & d_2b_2 & d_3b_3 \\ d_1c_1 & d_2c_2 & d_3c_3 \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix}; \quad 1.(10)) = 19;$$

$$1.(9)) = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ @ \end{matrix} \begin{matrix} a_{11}x^2 + 2a_{12}xy + 2a_1x + a_{22}y^2 + 2a_2y + a_0 \\ d_1a_{11} & d_1a_{12} & \cdots & d_1a_{1n} \\ d_2a_{21} & d_2a_{22} & \cdots & d_2a_{2n} \\ \vdots & \vdots & & \vdots \\ d_na_{n1} & d_na_{n2} & \cdots & d_na_{nn} \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix};$$

2.)



习题1.2( $P_{33} - P_{36}$ )

$$1.(8)) = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ @ \end{matrix} \begin{matrix} d_1a_1 & d_2a_2 & d_3a_3 \\ d_1b_1 & d_2b_2 & d_3b_3 \\ d_1c_1 & d_2c_2 & d_3c_3 \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix}; \quad 1.(10)) = 19;$$

$$1.(9)) = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ @ \end{matrix} \begin{matrix} a_{11}x^2 + 2a_{12}xy + 2a_1x + a_{22}y^2 + 2a_2y + a_0 \\ d_1a_{11} & d_1a_{12} & \cdots & d_1a_{1n} \\ d_2a_{21} & d_2a_{22} & \cdots & d_2a_{2n} \\ \vdots & \vdots & & \vdots \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix};$$

$$2.) = \begin{matrix} \textcircled{B} \\ \textcircled{B} \\ @ \end{matrix} \begin{matrix} d_1a_{11} & d_1a_{12} & \cdots & d_1a_{1n} \\ d_2a_{21} & d_2a_{22} & \cdots & d_2a_{2n} \\ \vdots & \vdots & & \vdots \\ d_na_{n1} & d_na_{n2} & \cdots & d_na_{nn} \end{matrix} \begin{matrix} \textcircled{C} \\ \textcircled{C} \\ \textcircled{A} \end{matrix};$$

)

习题1.2( $P_{33} - P_{36}$ )

$$1.(8)) = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ @ \end{matrix} \begin{matrix} d_1a_1 & d_2a_2 & d_3a_3 \\ d_1b_1 & d_2b_2 & d_3b_3 \\ d_1c_1 & d_2c_2 & d_3c_3 \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix}; \quad 1.(10)) = 19;$$

$$1.(9)) = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ @ \end{matrix} \begin{matrix} a_{11}x^2 + 2a_{12}xy + 2a_1x + a_{22}y^2 + 2a_2y + a_0 \\ d_1a_{11} & d_1a_{12} & \cdots & d_1a_{1n} \\ d_2a_{21} & d_2a_{22} & \cdots & d_2a_{2n} \\ \vdots & \vdots & & \vdots \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix};$$

$$2.) = \begin{matrix} \textcircled{B} \\ \textcircled{B} \\ @ \end{matrix} \begin{matrix} d_1a_{11} & d_1a_{12} & \cdots & d_1a_{1n} \\ d_2a_{21} & d_2a_{22} & \cdots & d_2a_{2n} \\ \vdots & \vdots & & \vdots \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix};$$

$$\begin{matrix} \textcircled{O} \\ \textcircled{B} \\ @ \end{matrix} \begin{matrix} d_na_{n1} & d_na_{n2} & \cdots & d_na_{nn} \\ d_1a_{11} & d_2a_{12} & \cdots & d_na_{1n} \\ d_1a_{21} & d_2a_{22} & \cdots & d_na_{2n} \\ \vdots & \vdots & & \vdots \end{matrix} \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{A} \end{matrix}.$$

$$d_1a_{n1} \quad d_2a_{n2} \quad \cdots \quad d_na_{nn}$$



习题1.2( $P_{33} - P_{36}$ )

3.)



习题1.2( $P_{33} - P_{36}$ )

3.)

$$A + B = \begin{matrix} & & ! \\ 1 & 2 & 1 \\ 1 & 2 & 1 \end{matrix} ;$$





习题1.2( $P_{33} - P_{36}$ )

3.)

$$A + B = \begin{vmatrix} 1 & 2 & 1 \\ 1 & 2 & 1 \\ 3 & -2 & -3 \end{vmatrix};$$

$$A - B = \begin{vmatrix} 5 & 0 & -5 \\ 8 & -4 & -7 \end{vmatrix};$$

$$3A - 2B = \begin{vmatrix} 13 & 1 & -12 \end{vmatrix};$$



习题1.2( $P_{33} - P_{36}$ )

4.)



习题1.2( $P_{33} - P_{36}$ )

4.)

$$AB = \begin{matrix} & \textcircled{O} & 5 & 1 \\ & 0 & & \\ & \textcircled{B} & & \\ @0 & -5 & 6 & \textcircled{C} \\ & 2 & 9 & 0 \\ & & & \textcircled{A} \end{matrix} ;$$



习题1.2( $P_{33} - P_{36}$ )

4.)

$$AB = \begin{matrix} & \textcircled{O} & 0 & 5 & 8 & 1 \\ & \textcircled{B} & @0 & -5 & 6 & \textcircled{C} \\ & \textcircled{A} & & & & ; \end{matrix}$$

$$BA = \begin{matrix} & \textcircled{O} & 2 & 9 & 0 & 1 \\ & \textcircled{B} & 6 & 0 & 2 & \\ & \textcircled{A} & @1 & -7 & 5 & \textcircled{C} \\ & & 6 & 4 & -4 & ; \end{matrix}$$



### 习题1.2( $P_{33} - P_{36}$ )

4.)

$$AB = \begin{matrix} & O & 5 & 1 \\ & 0 & & \\ B @ 0 & -5 & 6 & C \\ A & & & \end{matrix}$$

$$BA = \begin{matrix} \textcircled{2} & 9 & 0 & 1 \\ 6 & 0 & 2 & \textcircled{C} \\ @1 & -7 & 5 & \textcircled{A} \end{matrix}$$

$$B^T A^T = \begin{matrix} & \textcircled{6} & 4 & -4 \\ & 0 & 0 & 2 \\ @5 & & -5 & 9\textcircled{A} \end{matrix}$$

8 6 0



习题1.2( $P_{33} - P_{36}$ )

5.(1))



习题1.2( $P_{33} - P_{36}$ )

$$5.(1)) = \begin{matrix} & 1 & 0 \\ & 0 & 1 \end{matrix} ;$$



习题1.2( $P_{33} - P_{36}$ )

$$5.(1)) = \begin{matrix} & 1 & 0 \\ & 0 & 1 \end{matrix} ;$$

5.(2))

习题1.2( $P_{33} - P_{36}$ )

$$5.(1)) = \begin{matrix} & 1 & 0 \\ & 0 & 1 \end{matrix};$$

$$5.(2)) = \begin{matrix} 0 & 0 \\ 0 & 0 \end{matrix};$$

习题1.2( $P_{33} - P_{36}$ )

$$5.(1)) = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix};$$

$$5.(2)) = \begin{vmatrix} 0 & 0 \\ 0 & 0 \end{vmatrix};$$

5.(3))

### 习题1.2( $P_{33} - P_{36}$ )

$$5.(1)) = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix};$$

$$5.(2)) = \begin{matrix} 0 & 0 \\ 0 & 0 \end{matrix};$$

$$\begin{array}{cc} 1 & 1 \\ 0 & 1 \end{array} \quad n = 1;$$

$$n = 1;$$

5.(3)) =



习题1.2( $P_{33} - P_{36}$ )

$$5.(1)) = \begin{matrix} & 1 & 0 \\ & 0 & 1 \end{matrix};$$

$$5.(2)) = \begin{matrix} & 0 & 0 \\ & 0 & 0 \end{matrix};$$

$$\begin{matrix} & 1 & 1 \\ & 0 & 1 \end{matrix} \quad n=1;$$

$$\begin{matrix} & 1 & 2 \\ & 0 & 1 \end{matrix} \quad n=2;$$

$$5.(3)) = \begin{matrix} & 1 & 1 \\ & 0 & 1 \end{matrix}.$$



习题1.2( $P_{33} - P_{36}$ )

$$5.(1)) = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix};$$

$$5.(2)) = \begin{vmatrix} 0 & 0 \\ 0 & 0 \end{vmatrix};$$

$$\begin{matrix} \approx & 1 & 1 \\ & 0 & 1 \end{matrix} \quad n = 1;$$

$$\begin{matrix} \approx & 1 & 2 \\ & 0 & 1 \end{matrix} \quad n = 2;$$

$$5.(3)) = \begin{matrix} \approx & 1 & 3 \\ & 0 & 1 \end{matrix} \quad n = 3;$$



习题1.2( $P_{33} - P_{36}$ )

$$5.(1)) = \begin{matrix} & 1 & 0 \\ & 0 & 1 \end{matrix};$$

$$5.(2)) = \begin{matrix} & 0 & 0 \\ & 0 & 0 \end{matrix};$$

$\approx \begin{matrix} & 1 & 1 \\ & 0 & 1 \end{matrix} \quad n = 1;$

$\approx \begin{matrix} & 1 & 2 \\ & 0 & 1 \end{matrix} \quad n = 2;$

$$5.(3)) = \begin{matrix} & 1 & 3 \\ & 0 & 1 \end{matrix} \quad n = 3;$$

$$\vdots \quad \quad \quad \vdots$$

$$\approx \begin{matrix} & 1 & n \\ & 0 & 1 \end{matrix} \quad \forall n:$$



习题1.2( $P_{33} - P_{36}$ )

5.(4))

习题1.2( $P_{33} - P_{36}$ )

$$\begin{matrix} 8 & \textcircled{O} & & 1 \\ & 0 & 1 & 0 \\ \textcircled{B} @ & 0 & 0 & 1 \textcircled{A} \\ & 0 & 0 & 0 \end{matrix} \quad n = 1;$$

5.(4)) =



习题1.2( $P_{33} - P_{36}$ )

$$\begin{matrix} & \textcircled{O} & & 1 \\ 8 & 0 & 1 & 0 \\ \textcircled{B} @ 0 & 0 & 1 & \textcircled{C} \\ & 0 & 0 & 0 \end{matrix}$$

5.(4)) =



习题1.2( $P_{33} - P_{36}$ )

$$\begin{aligned}
 & \text{8 } \begin{matrix} \circ \\ 0 \\ \text{B} \\ @0 \end{matrix} \begin{matrix} 1 \\ 0 \\ 0 \\ 1 \end{matrix} \begin{matrix} 1 \\ C \\ A \end{matrix} \quad n = 1; \\
 & \text{5.(4))} = \begin{matrix} \circ \\ 0 \\ \text{B} \\ @0 \end{matrix} \begin{matrix} 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 1 \end{matrix} \begin{matrix} 1 \\ C \\ A \end{matrix} \quad n = 2; \\
 & \begin{matrix} \circ \\ 0 \\ \text{B} \\ @0 \end{matrix} \begin{matrix} 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 1 \end{matrix} \begin{matrix} 1 \\ C \\ A \end{matrix} \quad n \geq 3; \\
 & \quad \quad \quad \begin{matrix} 0 \\ 0 \\ 0 \end{matrix}
 \end{aligned}$$



习题1.2( $P_{33} - P_{36}$ )

5.(5))



习题1.2( $P_{33} - P_{36}$ )

5.(5)) 记  $A = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$ ;  $B = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$ ;



习题1.2( $P_{33} - P_{36}$ )

$$5.(5)) \text{ 记 } A = \begin{matrix} \textcircled{O} & 0 & 0 & 1 \\ \textcircled{B} & @0 & 0 & \textcircled{C} \\ 0 & 0 & 0 & 0 \end{matrix}; B = \begin{matrix} \textcircled{O} & 0 & 1 & 1 \\ \textcircled{B} & @0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{matrix};$$

由于 $A$ 是数**p**阶矩阵，以 $A$ 与 $B$ 可换，从而有

习题1.2( $P_{33} - P_{36}$ )

$$5.(5)) \text{ 记 } A = \begin{matrix} \textcircled{O} & 0 & 0 & 1 \\ \textcircled{B} & @0 & 0 & \textcircled{C} \\ 0 & 0 & 0 & \textcircled{A} \end{matrix}; B = \begin{matrix} \textcircled{O} & 0 & 1 & 1 \\ \textcircled{B} & @0 & 0 & 1 \\ 0 & 0 & 0 & \textcircled{A} \end{matrix};$$

由于 $A$ 是数**Y**阵, 以 $A$ 与 $B$ 可换, 从而有

$$(A + B)^n = A^n + C_n^1 A^{n-1} B + C_n^2 A^{n-2} B^2 + C_n^3 A^{n-3} B^3 + \dots$$

习题1.2( $P_{33} - P_{36}$ )

$$5.(5)) \text{ 记 } A = \begin{matrix} & 0 & 0 & 1 \\ \textcircled{O} & @0 & 0 \\ & 0 & 0 \end{matrix}; B = \begin{matrix} & 0 & 1 & 0 \\ \textcircled{O} & @0 & 0 & 1 \\ & 0 & 0 & 0 \end{matrix};$$

由于 $A$ 是数 $\mathbb{Y}$ 阵，以 $A$ 与 $B$ 可换，从而有

$$(A + B)^n = A^n + C_n^1 A^{n-1} B + C_n^2 A^{n-2} B^2 + C_n^3 A^{n-3} B^3 + \dots$$

$$\text{而 } A^m = \begin{matrix} & m & 0 & 0 & 1 \\ \textcircled{O} & @0 & m & 0 \\ & 0 & 0 & m \end{matrix}; \forall m \text{ 为正整数};$$

习题1.2( $P_{33} - P_{36}$ )

$$5.(5)) \text{ 记 } A = \begin{matrix} & 0 & 0 & 1 \\ \textcircled{O} & @0 & 0 \\ & 0 & 0 \end{matrix}; B = \begin{matrix} & 0 & 1 & 0 \\ \textcircled{O} & @0 & 0 & 1 \\ & 0 & 0 & 0 \end{matrix};$$

由于 $A$ 是数 $\mathbb{Y}$ 阵，以 $A$ 与 $B$ 可换，从而有

$$(A + B)^n = A^n + C_n^1 A^{n-1} B + C_n^2 A^{n-2} B^2 + C_n^3 A^{n-3} B^3 + \dots$$

$$\text{而 } A^m = \begin{matrix} & m & 0 & 0 & 1 \\ \textcircled{O} & @0 & m & 0 \\ & 0 & 0 & m \end{matrix}; \forall m \text{ 为正整数};$$

2 | 用5.(4)的(论，

习题1.2( $P_{33} - P_{36}$ )

$$\begin{array}{c}
 \text{8} \\
 \text{C}_n^1 A^{n-1} B = \begin{array}{ccc}
 \text{O} & C_n^1 & n-1 \\
 @0 & 0 & C_n^1 & n-1 \\
 & 0 & 0 & 0
 \end{array} \text{; } \\
 \text{A} \\
 \text{B} \\
 \text{C}
 \end{array}$$



习题1.2( $P_{33} - P_{36}$ )

$$\begin{aligned}
 & C_n^1 A^{n-1} B = \begin{array}{ccccc} O & & & & 1 \\ @0 & C_n^1 & n-1 & 0 & \\ @0 & 0 & & C_n^1 & n-1 \\ & & & & C \end{array}; \\
 & C_n^2 A^{n-2} B^2 = \begin{array}{ccccc} O & 0 & 0 & 1 & 0 \\ @0 & 0 & C_n^2 & n-2 & \\ @0 & 0 & 0 & & C \\ 0 & 0 & 0 & & \end{array}; \\
 & \vdots
 \end{aligned}$$



习题1.2( $P_{33} - P_{36}$ )

$$\begin{aligned}
 & C_n^1 A^{n-1} B = \begin{array}{ccccc} O & & & & 1 \\ @0 & C_n^1 & n-1 & 0 & \\ @0 & 0 & & C_n^1 & n-1 \\ & & & & A \end{array}; \\
 & C_n^2 A^{n-2} B^2 = \begin{array}{ccccc} O & & & & 0 \\ @0 & 0 & C_n^2 & n-2 & 1 \\ @0 & 0 & 0 & & A \\ & & & & \end{array}; \\
 & C_n^m A^{n-m} B^m = \begin{array}{ccccc} O & & & & 0 \\ @0 & 0 & 0 & & 1 \\ @0 & 0 & 0 & & \\ & & & & A \\ & 0 & 0 & 0 & \end{array}: \quad 3 \leq m \leq n;
 \end{aligned}$$



### 习题1.2( $P_{33} - P_{36}$ )

以，

$$8 \text{ O} \quad 1 \quad 0 \quad 1 \\ \text{B} @ 0 \quad 1 \text{ A} \quad n = 1;$$

$$\begin{matrix} O & & & 1_n \\ & 1 & 0 & \\ B @ 0 & & C & \\ & 1A & & \end{matrix} =$$

1A



习题1.2( $P_{33} - P_{36}$ )

以,

$$\begin{matrix} \textcircled{O} & \textcircled{B} @ 0 & \textcircled{A} \\ \textcircled{O} & \textcircled{B} @ 0 & \textcircled{A} \end{matrix} \quad n=1;$$

$$\begin{matrix} \textcircled{O} & \textcircled{B} @ 0 & \textcircled{A} \\ \textcircled{O} & \textcircled{B} @ 0 & \textcircled{A} \end{matrix} = \begin{matrix} \textcircled{O} & \textcircled{B} @ 0 & \textcircled{A} \\ \textcircled{O} & \textcircled{B} @ 0 & \textcircled{A} \end{matrix} \quad n=2;$$

$$\begin{matrix} 0 & 0 \end{matrix}$$

$$\begin{matrix} 0 & 0 & 2 \\ 0 & 0 & 2 \end{matrix}$$

.



习题1.2( $P_{33} - P_{36}$ )

以,

$$\begin{matrix} 8 & \textcircled{O} & 1 & 0 & 1 \\ \curvearrowleft & \textcircled{B} @ 0 & & & \textcircled{C} \\ & & 1 & & \textcircled{A} \end{matrix} \quad n = 1;$$

$$\begin{matrix} \textcircled{O} & 1 & 0 & 1 & n \\ \textcircled{B} @ 0 & & 1 & \textcircled{C} \\ 0 & 0 \end{matrix} = \begin{matrix} \textcircled{O} & 0 & 0 & 1 \\ \curvearrowleft & \textcircled{B} @ 0 & 2 & 2 & \textcircled{C} \\ & & 2 & 2 & \textcircled{A} \end{matrix} \quad n = 2;$$

$$\begin{matrix} \textcircled{O} & 0 & 0 & 2 \\ \textcircled{B} @ 0 & n & n & n-1 \\ 0 & 0 & n & n-1 \end{matrix} \quad \frac{n(n-1)}{2} \quad \begin{matrix} \textcircled{C} & 1 \\ \textcircled{A} & n-2 \end{matrix} \quad n \geq 3:$$



习题1.2( $P_{33} - P_{36}$ )

6.(1))



习题1.2( $P_{33} - P_{36}$ )

6.(1))

$$f(A) =$$



习题1.2( $P_{33} - P_{36}$ )

6.(1))

$$f(A) = A^2 - A - I_3$$

=



习题1.2( $P_{33} - P_{36}$ )

6.(1))

$$\begin{aligned}
 f(A) &= A^2 - A - I_3 \\
 &= \begin{matrix} \textcircled{3} & 1 & 1 \\ @3 & 1 & 2 \end{matrix} \begin{matrix} \textcircled{1} & 2 \\ \textcircled{3} & 1 \end{matrix} - \begin{matrix} \textcircled{3} & 1 & 1 \\ @3 & 1 & 2 \end{matrix} \begin{matrix} \textcircled{1} & 0 & 0 \\ @0 & 1 & 0 \end{matrix} \\
 &\quad \begin{matrix} 1 & -1 & 0 \end{matrix} \quad \begin{matrix} 1 & -1 & 0 \end{matrix} \quad \begin{matrix} 0 & 0 & 1 \end{matrix}
 \end{aligned}$$

=



习题1.2( $P_{33} - P_{36}$ )

6.(1))

$$\begin{aligned}
 f(A) &= A^2 - A - I_3 \\
 &= \begin{matrix} \textcircled{3} & 1 & 1 \\ @3 & 1 & 2 \end{matrix} \text{C} - \begin{matrix} \textcircled{3} & 1 & 1 \\ @3 & 1 & 2 \end{matrix} \text{C} - \begin{matrix} \textcircled{1} & 0 & 0 \\ @0 & 1 & 0 \end{matrix} \text{C} \\
 &= \begin{matrix} \textcircled{1} & -1 & 0 & 1 \\ @13 & 3 & 5 & 3 \end{matrix} \text{C} - \begin{matrix} \textcircled{1} & -1 & 0 & 1 \\ @3 & 1 & 2 \end{matrix} \text{C} - \begin{matrix} \textcircled{0} & 0 & 1 & 1 \\ @0 & 1 & 0 & 0 \end{matrix} \text{C} \\
 &= \begin{matrix} 0 & 0 & -1 \\ @14 & 2 & 5 \end{matrix} \text{C} - \begin{matrix} 1 & -1 & 0 \\ @3 & 1 & 2 \end{matrix} \text{C} - \begin{matrix} 0 & 0 & 1 \\ @0 & 1 & 0 \end{matrix} \text{C}
 \end{aligned}$$

=



习题1.2( $P_{33} - P_{36}$ )

6.(1))

$$\begin{aligned}
 f(A) &= A^2 - A - I_3 \\
 &= \begin{matrix} \textcircled{3} & 1 & 1 \\ @3 & 1 & 2 \end{matrix} \text{C} - \begin{matrix} \textcircled{3} & 1 & 1 \\ @3 & 1 & 2 \end{matrix} \text{C} - \begin{matrix} \textcircled{1} & 0 & 0 \\ @0 & 1 & 0 \end{matrix} \text{C} \\
 &= \begin{matrix} \textcircled{1} & -1 & 0 & 1 \\ @3 & 3 & 5 & 3 \end{matrix} \text{C} - \begin{matrix} \textcircled{1} & -1 & 0 & 1 \\ @3 & 1 & 1 & 1 \end{matrix} \text{C} - \begin{matrix} \textcircled{0} & 0 & 1 & 1 \\ @0 & 1 & 0 & 0 \end{matrix} \text{C} \\
 &= \begin{matrix} \textcircled{0} & 0 & -1 & 1 \\ @9 & 2 & 4 & 1 \end{matrix} \text{C} - \begin{matrix} 1 & -1 & 0 & 0 \\ @1 & 2 & 0 & 0 \end{matrix} \text{C} - \begin{matrix} 0 & 0 & 1 & 1 \\ @0 & 1 & 0 & 0 \end{matrix} \text{C} \\
 &= \begin{matrix} \textcircled{1} & 1 & -2 \\ @11 & 0 & 3 \end{matrix} \text{C}
 \end{aligned}$$



习题1.2( $P_{33} - P_{36}$ )

6.(2))



习题1.2( $P_{33} - P_{36}$ )

6.(2))

$$f(A) =$$



习题1.2( $P_{33} - P_{36}$ )

6.(2))

$$f(A) = A^2 - 5A + 3I_2$$



习题1.2( $P_{33} - P_{36}$ )

6.(2))

$$\begin{aligned}
 f(A) &= A^2 - 5A + 3I_2 \\
 &= \begin{vmatrix} 2 & -1 \\ -3 & 3 \end{vmatrix} - 5 \begin{vmatrix} 2 & -1 \\ -3 & 3 \end{vmatrix} + 3 \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} \\
 &=
 \end{aligned}$$



习题1.2( $P_{33} - P_{36}$ )

6.(2))

$$\begin{aligned}
 f(A) &= A^2 - 5A + 3I_2 \\
 &= \begin{vmatrix} 2 & -1 \\ -3 & 3 \end{vmatrix} - 5 \begin{vmatrix} 2 & -1 \\ -3 & 3 \end{vmatrix} + 3 \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} \\
 &= \begin{vmatrix} 7 & -5 \\ -15 & 12 \end{vmatrix} - \begin{vmatrix} 10 & -5 \\ -15 & 15 \end{vmatrix} + \begin{vmatrix} 3 & 0 \\ 0 & 3 \end{vmatrix} \\
 &= 
 \end{aligned}$$



### 习题1.2( $P_{33} - P_{36}$ )

6.(2))

$$\begin{aligned}
 f(A) &= A^2 - 5A + 3I_2 \\
 &= \begin{matrix} 2 & -1 \\ -3 & 3 \end{matrix} - \begin{matrix} 5 & 0 \\ 0 & 1 \end{matrix} + \begin{matrix} 3 & 0 \\ 0 & 1 \end{matrix} \\
 &= \begin{matrix} 7 & -5 \\ -15 & 12 \end{matrix} - \begin{matrix} 10 & -5 \\ -15 & 15 \end{matrix} + \begin{matrix} 3 & 0 \\ 0 & 3 \end{matrix} \\
 &= \begin{matrix} 0 & 0 \\ 0 & 0 \end{matrix}
 \end{aligned}$$



习题1.2( $P_{33} - P_{36}$ )

6.(3))



习题1.2( $P_{33} - P_{36}$ )

6.(3))

$$f(A) =$$



习题1.2( $P_{33} - P_{36}$ )

6.(3))

$$f(A) = A^2 - 3A + 5I_2$$

=

习题1.2( $P_{33} - P_{36}$ )

6.(3))

$$\begin{aligned}
 f(A) &= A^2 - 3A + 5I_2 \\
 &= \begin{matrix} a & 0 \\ 0 & b \end{matrix}^2 - 3 \begin{matrix} a & 0 \\ 0 & b \end{matrix} + 5 \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix} \\
 &=
 \end{aligned}$$



习题1.2( $P_{33} - P_{36}$ )

6.(3))

$$\begin{aligned}
 f(A) &= A^2 - 3A + 5I_2 \\
 &= \begin{vmatrix} a & 0 \\ 0 & b \end{vmatrix} - 3 \begin{vmatrix} a & 0 \\ 0 & b \end{vmatrix} + 5 \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} \\
 &= \begin{vmatrix} a^2 & 0 \\ 0 & b^2 \end{vmatrix} - \begin{vmatrix} 3a & 0 \\ 0 & 3b \end{vmatrix} + \begin{vmatrix} 5 & 0 \\ 0 & 5 \end{vmatrix} \\
 &= 
 \end{aligned}$$



习题1.2( $P_{33} - P_{36}$ )

6.(3))

$$\begin{aligned}
 f(A) &= A^2 - 3A + 5I_2 \\
 &= \begin{vmatrix} a & 0 \\ 0 & b \end{vmatrix} - 3 \begin{vmatrix} a & 0 \\ 0 & b \end{vmatrix} + 5 \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} \\
 &= \begin{vmatrix} a^2 & 0 \\ 0 & b^2 \end{vmatrix} - \begin{vmatrix} 3a & 0 \\ 0 & 3b \end{vmatrix} + \begin{vmatrix} 5 & 0 \\ 0 & 5 \end{vmatrix} \\
 &= \begin{matrix} a^2 - 3a + 5 & 0 \\ 0 & b^2 - 3b + 5 \end{matrix}
 \end{aligned}$$



### 习题1.2( $P_{33} - P_{36}$ )

6.(3))

$$\begin{aligned}
 f(A) &= A^2 - 3A + 5I_2 \\
 &= \begin{vmatrix} a & 0 \\ 0 & b \end{vmatrix} - 3 \begin{vmatrix} a & 0 \\ 0 & b \end{vmatrix} + 5 \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} \\
 &= \begin{vmatrix} a^2 & 0 \\ 0 & b^2 \end{vmatrix} - \begin{vmatrix} 3a & 0 \\ 0 & 3b \end{vmatrix} + \begin{vmatrix} 5 & 0 \\ 0 & 5 \end{vmatrix} \\
 &= \begin{vmatrix} a^2 - 3a + 5 & 0 \\ 0 & b^2 - 3b + 5 \end{vmatrix} \\
 &= \begin{vmatrix} f(a) & 0 \\ 0 & f(b) \end{vmatrix}
 \end{aligned}$$





习题1.2( $P_{33} - P_{36}$ )

7.) 因为  $B^2 = I$ , 以  $B^{2012} =$

习题1.2( $P_{33} - P_{36}$ )

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习题1.2( $P_{33} - P_{36}$ )

7.) 因为  $B^2 = I$ , 以  $B^{2012} = (B^2)^{506} = I$ ;

$$B^{2012}AB^{2013} =$$



习题1.2( $P_{33} - P_{36}$ )

7.) 因为  $B^2 = I$ , 以  $B^{2012} = (B^2)^{506} = I$ ;

$$B^{2012}AB^{2013} = IABB^{2012} =$$



习题1.2( $P_{33} - P_{36}$ )

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### 习题1.2( $P_{33} - P_{36}$ )

$$7.) \text{ 因为 } B^2 = I, \text{ 以 } B^{2012} = (B^2)^{506} = I; \\ B^{2012}AB^{2013} = IABB^{2012} = AB = \begin{matrix} 1 & 2 & 0 & 1 \\ 3 & 4 & 1 & 0 \end{matrix} =$$



习题1.2( $P_{33} - P_{36}$ )

7.) 因为  $B^2 = I$ , 以  $B^{2012} = (B^2)^{506} = I$ ;

$$B^{2012}AB^{2013} = IABB^{2012} = AB = \begin{matrix} 1 & 2 & 0 & 1 \\ 3 & 4 & 1 & 0 \end{matrix} =$$

!

$$\begin{matrix} 2 & 1 \\ 4 & 3 \end{matrix} .$$



习题1.2( $P_{33} - P_{36}$ )

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$$B^{2012}AB^{2013} = IABB^{2012} = AB = \begin{matrix} 1 & 2 & 0 & 1 \\ 3 & 4 & 1 & 0 \end{matrix} =$$

$$\begin{matrix} ! & & & \\ 2 & 1 & & \\ 4 & 3 & . & \end{matrix}$$

8.)

习题1.2( $P_{33} - P_{36}$ )

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$$\begin{matrix} 2 & 1 \\ 4 & 3 \end{matrix} .$$

8.)  $x^T A x =$

习题1.2( $P_{33} - P_{36}$ )

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!

$$\begin{matrix} 2 & 1 \\ 4 & 3 \end{matrix} .$$

8.)  $x^T Ax = \begin{matrix} x_1 & x_2 & x_3 \end{matrix} \begin{matrix} 1 & 2 & 1 \\ @3 & 4 & 0 \end{matrix} \begin{matrix} x_1 \\ x_2 \\ x_3 \end{matrix} =$

$$\begin{matrix} 0 & 1 & 2 \end{matrix} \begin{matrix} 3 \\ B \\ C \\ A \\ B \\ @x_2 \\ x_3 \end{matrix}$$

### 习题1.2( $P_{33} - P_{36}$ )

7.) 因为  $B^2 = I$ , 所以  $B^{2012} = (B^2)^{506} = I$ ;

$$B^{2012}AB^{2013} = IABB^{2012} = AB = \begin{matrix} 1 & 2 & 0 & 1 \\ 3 & 4 & 1 & 0 \end{matrix} =$$

2 1

4 3

$$8.) \quad x^T A x = \begin{matrix} & & & & & \\ & O & 1 & 2 & 1 & O & 1 \\ & B & @3 & 4 & 0 & C & B \\ x_1 & x_2 & x_3 & & & x_1 & x_2 & x_3 \\ & & & & & & & \\ & 0 & 1 & 2 & & & & x_3 \end{matrix}$$

$$x_1^2 + 5x_1x_2 + x_1x_3 + 4x_2^2 + x_2x_3 + 2x_3^2$$

习题1.2( $P_{33} - P_{36}$ )

7.) 因为  $B^2 = I$ , 以  $B^{2012} = (B^2)^{506} = I$ ;

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### 习题1.2( $P_{33} - P_{36}$ )

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2 1  
4 3

$$8.) \quad x^T A x = \begin{matrix} & & & & & \\ & O & 1 & 2 & 1 & 1 & O & 1 \\ & B & @3 & 4 & 0 & C & B & C \\ x_1 & x_2 & x_3 & & & x_1 & x_2 & x_3 \\ & & & & & & & \\ & 0 & 1 & 2 & & & & x_3 \end{matrix}$$

$$x_1^2 + 5x_1x_2 + x_1x_3 + 4x_2^2 + \cancel{x_2x_3} + 2x_3^2: \quad 1 \text{ O } -$$

$$x^T A x = \begin{matrix} & & & a_{11} & a_{12} & a_{13} & & x_1 \\ x_1 & x_2 & x_3 & @a_{21} & a_{22} & a_{23} & @x_2 & C \\ & & & a_{31} & a_{32} & a_{33} & & x_3 \end{matrix}$$



习题1.2( $P_{33} - P_{36}$ )

7.) 因为  $B^2 = I$ , 以  $B^{2012} = (B^2)^{506} = I$ ;

$$B^{2012}AB^{2013} = IABB^{2012} = AB = \begin{matrix} 1 & 2 & 0 & 1 \\ 3 & 4 & 1 & 0 \end{matrix} =$$

!

$$\begin{matrix} 2 & 1 \\ 4 & 3 \end{matrix} .$$

$$8.) x^T Ax = \begin{matrix} x_1 & x_2 & x_3 \end{matrix} \begin{matrix} 1 & 2 & 1 \\ @3 & 4 & 0 \end{matrix} \begin{matrix} 1 & 0 & 1 \\ x_1 \\ @x_2 \end{matrix} =$$

$$\begin{matrix} 0 & 1 & 2 & x_3 \end{matrix}$$

$$x_1^2 + 5x_1x_2 + x_1x_3 + 4x_2^2 + \cancel{x_2x_3} + 2x_3^2: \quad \begin{matrix} 1 & 0 & 1 \end{matrix}$$

$$x^T Ax = \begin{matrix} x_1 & x_2 & x_3 \end{matrix} \begin{matrix} a_{11} & a_{12} & a_{13} \\ @a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{matrix} \begin{matrix} x_1 \\ @x_2 \\ x_3 \end{matrix} = a_{11}x_1^2 +$$

$$(a_{12} + a_{21})x_1x_2 + (a_{13} + a_{31})x_1x_3 + a_{22}x_2^2 + (a_{23} + a_{32})x_2x_3 + a_{33}x_3^2.$$



习题1.2( $P_{33} - P_{36}$ )

9.)



习题1.2( $P_{33} - P_{36}$ )

9.)  $= I + B + B^2 - B - B^2 - B^3 =$



习题1.2( $P_{33} - P_{36}$ )

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习题1.2( $P_{33} - P_{36}$ )

9.)  $= I + B + B^2 - B - B^2 - B^3 = I - B^3 = I.$



习题1.2( $P_{33} - P_{36}$ )

$$9.) = I + B + B^2 - B - B^2 - B^3 = I - B^3 = I.$$

10.)

习题1.2( $P_{33} - P_{36}$ )

9.)  $= I + B + B^2 - B - B^2 - B^3 = I - B^3 = I.$

10.) | 用 $\text{Y}$ 阵乘法的(合律, 有



习题1.2( $P_{33} - P_{36}$ )

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10.) | 用 $\mathbf{Y}$ 阵乘法的(合律, 有 $(\quad)^T)^2 =$











习题1.2( $P_{33} - P_{36}$ )

9.)  $= I + B + B^2 - B - B^2 - B^3 = I - B^3 = I.$

10.) | 用 $\bar{Y}$ 阵乘法的(合律, 有 $(\text{ }^T)^2 = (\text{ }^T)^T$ ,

而 $(\text{ }^T)$ 是一个 $1 \times 1$  $\bar{Y}$ 阵, 其与 $\bar{Y}$ 阵的乘积可以看作

数 $(\text{ }^T)$ 与 $\bar{Y}$ 阵的积, 以 $(\begin{smallmatrix} & & \\ 1 & -1 & 1 \\ & 1 & 2 \end{smallmatrix})^T = (\text{ }^T)$ ,

$$\text{而 } (\text{ }^T)^2 = \begin{matrix} \text{B} \\ @-1 & 1 & -1 \end{matrix} \text{C} = \begin{matrix} \text{B} \\ @-3 & 3 & -3 \end{matrix} \text{C} = \begin{matrix} & & \\ 1 & -1 & 1 \\ & 3 & -3 & 3 \end{matrix}$$





习题1.2( $P_{33} - P_{36}$ )

$$9.) = I + B + B^2 - B - B^2 - B^3 = I - B^3 = I.$$

10.) | 用 $\mathbf{Y}$ 阵乘法的(合律, 有 $(\mathbf{T})^2 = (\mathbf{T}) \mathbf{T}$ ,

而 $(\mathbf{T})$ 是一个 $1 \times 1$  $\mathbf{Y}$ 阵, 其与 $\mathbf{Y}$ 阵的乘积可以看作

数 $(\mathbf{T})$ 与 $\mathbf{Y}$ 阵的积, 以 $(\mathbf{T}) \mathbf{Y} = (\mathbf{T})$

$$\text{而 } (\mathbf{T})^2 = \mathbf{B} @ \begin{matrix} 1 & -1 & 1 \\ -1 & 1 & -1 \end{matrix} \mathbf{C} = \mathbf{B} @ \begin{matrix} 3 & -3 & 3 \\ -3 & 3 & -3 \end{matrix} \mathbf{C} =$$

$$\mathbf{O} @ \begin{matrix} 1 & -1 & 1 \\ 1 & -1 & 1 \\ -1 & 1 & -1 \end{matrix} \mathbf{C}, \quad \text{以 } \mathbf{T} = 3.$$

$$\begin{matrix} 1 & -1 & 1 \end{matrix}$$



## 习题1.2( $P_{33} - P_{36}$ )

11. 证

习题1.2( $P_{33} - P_{36}$ )

11. 证 因为  $B_1; B_2$  都与  $A$  可换,



习题1.2( $P_{33} - P_{36}$ )

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$$B_1 A = A B_1; B_2 A = A B_2.$$



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$$(B_1 + B_2)A =$$



习题1.2( $P_{33} - P_{36}$ )

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$$(B_1 + B_2)A = B_1 A + B_2 A =$$



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$$(B_1 + B_2)A = B_1 A + B_2 A = A B_1 + A B_2 =$$



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$$B_1 A = A B_1; B_2 A = A B_2. \quad \text{以}$$

$$(B_1 + B_2)A = B_1 A + B_2 A = A B_1 + A B_2 = A(B_1 + B_2);$$



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$B_1 + B_2, B_1 B_2$  与  $A$  可换.



习题1.2( $P_{33} - P_{36}$ )

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$B_1 + B_2, B_1 B_2$  与  $A$  可换.

12.)

习题1.2( $P_{33} - P_{36}$ )

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$$B_1 A = AB_1; B_2 A = AB_2. \quad \text{以}$$

$$(B_1 + B_2)A = B_1 A + B_2 A = AB_1 + AB_2 = A(B_1 + B_2);$$

$$(B_1 B_2)A = B_1(B_2 A) = B_1(AB_2) = (B_1 A)B_2 = (AB_1)B_2 = A(B_1 B_2);$$

$B_1 + B_2, B_1 B_2$  与  $A$  可换。!

12.) 因为  $AB = \begin{matrix} 6+a & 4+b \\ a-3 & b-2 \end{matrix}$ ,

习题1.2( $P_{33} - P_{36}$ )

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$$(B_1 B_2)A = B_1(B_2 A) = B_1(AB_2) = (B_1 A)B_2 = (AB_1)B_2 = A(B_1 B_2);$$

$B_1 + B_2, B_1 B_2$  与  $A$  可换。!

12.) 因为  $AB = \begin{matrix} 6+a & 4+b \\ a-3 & b-2 \end{matrix}, BA = \begin{matrix} a+b & 2a-b \\ 5 & 4 \end{matrix}$



习题1.2( $P_{33} - P_{36}$ )

11. 证 因为  $B_1, B_2$  都与  $A$  可换，以

$$B_1A = AB_1; B_2A = AB_2. \quad \text{以}$$

$$(B_1 + B_2)A = B_1A + B_2A = AB_1 + AB_2 = A(B_1 + B_2);$$

$$(B_1B_2)A = B_1(B_2A) = B_1(AB_2) = (B_1A)B_2 = (AB_1)B_2 = A(B_1B_2);$$

$B_1 + B_2, B_1B_2$  与  $A$  可换。!

12.) 因为  $AB = \begin{matrix} 6+a & 4+b \\ a-3 & b-2 \end{matrix}, BA = \begin{matrix} a+b & 2a-b \\ 5 & 4 \end{matrix}$  !

又因为  $AB = BA$ , 即  $\begin{matrix} 6+a & 4+b \\ a-3 & b-2 \end{matrix} = \begin{matrix} a+b & 2a-b \\ 5 & 4 \end{matrix}$ ,

### 习题1.2( $P_{33} - P_{36}$ )

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$$(B_1 + B_2)A = B_1A + B_2A = AB_1 + AB_2 = A(B_1 + B_2);$$

$$(B_1 B_2) A = B_1 (B_2 A) = B_1 (A B_2) = (B_1 A) B_2 = (A B_1) B_2 =$$

$$A(B_1 B_2);$$

$B_1 + B_2$ 、 $B_1 B_2$ 与 $A$ 可换.

$$12.) \text{ 因为 } AB = \begin{matrix} 6+a & 4+b \\ a-3 & b-2 \end{matrix}, \quad BA = \begin{matrix} a+b & 2a-b \\ 5 & 4 \end{matrix}$$

$$\text{又因为 } AB = BA, \text{ 即 } \begin{pmatrix} 6+a & 4+b \\ a-3 & b-2 \end{pmatrix} = \begin{pmatrix} a+b & 2a-b \\ 5 & 4 \end{pmatrix},$$

比上一个 $\bar{Y}$ 阵的，由 $\bar{Y}$ 阵的相等得  $a = 8$   
 $b = 6$



习题1.2( $P_{33} - P_{36}$ )

13.(1))

习题1.2( $P_{33} - P_{36}$ )

13.(1))  $AX = b;$

习题1.2( $P_{33} - P_{36}$ )

13.(1))  $A\mathbf{X} = \mathbf{b};$

13.(2))



习题1.2( $P_{33} - P_{36}$ )

$$13.(1)) \quad AX = b;$$

$$13.(2)) \quad YB = c;$$



习题1.2( $P_{33} - P_{36}$ )

13.(1))  $AX = b;$

13.(2))  $YB = c;$

13.(3))

习题1.2( $P_{33} - P_{36}$ )

13.(1))  $AX = b;$

13.(2))  $YB = c;$

13.(3))  $B = A^T; Y = X^T; c = b^T,$

习题1.2( $P_{33} - P_{36}$ )

$$13.(1)) \quad AX = b;$$

$$13.(2)) \quad YB = c;$$

$$13.(3)) \quad B = A^T; \quad Y = X^T; \quad c = b^T,$$

$$(AX)^T = X^TA^T = YB.$$



习题1.2( $P_{33} - P_{36}$ )

13.(1))  $AX = b;$

13.(2))  $YB = c;$

13.(3))  $B = A^T; Y = X^T; c = b^T,$

$(AX)^T = X^TA^T = YB.$

14.)

习题1.2( $P_{33} - P_{36}$ )13.(1))  $AX = b$ ;13.(2))  $YB = c$ ;13.(3))  $B = A^T$ ;  $Y = X^T$ ;  $c = b^T$ , $(AX)^T = X^T A^T = YB$ . !14.) ~如,  $A = \begin{matrix} 1 & 1 \\ -1 & -1 \end{matrix}$ ;  $B = \begin{matrix} 1 & -1 \\ -1 & 1 \end{matrix}$ ,

习题1.2( $P_{33} - P_{36}$ )13.(1))  $AX = b$ ;13.(2))  $YB = c$ ;13.(3))  $B = A^T$ ;  $Y = X^T$ ;  $c = b^T$ , $(AX)^T = X^T A^T = YB$ . !14.) ~如,  $A = \begin{matrix} 1 & 1 \\ -1 & -1 \end{matrix}$ ;  $B = \begin{matrix} 1 & -1 \\ -1 & 1 \end{matrix}$ ,有 $(A + B)^2 =$

习题1.2( $P_{33} - P_{36}$ )13.(1))  $AX = b$ ;13.(2))  $YB = c$ ;13.(3))  $B = A^T$ ;  $Y = X^T$ ;  $c = b^T$ , $(AX)^T = X^T A^T = YB$ . ! !14.) ~如,  $A = \begin{matrix} 1 & 1 \\ -1 & -1 \end{matrix}$ ;  $B = \begin{matrix} 1 & -1 \\ -1 & 1 \end{matrix}$ ,有 $(A + B)^2 = \begin{matrix} 2 & 0 \\ -2 & 0 \end{matrix} =$ 

### 习题1.2( $P_{33} - P_{36}$ )

$$13.(1)) \quad AX = b;$$

$$13.(2)) \quad YB = c;$$

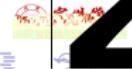
$$13.(3)) \quad B = A^T; \quad Y = X^T; \quad c = b^T,$$

$$(AX)^T = X^T A^T = YB. \quad |$$

14.) ~如,  $A = \begin{pmatrix} 1 & 1 \\ -1 & -1 \end{pmatrix}$ ;  $B = \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ ,

$$\text{有 } (A+B)^2 = \begin{pmatrix} 2 & 0 \\ -2 & 0 \end{pmatrix}^2 = \begin{pmatrix} 4 & 0 \\ -4 & 0 \end{pmatrix},$$





### 习题1.2( $P_{33} - P_{36}$ )

$$13.(1)) \quad AX = b;$$

$$13.(2)) \quad YB = c;$$

$$13.(3)) \quad B = A^T; \quad Y = X^T; \quad c = b^T,$$

$$(AX)^T = X^T A^T = YB. \quad | \quad |$$

14.) ~如,  $A = \begin{pmatrix} 1 & 1 \\ -1 & -1 \end{pmatrix}$ ;  $B = \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ ,

$$\text{有 } (A+B)^2 = \begin{pmatrix} 2 & 0 \\ -2 & 0 \end{pmatrix}^2 = \begin{pmatrix} 4 & 0 \\ -4 & 0 \end{pmatrix},$$

$$A^2 + 2AB + B^2$$

$$= \begin{matrix} 1 & 1 \\ -1 & -1 \end{matrix} + 2 \begin{matrix} 1 & 1 \\ -1 & -1 \end{matrix} - \begin{matrix} 1 & -1 \\ -1 & 1 \end{matrix} + \begin{matrix} 1 & -1 \\ -1 & 1 \end{matrix}$$

二



### 习题1.2( $P_{33} - P_{36}$ )

$$13.(1)) \quad AX = b;$$

$$13.(2)) \quad YB = c;$$

$$13.(3)) \quad B = A^T; \quad Y = X^T; \quad c = b^T,$$

$$(AX)^T = X^T A^T = YB. \quad |$$

14.) ~如,  $A = \begin{pmatrix} 1 & 1 \\ -1 & -1 \end{pmatrix}$ ;  $B = \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ ,

$$\text{有 } (A+B)^2 = \begin{pmatrix} 2 & 0 \\ -2 & 0 \end{pmatrix}^2 = \begin{pmatrix} 4 & 0 \\ -4 & 0 \end{pmatrix},$$

$$A^2 + 2AB + B^2$$

$$= \begin{matrix} 1 & 1 \\ -1 & -1 \end{matrix} + 2 \begin{matrix} 1 & 1 \\ -1 & -1 \end{matrix} - \begin{matrix} 1 & -1 \\ -1 & 1 \end{matrix}$$

$$= \begin{pmatrix} 2 & -2 \\ -2 & 2 \end{pmatrix}$$



习题1.2( $P_{33} - P_{36}$ )

13.(1))  $AX = b;$

13.(2))  $YB = c;$

13.(3))  $B = A^T; Y = X^T; c = b^T,$

$(AX)^T = X^T A^T = YB.$  !

14.) ~如,  $A = \begin{matrix} 1 & 1 \\ -1 & -1 \end{matrix}; B = \begin{matrix} 1 & -1 \\ -1 & 1 \end{matrix},$

有  $(A + B)^2 = \begin{matrix} 2 & 0 \\ -2 & 0 \end{matrix} = \begin{matrix} 4 & 0 \\ -4 & 0 \end{matrix},$

$$\begin{aligned}
 & A^2 + 2AB + B^2 \\
 &= \begin{matrix} 1 & 1 \\ -1 & -1 \end{matrix} + 2 \begin{matrix} 1 & 1 \\ -1 & -1 \end{matrix} + \begin{matrix} 1 & -1 \\ -1 & 1 \end{matrix} \\
 &= \begin{matrix} 2 & -2 \\ -2 & 2 \end{matrix} \neq (A + B)^2.
 \end{aligned}$$



习题1.2( $P_{33} - P_{36}$ )

因为  $(A + B)^2 = A^2 + AB + BA + B^2$ , 以

$$(A + B)^2 = A^2 + 2AB + B^2$$

习题1.2( $P_{33} - P_{36}$ )

因为  $(A + B)^2 = A^2 + AB + BA + B^2$ , 以

$$(A + B)^2 = A^2 + 2AB + B^2$$

$$\Leftrightarrow A^2 + AB + BA + B^2 = A^2 + 2AB + B^2$$

习题1.2( $P_{33} - P_{36}$ )

因为  $(A + B)^2 = A^2 + AB + BA + B^2$ , 以

$$(A + B)^2 = A^2 + 2AB + B^2$$

$$\Leftrightarrow A^2 + AB + BA + B^2 = A^2 + 2AB + B^2$$

$$\Leftrightarrow AB = BA.$$

习题1.2( $P_{33} - P_{36}$ )

因为  $(A + B)^2 = A^2 + AB + BA + B^2$ , 以

$$(A + B)^2 = A^2 + 2AB + B^2$$

$$\Leftrightarrow A^2 + AB + BA + B^2 = A^2 + 2AB + B^2$$

$$\Leftrightarrow AB = BA.$$

即  $(A + B)^2 = A^2 + 2AB + B^2$  的充要条件是  $AB = BA$ .



习题1.2( $P_{33} - P_{36}$ )

因为  $(A + B)^2 = A^2 + AB + BA + B^2$ , 以

$$(A + B)^2 = A^2 + 2AB + B^2$$

$$\Leftrightarrow A^2 + AB + BA + B^2 = A^2 + 2AB + B^2$$

$$\Leftrightarrow AB = BA.$$

即  $(A + B)^2 = A^2 + 2AB + B^2$  的充要条件是  $AB = BA$ .

15.)

习题1.2( $P_{33} - P_{36}$ )

因为  $(A + B)^2 = A^2 + AB + BA + B^2$ , 以

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即  $(A + B)^2 = A^2 + 2AB + B^2$  的充要条件是  $AB = BA$ .

15.) 以  $x_k$  记第  $k$  周周末 3 校学生比率, 以  $y_k$  记第  $k$  周周末回

家学生比率,

习题1.2( $P_{33} - P_{36}$ )

因为  $(A + B)^2 = A^2 + AB + BA + B^2$ , 以

$$(A + B)^2 = A^2 + 2AB + B^2$$

$$\Leftrightarrow A^2 + AB + BA + B^2 = A^2 + 2AB + B^2$$

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15.) 以  $x_k$  记第  $k$  周周末 3 校学生比率, 以  $y_k$  记第  $k$  周周末回

家学生比率,  $\text{K } x_1 = \frac{70}{100}, y_1 = \frac{30}{100}$ ,

习题1.2( $P_{33} - P_{36}$ )

因为  $(A + B)^2 = A^2 + AB + BA + B^2$ , 以

$$(A + B)^2 = A^2 + 2AB + B^2$$

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15.) 以  $x_k$  记第  $k$  周周末 3 校学生比率, 以  $y_k$  记第  $k$  周周末回

$$\text{家学生比率, } \text{且 } x_1 = \frac{70}{100}, y_1 = \frac{30}{100}, \text{ 且 } \begin{aligned} x_{k+1} &= \frac{1}{5}x_k + \frac{3}{5}y_k \\ y_{k+1} &= \frac{4}{5}x_k + \frac{2}{5}y_k \end{aligned},$$



习题1.2( $P_{33} - P_{36}$ )

因为  $(A + B)^2 = A^2 + AB + BA + B^2$ , 以

$$(A + B)^2 = A^2 + 2AB + B^2$$

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15.) 以  $x_k$  记第  $k$  周周末 3 校学生比率, 以  $y_k$  记第  $k$  周周末回

$$\text{家学生比率, } \begin{matrix} x_1 = \frac{70}{100}, \\ y_1 = \frac{30}{100} \end{matrix} \text{ 且 } \begin{matrix} x_{k+1} = \frac{1}{5}x_k + \frac{3}{5}y_k \\ y_{k+1} = \frac{4}{5}x_k + \frac{2}{5}y_k \end{matrix},$$

用  $\begin{pmatrix} x_{k+1} \\ y_{k+1} \end{pmatrix}$  阵表示, 即为  $\begin{pmatrix} x_{k+1} \\ y_{k+1} \end{pmatrix} = \begin{pmatrix} \frac{1}{5} & \frac{3}{5} \\ \frac{4}{5} & \frac{2}{5} \end{pmatrix} \begin{pmatrix} x_k \\ y_k \end{pmatrix}, k = 2, 3, 4, \dots$

习题1.2( $P_{33} - P_{36}$ )

因为  $(A + B)^2 = A^2 + AB + BA + B^2$ , 以

$$(A + B)^2 = A^2 + 2AB + B^2$$

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15.) 以  $x_k$  记第  $k$  周周末 3 校学生比率, 以  $y_k$  记第  $k$  周周末回

$$\text{家学生比率, } \begin{matrix} x_1 = \frac{70}{100}, y_1 = \frac{30}{100}, \text{ 且} \\ | \qquad | \end{matrix} \begin{matrix} x_{k+1} = \frac{1}{5}x_k + \frac{3}{5}y_k \\ y_{k+1} = \frac{4}{5}x_k + \frac{2}{5}y_k \end{matrix},$$

用  $\begin{pmatrix} x_{k+1} \\ y_{k+1} \end{pmatrix}$  阵表示, 即为

$$\begin{matrix} x_{k+1} & = & \frac{1}{5} & \frac{3}{5} & x_k \\ y_{k+1} & = & \frac{4}{5} & \frac{2}{5} & y_k \end{matrix}, \quad k = 2, 3, 4, \dots$$

$$\begin{matrix} x_5 & = & \frac{1}{5} & \frac{3}{5} & x_1 \\ y_5 & = & \frac{4}{5} & \frac{2}{5} & y_1 \end{matrix},$$

习题1.2( $P_{33} - P_{36}$ )

$$\text{计} \quad \begin{matrix} 1 & 3 \\ \frac{1}{5} & \frac{3}{5} \end{matrix}^4 = \begin{matrix} 277 & 261 \\ \frac{277}{625} & \frac{261}{625} \end{matrix},$$

习题1.2( $P_{33} - P_{36}$ )

计 
$$\begin{array}{r|rr} & 3 & 4 \\ \hline 1 & \overline{5} & = \end{array} \quad \begin{array}{r|rr} 277 & 261 \\ \hline 625 & 625 \\ 348 & 364 \\ \hline 625 & |625 \end{array},$$

以 
$$\begin{array}{r|rrr} x_5 & 277 & 261 & 70 \\ \hline 625 & 625 & 30 \\ y_5 & 348 & 364 & 100 \\ \hline 625 & 625 & 100 \end{array}$$



习题1.2( $P_{33} - P_{36}$ )

$$\begin{array}{c}
 \text{计} \\
 \begin{array}{r}
 \frac{1}{5} \quad \frac{3}{5} \quad | \quad 4 \\
 \frac{4}{5} \quad | \quad \frac{2}{5} \\
 \end{array}
 = \begin{array}{r}
 \frac{277}{625} \quad \frac{261}{625} \\
 \frac{348}{625} \quad | \frac{364}{625} \\
 \end{array}, \\
 \text{以} \quad \begin{array}{r}
 x_5 = \frac{277}{625} \quad \frac{261}{625} \quad \frac{70}{100} \\
 y_5 = \frac{348}{625} \quad \frac{364}{625} \quad | \frac{30}{100} \\
 \end{array} = \begin{array}{r}
 \frac{2722}{6250} \\
 \frac{3528}{6250}
 \end{array}
 \end{array}$$



习题1.2( $P_{33} - P_{36}$ )

计 
$$\begin{matrix} & 3 & | & 4 \\ \frac{1}{5} & \frac{3}{5} & = & \frac{277}{625} & \frac{261}{625} \\ & 4 & | & 2 \\ \frac{4}{5} & \frac{2}{5} & & \frac{348}{625} & \frac{364}{625} \\ & & & | & 625 \end{matrix},$$

以 
$$\begin{matrix} x_5 & = & \frac{277}{625} & \frac{261}{625} & \frac{70}{100} & = & \frac{2722}{6250} \\ y_5 & = & \frac{348}{625} & \frac{364}{625} & \frac{30}{100} & = & \frac{3528}{6250} \end{matrix}$$

16.)



习题1.2( $P_{33} - P_{36}$ )

$$\begin{array}{c}
 \text{计} \quad \begin{array}{cc|cc}
 \frac{1}{5} & \frac{3}{5} & \frac{277}{625} & \frac{261}{625} \\
 \frac{4}{5} & \frac{2}{5} & \frac{348}{625} & \frac{364}{625} \\
 \hline
 & & \frac{625}{625} & \frac{1625}{625}
 \end{array}, \\
 \text{以} \quad \begin{array}{ccc|c}
 x_5 & = & \frac{277}{625} & \frac{261}{625} \\
 y_5 & = & \frac{348}{625} & \frac{364}{625} \\
 \hline
 & & \frac{70}{100} & \frac{30}{100}
 \end{array} = \frac{2722}{6250} \\
 \end{array}$$

16.) 以 $x_k; y_k; z_k$ 分别表示三个年龄组(0~5、6~10、10~15)3  $k \times 5$ 年后的动物数， $K$



习题1.2( $P_{33} - P_{36}$ )

$$\begin{array}{c}
 \text{计} \quad \left| \begin{array}{cc} 1 & 3 \\ 5 & 5 \end{array} \right|^4 = \left| \begin{array}{cc} 277 & 261 \\ 625 & 625 \end{array} \right|, \\
 \quad \left| \begin{array}{cc} 4 & 2 \\ 5 & 5 \end{array} \right| = \left| \begin{array}{cc} 348 & 364 \\ 625 & 625 \end{array} \right|, \\
 \text{以} \quad \left| \begin{array}{cc} x_5 & 277 & 261 & 70 \\ y_5 & 348 & 364 & 30 \end{array} \right| = \left| \begin{array}{cc} 2722 & 2722 \\ 6250 & 6250 \end{array} \right|
 \end{array}$$

16.) 以 $x_k, y_k, z_k$ 分别表示三个年龄组(0~5、6~10、10~15)3年后的动物数， $\kappa$

$$\geq x_{k+1} = 4y_k + 3z_k$$

$$> y_{k+1} = \frac{1}{2}x_k \quad ; \quad k = 0, 1, 2, 3;$$

$$z_{k+1} = \frac{1}{4}z_k$$



习题1.2( $P_{33} - P_{36}$ )

$$\begin{array}{c}
 \text{计} \quad \left| \begin{array}{cc} 1 & 3 \\ 5 & 5 \end{array} \right|^4 = \left| \begin{array}{cc} 277 & 261 \\ 625 & 625 \end{array} \right|, \\
 \quad \left| \begin{array}{cc} 4 & 2 \\ 5 & 5 \end{array} \right| = \left| \begin{array}{cc} 348 & 364 \\ 625 & 625 \end{array} \right|, \\
 \text{以} \quad \begin{array}{l} x_5 = \frac{277}{625} \frac{261}{625} \frac{70}{100} = \frac{2722}{6250} \\ y_5 = \frac{348}{625} \frac{364}{625} \frac{30}{100} = \frac{3528}{6250} \end{array}
 \end{array}$$

16.) 以 $x_k, y_k, z_k$ 分别表示三个年龄组(0~5、6~10、

10~15) 3k × 5年后的动物数 | , K

$$\begin{array}{ll}
 \geq x_{k+1} = 4y_k + 3z_k & \geq x_0 = 1000 \\
 > y_{k+1} = \frac{1}{2}x_k & ; k = 0; 1; 2; 3; > y_0 = 1000, \\
 & z_{k+1} = \frac{1}{4}z_k & z_0 = 1000
 \end{array}$$



习题1.2( $P_{33} - P_{36}$ )

$$\begin{array}{c} \text{计} \\ \begin{array}{ccccc} & & 4 & & \\ \frac{1}{5} & \frac{3}{5} & = & \frac{277}{625} & \frac{261}{625} \\ & \frac{4}{5} & & \frac{348}{625} & \frac{364}{625} \\ & & & | & | \\ & & & 625 & 625 \end{array}, \\ \text{以} \quad \begin{array}{ccccc} x_5 & = & \frac{277}{625} & \frac{261}{625} & \frac{70}{100} \\ y_5 & = & \frac{348}{625} & \frac{364}{625} & \frac{30}{100} \end{array} = \begin{array}{c} 2722 \\ 6250 \\ 3528 \\ 6250 \end{array} \end{array}$$

16.) 以 $x_k, y_k, z_k$ 分别表示三个年龄组(0~5、6~10、

10~15) 3k × 5年后的动物数 | , K

$$\begin{array}{ll} \geq x_{k+1} = 4y_k + 3z_k & \geq x_0 = 1000 \\ > y_{k+1} = \frac{1}{2}x_k & ; k = 0, 1, 2, 3; \\ > z_{k+1} = \frac{1}{4}z_k & > y_0 = 1000, \\ & \vdots \quad \quad \quad \vdots \quad \quad \quad \vdots \quad \quad \quad \vdots \quad \quad \quad \vdots \end{array}$$

$$x_{k+1} \quad 0 \quad 4 \quad 3 \quad x_k \\ \text{Y 阵表示, 即为 } \begin{pmatrix} B \\ y_{k+1} \\ C \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ \frac{1}{2} & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} B \\ y_k \\ C \end{pmatrix},$$

$$\begin{matrix} z_{k+1} & 0 & \frac{1}{4} & 0 & z_k \end{matrix}$$



习题1.2( $P_{33} - P_{36}$ )

15年后,  $k = 2$ ,



习题1.2( $P_{33} - P_{36}$ )

15年后,  $k=2$ ,

$$\begin{matrix} & x_3 \\ \text{B} & \text{C} \\ @y_3 & \end{matrix} = \begin{matrix} & 0 & 4 & 3 \\ & 1 & 3 & 0 \\ \text{B} & \text{C} \\ @\frac{1}{2} & 0 & 0 & \end{matrix} \begin{matrix} & x_0 \\ \text{B} & \text{C} \\ @y_0 & \end{matrix}$$

$$\begin{matrix} & z_3 \\ & 0 & \frac{1}{4} & 0 \\ & 0 & 4 & 3 \\ \text{计} & \text{Y} \text{ 阵} \text{C} \\ @\frac{1}{2} & 0 & 0 & \end{matrix} = \begin{matrix} & z_0 \\ & 0 & \frac{3}{8} & 8 & 6 & 1 \\ & 0 & \frac{3}{8} & 1 & 0 & \text{C} \\ & 0 & \frac{1}{2} & 0 & 0 & \frac{3}{8} & \end{matrix},$$



习题1.2( $P_{33} - P_{36}$ )

15年后,  $k=2$ ,

$$\begin{matrix} & x_3 \\ \text{B}_{y_3} & = \end{matrix} \begin{matrix} 0 & 4 & 3 \\ @\frac{1}{2} & 0 & 0 \end{matrix} \begin{matrix} 1 & 3 \\ \text{C} \\ @y_0 \end{matrix} \begin{matrix} 1 \\ x_0 \\ \text{C} \end{matrix}$$

$$\begin{matrix} z_3 \\ & 0 & \frac{1}{4} & 0 \\ & 0 & 4 & 3 \\ \text{计 } \text{Y} \text{ 阵} & @\frac{1}{2} & 0 & 0 \end{matrix} \begin{matrix} 1 & 3 \\ \text{C} \\ @1 \end{matrix} = \begin{matrix} z_0 \\ 0 \\ \frac{3}{8} \\ 8 \\ 6 \\ 1 \end{matrix} \begin{matrix} 1 & \frac{3}{8} & 0 \\ \text{C} \\ @1 \end{matrix},$$

$$\begin{matrix} & 0 & \frac{1}{4} & 0 & 0 \\ & 1 & 0 & 1 & 1 \\ \text{B}_{y_3} & = \end{matrix} \begin{matrix} x_3 \\ @1 \\ \frac{3}{8} \\ 8 \\ 6 \\ 1000 \end{matrix} \begin{matrix} \text{C} \\ @1 \\ \frac{3}{8} \\ 0 \\ @1000 \end{matrix} =$$

$$\begin{matrix} z_3 \\ 0 & \frac{1}{2} & \frac{3}{8} & 1000 \end{matrix}$$



习题1.2( $P_{33} - P_{36}$ )

15年后,  $k=2$ ,

$$\begin{matrix} & & 1 & 3 & & 1 \\ & & 0 & 4 & 3 & \\ \text{B}_{y_3} & \text{C} = & \text{B}_{\frac{1}{2}} & 0 & 0 & \text{C} \end{matrix} \quad \begin{matrix} & & x_0 \\ & & 1 \end{matrix}$$

$$\begin{matrix} z_3 & 0 & \frac{1}{4} & 0 & z_0 \\ & 0 & 4 & 3 & \\ \text{计} & \text{Y} \text{阵} & \text{B}_{\frac{1}{2}} & 0 & 0 \end{matrix} = \begin{matrix} & & \frac{3}{8} & 8 & 6 & 1 \\ & & 1 & \frac{3}{8} & 0 & \text{C} \end{matrix},$$

$$\begin{matrix} & 0 & \frac{1}{4} & 0 & 0 & \frac{1}{2} & \frac{3}{8} & 1 \\ & 8 & 6 & 1000 & 1 & \frac{1}{2} & \frac{3}{8} & 14375 \\ \text{B}_{y_3} & \text{C} = & \text{B}_1 & \text{C} & \text{B}_{1000} & \text{C} = & \text{B}_{1375} & \text{C} \end{matrix}$$

$$z_3 \quad 0 \quad \frac{1}{2} \quad \frac{3}{8} \quad 1000 \quad 875$$



习题1.2( $P_{33} - P_{36}$ )

17.)



习题1.2( $P_{33} - P_{36}$ )

(17.) 以 $x_k, y_k$ 分别表示A, B公司第 $k$ 年后的市场份额, 公式为

$$\begin{aligned} x_{k+1} &= \frac{1}{4}x_k + \frac{1}{3}y_k & k = 0, 1, 2, \dots, \text{用矩阵表示即为} \\ y_{k+1} &= \frac{3}{4}x_k + \frac{2}{3}y_k \end{aligned}$$

$$\begin{matrix} x_{k+1} \\ y_{k+1} \end{matrix} = \begin{pmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{pmatrix} \begin{matrix} x_k \\ y_k \end{matrix}, \quad \begin{matrix} x_0 \\ y_0 \end{matrix} = \begin{pmatrix} \frac{3}{5} \\ \frac{2}{5} \end{pmatrix},$$



习题1.2( $P_{33} - P_{36}$ )

(17.) 以 $x_k, y_k$ 分别表示A, B公司第 $k$ 年后的市场份额, 则

$$\begin{aligned} x_{k+1} &= \frac{1}{4}x_k + \frac{1}{3}y_k ; \quad k = 0, 1, 2, \dots, \\ y_{k+1} &= \frac{3}{4}x_k + \frac{2}{3}y_k \end{aligned}$$

$$\begin{matrix} x_{k+1} \\ y_{k+1} \end{matrix} = \begin{pmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{pmatrix} \begin{matrix} x_k \\ y_k \end{matrix}, \quad \begin{matrix} x_0 \\ y_0 \end{matrix} = \begin{pmatrix} \frac{3}{5} \\ \frac{2}{5} \end{pmatrix},$$

$$\text{以, 第2年后, } \begin{matrix} x_2 \\ y_2 \end{matrix} = \begin{pmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{pmatrix}^2 \begin{matrix} x_0 \\ y_0 \end{matrix},$$



习题1.2( $P_{33} - P_{36}$ )

(17.) 以 $x_k, y_k$ 分别表示A, B公司第 $k$ 年后的市场份额, 用矩阵表示即为

$$\begin{aligned} & \begin{aligned} x_{k+1} &= \frac{1}{4}x_k + \frac{1}{3}y_k \\ y_{k+1} &= \frac{3}{4}x_k + \frac{2}{3}y_k \end{aligned} ; \quad k = 0, 1, 2, \dots, \text{用矩阵表示即为} \\ & \begin{matrix} x_{k+1} \\ y_{k+1} \end{matrix} = \begin{pmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{pmatrix} \begin{matrix} x_k \\ y_k \end{matrix}, \quad \begin{matrix} x_0 \\ y_0 \end{matrix} = \begin{pmatrix} \frac{3}{5} \\ \frac{2}{5} \end{pmatrix}, \end{aligned}$$

以, 第2年后,

$$\begin{matrix} x_2 \\ y_2 \end{matrix} = \begin{pmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{pmatrix}^2 \begin{matrix} x_0 \\ y_0 \end{matrix},$$

$$\text{计} \quad \begin{pmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{pmatrix}^2 = \begin{pmatrix} \frac{5}{16} & \frac{11}{36} \\ \frac{11}{16} & \frac{25}{36} \end{pmatrix},$$



习题1.2( $P_{33} - P_{36}$ )

(17.) 以 $x_k, y_k$ 分别表示A, B公司第 $k$ 年后的市场份额, 用矩阵表示即为

$$\begin{aligned} x_{k+1} &= \frac{1}{4}x_k + \frac{1}{3}y_k & k = 0, 1, 2, \dots, \\ y_{k+1} &= \frac{3}{4}x_k + \frac{2}{3}y_k \end{aligned}$$

$$\begin{matrix} x_{k+1} \\ y_{k+1} \end{matrix} = \begin{pmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{pmatrix} \begin{matrix} x_k \\ y_k \end{matrix}, \quad \begin{matrix} x_0 \\ y_0 \end{matrix} = \begin{pmatrix} \frac{3}{5} \\ \frac{2}{5} \end{pmatrix},$$

$$\text{以, 第2年后, } \begin{matrix} x_2 \\ y_2 \end{matrix} = \begin{pmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{pmatrix}^2 \begin{matrix} x_0 \\ y_0 \end{matrix},$$

$$\text{计 } \begin{pmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{pmatrix}^2 = \begin{pmatrix} \frac{5}{16} & \frac{11}{36} \\ \frac{11}{16} & \frac{25}{36} \end{pmatrix},$$

$$\text{以, } \begin{matrix} x_2 \\ y_2 \end{matrix} = \begin{pmatrix} \frac{5}{16} & \frac{11}{36} \\ \frac{11}{16} & \frac{25}{36} \end{pmatrix} \begin{pmatrix} \frac{3}{5} \\ \frac{2}{5} \end{pmatrix} =$$

### 习题1.2( $P_{33} - P_{36}$ )

( 17.) 以  $x_k$ ;  $y_k$  分别表示 A; B 公司在第  $k$  年后的市场份额,

K  $x_{k+1} = \frac{1}{4}x_k + \frac{1}{3}y_k$  ;  $k = 0, 1, 2, \dots$ , 用Y阵表示即为  
 $y_{k+1} = \frac{3}{4}x_k + \frac{2}{3}y_k$

$$\begin{array}{rcl} x_{k+1} & = & \frac{1}{4} \quad \frac{1}{3} \quad x_k \\ y_{k+1} & = & \frac{3}{4} \quad \frac{2}{3} \quad y_k \end{array} ; \quad \begin{array}{rcl} x_0 & = & \frac{3}{5} \\ y_0 & = & \frac{2}{5} \end{array} ,$$

以，第2年后，

$$\begin{array}{rcl} x_2 & = & \frac{1}{4} \\ y_2 & = & \frac{3}{4} \end{array} \quad \begin{array}{rcl} x_0 & = & 2 \\ y_0 & = & \frac{2}{3} \end{array},$$

计

$$\begin{array}{c|ccccc} 1 & 1 & 2 & \frac{5}{16} & \frac{11}{36} \\ \hline \frac{1}{4} & \frac{1}{3} & = & \frac{11}{16} & \frac{25}{36} \\ \frac{3}{4} & 2 & \frac{2}{3} & \frac{16}{16} & \frac{36}{36} \end{array}$$

以，

$$\begin{array}{rcl} x_2 & = & \frac{5}{16} \quad \frac{11}{36} \quad \frac{3}{5} \\ y_2 & = & \frac{11}{16} \quad \frac{25}{36} \quad \frac{2}{5} \end{array} = \frac{\frac{223}{720}}{\frac{497}{720}}$$



习题1.2( $P_{33} - P_{36}$ )

取 $P = \begin{matrix} & 1 & 4 \\ & -1 & 9 \end{matrix}^!$ , K

习题1.2( $P_{33} - P_{36}$ )

$$\text{取 } P = \begin{pmatrix} 1 & 4 \\ -1 & 9 \end{pmatrix}, K = \begin{pmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{pmatrix}, \begin{pmatrix} 1 & 4 \\ -1 & 9 \end{pmatrix} = \begin{pmatrix} -\frac{1}{12} & 0 \\ 0 & 1 \end{pmatrix},$$



### 习题1.2( $P_{33} - P_{36}$ )

$$\text{取 } P = \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix}, K = \begin{vmatrix} \frac{9}{13} & -\frac{4}{13} & \frac{1}{4} & \frac{1}{3} \\ \frac{1}{13} & \frac{1}{13} & \frac{3}{4} & \frac{2}{3} \end{vmatrix}, \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} = \begin{vmatrix} -\frac{1}{12} & 0 \\ 0 & 1 \end{vmatrix}, \text{且} \\ \begin{vmatrix} \frac{9}{13} & -\frac{4}{13} & 1 & 4 \\ \frac{1}{13} & \frac{1}{13} & -1 & 9 \end{vmatrix} = \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} \begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix},$$



习题1.2( $P_{33} - P_{36}$ )

$$\text{取 } P = \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix}, K$$

$$\begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} \begin{vmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{vmatrix} \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} = \begin{vmatrix} -\frac{1}{12} & 0 \\ 0 & 1 \end{vmatrix}, \text{且}$$

$$\begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} = \begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix},$$

从而

$$\begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} \begin{vmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{vmatrix} \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} =$$

$$\begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} =$$

$$\begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} =$$

习题1.2( $P_{33} - P_{36}$ )

$$\text{取 } P = \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix}, K$$

$$\begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} \begin{vmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{vmatrix} \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} = \begin{vmatrix} -\frac{1}{12} & 0 \\ 0 & 1 \end{vmatrix}, \text{ 且}$$

$$\begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} = \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} \begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix},$$

从而

$$\begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} \begin{vmatrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{vmatrix} \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} =$$

$$\begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix} \begin{vmatrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{vmatrix} = \begin{vmatrix} -\frac{1}{12} & 0 \\ 0 & 1 \end{vmatrix}^{10}$$

习题1.2( $P_{33} - P_{36}$ )

$$\text{取 } P = \begin{vmatrix} 1 & 4 \\ -1 & 9 \end{vmatrix}, K$$

$$\begin{matrix} \frac{9}{13} & -\frac{4}{13} & \frac{1}{4} & \frac{1}{3} \\ \frac{1}{13} & \frac{1}{13} & \frac{3}{4} & \frac{2}{3} \end{matrix} \begin{matrix} 1 & 4 \\ -1 & 9 \end{matrix} = \begin{matrix} -\frac{1}{12} & 0 \\ 0 & 1 \end{matrix}, \text{且}$$

$$\begin{matrix} \frac{9}{13} & -\frac{4}{13} & 1 & 4 \\ \frac{1}{13} & \frac{1}{13} & -1 & 9 \end{matrix} = \begin{matrix} 1 & 4 \\ -1 & 9 \end{matrix} \begin{matrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{matrix} = \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix},$$

从而  $\begin{matrix} \frac{9}{13} & -\frac{4}{13} & \frac{1}{4} & \frac{1}{3} \\ \frac{1}{13} & \frac{1}{13} & \frac{3}{4} & \frac{2}{3} \end{matrix} \begin{matrix} 1 & 4 \\ -1 & 9 \end{matrix} =$

$$\begin{matrix} \frac{9}{13} & -\frac{4}{13} & \frac{1}{4} & \frac{1}{3} \\ \frac{1}{13} & \frac{1}{13} & \frac{3}{4} & \frac{2}{3} \end{matrix} \begin{matrix} 1 & 4 \\ -1 & 9 \end{matrix} \begin{matrix} -\frac{1}{12} & 0 \\ 0 & 1 \end{matrix} = \begin{matrix} 1 & 4 \\ -1 & 9 \end{matrix} \begin{matrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{matrix} = \begin{matrix} 1 & 4 \\ -1 & 9 \end{matrix} \begin{matrix} 10 & \\ & 10 \end{matrix}$$

以  $\begin{matrix} \frac{1}{4} & \frac{1}{3} \\ \frac{3}{4} & \frac{2}{3} \end{matrix} = \begin{matrix} 1 & 4 \\ -1 & 9 \end{matrix} \begin{matrix} -\frac{1}{12} & 0 \\ 0 & 1 \end{matrix} \begin{matrix} \frac{9}{13} & -\frac{4}{13} \\ \frac{1}{13} & \frac{1}{13} \end{matrix} = \begin{matrix} 1 & 4 \\ -1 & 9 \end{matrix} \begin{matrix} 10 & \\ & 10 \end{matrix}$

习题1.2( $P_{33} - P_{36}$ )

由于  $\frac{1}{12^{10}} \approx 0$ , 以  $\begin{matrix} ! & 10 \\ -\frac{1}{12} & 0 \\ 0 & 1 \end{matrix} \approx \begin{matrix} 0 & 0 \\ 0 & 1 \end{matrix}$ ,

习题1.2( $P_{33} - P_{36}$ )

由于  $\frac{1}{12^{10}} \approx 0$ , 以  $\begin{array}{cc|c} -\frac{1}{12} & 0 & 1 \\ 0 & 1 & 0 \end{array} \approx \begin{array}{cc|c} 0 & 0 & 1 \\ 0 & 1 & 0 \end{array}$ ,

$$\text{以 } \begin{array}{cc|c} \frac{1}{4} & \frac{1}{3} & 1 \\ \frac{3}{4} & \frac{2}{3} & 10 \end{array} = \begin{array}{cc|c} \frac{4}{13} & \frac{4}{13} & 1 \\ \frac{9}{13} & \frac{9}{13} & 0 \end{array},$$

习题1.2( $P_{33} - P_{36}$ )

由于  $\frac{1}{12^{10}} \approx 0$ , 以  $\begin{matrix} ! & 10 \\ -\frac{1}{12} & 0 \\ 0 & 1 \end{matrix} \approx \begin{matrix} 0 & 0 \\ 0 & 1 \end{matrix}$ ,

$$\text{以 } \begin{matrix} \frac{1}{4} & \frac{1}{3} & ! & 10 \\ \frac{3}{4} & \frac{2}{3} & ! & \frac{4}{13} & \frac{4}{13} \\ ! & 4 & & \frac{9}{13} & \frac{9}{13} \\ & & & ! & 13 \end{matrix},$$

$$x_{10} = \frac{4}{13} \quad \frac{4}{13} \quad \frac{3}{5} =$$

$$y_{10} = \frac{9}{13} \quad \frac{9}{13} \quad \frac{2}{5} =$$



习题1.2( $P_{33} - P_{36}$ )

由于  $\frac{1}{12^{10}} \approx 0$ , 以  $\begin{matrix} ! & 10 \\ -\frac{1}{12} & 0 \\ 0 & 1 \end{matrix} \approx \begin{matrix} 0 & 0 \\ 0 & 1 \end{matrix}$ ,

$$\text{以 } \begin{matrix} \frac{1}{4} & \frac{1}{3} & ! & 10 \\ \frac{3}{4} & \frac{2}{3} & ! & \frac{4}{13} & \frac{4}{13} \\ ! & 4 & & 9 & 9 \\ & & & 13 & 13 \end{matrix},$$

$$x_{10} = \frac{4}{13} \quad \frac{4}{13} \quad \frac{3}{5} = \frac{4}{13}$$

$$y_{10} = \frac{9}{13} \quad \frac{9}{13} \quad \frac{2}{5} = \frac{9}{13}$$



习题1.3( $P_{36} - P_{38}$ )

1.(1))



习题1.3( $P_{36} - P_{38}$ )

$$\text{1.(1)) } \begin{matrix} \textcircled{O} & 1 & -1 & 0 & \textcircled{O} & 1 & 1 & 0 & \textcircled{O} \\ \textcircled{B} @0 & 1 & 0 & \textcircled{A} @0 & 1 & 0 & \textcircled{C} \\ 0 & 0 & 1 & 0 & 0 & 1 \end{matrix} =$$



习题1.3( $P_{36} - P_{38}$ )

$$1.(1)) \quad \begin{matrix} \textcircled{1} & -1 & 0 \\ \textcircled{0} & 1 & 0 \\ \textcircled{0} & 0 & 1 \end{matrix} \begin{matrix} \textcircled{1} & 1 & 0 \\ \textcircled{0} & 1 & 0 \\ \textcircled{0} & 0 & 1 \end{matrix} = \begin{matrix} \textcircled{1} & 0 & 1 \\ \textcircled{0} & 1 & 0 \\ \textcircled{0} & 0 & 1 \end{matrix};$$

$$\begin{matrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$



### 习题1.3( $P_{36} - P_{38}$ )

$$1.(1)) \quad \begin{matrix} O & 1 & -1 & 0 & 1 & O & 1 & 1 & 0 & 1 \\ B & @0 & 1 & 0A & C & B & @0 & 1 & 0A & C \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0A \end{matrix} = \begin{matrix} O & 1 & 0 & 0 & 1 \\ B & @0 & 1 & 0A & C \end{matrix};$$

1.(2))



习题1.3( $P_{36} - P_{38}$ )

$$1.(1)) \quad \begin{matrix} \textcircled{1} & -1 & 0 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix} \begin{matrix} \textcircled{1} & 1 & 0 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix} = \begin{matrix} \textcircled{1} & 0 & 1 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix};$$

$$1.(2)) \quad \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 1 & 0 \\ \textcircled{2} & 0 & 1 \end{matrix} \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 1 \\ \textcircled{2} & 0 & 0 \end{matrix} = \begin{matrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$



习题1.3( $P_{36} - P_{38}$ )

$$1.(1)) \quad \begin{matrix} \textcircled{1} & -1 & 0 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix} \begin{matrix} \textcircled{1} & 1 & 0 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix} = \begin{matrix} \textcircled{1} & 0 & 1 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix};$$

$$1.(2)) \quad \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 1 & 0 \\ \textcircled{2} & 0 & 1 \end{matrix} \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 1 & 0 \\ \textcircled{2} & 0 & 1 \end{matrix} = \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 0 \\ \textcircled{2} & 1 & 0 \end{matrix};$$

$$\begin{matrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$



习题1.3( $P_{36} - P_{38}$ )

$$1.(1)) \quad \begin{matrix} \textcircled{1} & -1 & 0 & \textcircled{1} \\ \textcircled{1} & @0 & 1 & 0 \\ \textcircled{1} & @0 & 1 & 0 \end{matrix} \begin{matrix} \textcircled{1} & 1 & 0 & \textcircled{1} \\ \textcircled{1} & @0 & 1 & 0 \\ \textcircled{1} & @0 & 1 & 0 \end{matrix} = \begin{matrix} \textcircled{1} & 0 & 1 \\ \textcircled{1} & @0 & 1 \\ \textcircled{1} & @0 & 1 \end{matrix};$$

$$1.(2)) \quad \begin{matrix} \textcircled{0} & 0 & \textcircled{1} & \textcircled{0} & 0 & \textcircled{1} \\ \textcircled{0} & 1 & 0 & \textcircled{0} & 1 & 0 \\ \textcircled{0} & @1 & 0 & \textcircled{0} & @1 & 0 \end{matrix} = \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 0 \\ \textcircled{1} & @0 & 0 \end{matrix};$$

$$\begin{matrix} 0 & 0 & 1 & 0 & 0 & 1 \\ & & & & & \\ & & & & & \end{matrix} \quad \begin{matrix} 0 & 0 & 1 \\ & & \\ & & \end{matrix}$$

1.(3))

### 习题1.3( $P_{36} - P_{38}$ )

$$1.(1)) \quad \begin{matrix} O & 1 & -1 & 0 & 1 & O & 1 & 1 & 0 & 1 \\ B & @0 & 1 & 0A & C & B & @0 & 1 & 0C & A \end{matrix} = \begin{matrix} O & 1 & 0 & 0 & 1 \\ B & @0 & 1 & 0A & C \end{matrix};$$

$$1.(2)) \quad \text{B} @1 \quad 0 \quad 0 \text{A} \quad \text{B} @1 \quad 0 \quad 0 \text{A} = \text{B} @0 \quad 1 \quad 0 \text{A};$$

$$1.(3)) \quad \text{B} @ 0 \quad \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \end{matrix} \quad \text{B} @ 0 \quad \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \end{matrix} =$$



习题1.3( $P_{36} - P_{38}$ )

$$1.(1)) \quad \begin{matrix} \textcircled{1} & -1 & 0 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix} \begin{matrix} \textcircled{1} & 1 & 0 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix} = \begin{matrix} \textcircled{1} & 0 & 1 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix};$$

$$1.(2)) \quad \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 1 & 0 \\ \textcircled{2} & 0 & 1 \end{matrix} \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 1 \\ \textcircled{2} & 0 & 0 \end{matrix} = \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 0 \\ \textcircled{2} & 1 & 0 \end{matrix};$$

$$1.(3)) \quad \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 0 \\ \textcircled{2} & 2 & 0 \end{matrix} \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 0 \\ \textcircled{2} & \frac{1}{2} & 0 \end{matrix} = \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 0 \\ \textcircled{2} & 1 & 0 \end{matrix};$$

$$0 \quad 0 \quad 1 \quad 0 \quad 0 \quad 1 \quad 0 \quad 0 \quad 1$$



习题1.3( $P_{36} - P_{38}$ )

$$1.(1)) \quad \begin{matrix} \textcircled{1} & -1 & 0 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix} \begin{matrix} \textcircled{1} & 1 & 0 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix} = \begin{matrix} \textcircled{1} & 0 & 1 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix};$$

$$1.(2)) \quad \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 1 & 0 \\ \textcircled{2} & 0 & 1 \end{matrix} \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 1 \\ \textcircled{2} & 0 & 0 \end{matrix} = \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 0 \\ \textcircled{2} & 1 & 0 \end{matrix};$$

$$1.(3)) \quad \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 0 \\ \textcircled{2} & 2 & 0 \end{matrix} \begin{matrix} \textcircled{1} & 0 & 1 \\ \textcircled{2} & 1 & 0 \\ \textcircled{3} & 0 & 1 \end{matrix} = \begin{matrix} \textcircled{0} & 0 & 1 \\ \textcircled{1} & 0 & 0 \\ \textcircled{2} & 1 & 0 \end{matrix};$$

$$\begin{matrix} 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \end{matrix}$$

1.(4))

习题1.3( $P_{36} - P_{38}$ )

$$1.(1)) \quad \begin{matrix} O & 1 & -1 & 0 & 1 \\ B & @0 & 1 & 0 \\ C & @0 & 1 & 0 \end{matrix} A = \begin{matrix} O & 1 & 0 & 0 \\ B & @0 & 1 & 0 \\ C & @0 & 1 & 0 \end{matrix} ;$$

$$1.(2)) \quad \begin{matrix} O & 0 & 0 & 1 \\ O & 0 & 1 & 0 \\ B & @1 & 0 & 0 \end{matrix} C = \begin{matrix} O & 0 & 0 & 1 \\ O & 1 & 0 & 0 \\ B & @0 & 1 & 0 \end{matrix} C ;$$

$$1.(3)) \quad \begin{matrix} O & 0 & 0 & 1 \\ O & 1 & 0 & 0 \\ B & @0 & 2 & 0 \end{matrix} C = \begin{matrix} O & 0 & 0 & 1 \\ O & 1 & 0 & 0 \\ B & @0 & 1 & 0 \end{matrix} C ;$$

$$1.(4)) \quad \begin{matrix} O & 0 & 0 & 1 \\ O & 2 & 0 & 0 \\ B & @0 & 3 & 0 \end{matrix} C = \begin{matrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ \frac{1}{3} & 0 & 0 \end{matrix}$$





习题1.3( $P_{36} - P_{38}$ )

2.(1)

习题1.3( $P_{36} - P_{38}$ )

2.(1)证

习题1.3( $P_{36} - P_{38}$ )

2(1)证 设  $a_1 a_2 \cdots a_n \neq 0$ , 由 $\text{Y}$  阵的乘法直 可以验证

$$\begin{matrix} a_1 & 0 & \cdots & 0 & \frac{1}{a_1} & 0 & \cdots & 0 \\ 0 & a_2 & \cdots & 0 & 0 & \frac{1}{a_2} & \cdots & 0 \\ \vdots & \vdots & & \vdots & \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & a_n & 0 & 0 & \cdots & \frac{1}{a_n} \end{matrix} =$$



习题1.3( $P_{36} - P_{38}$ )

2(1)证 设  $a_1 a_2 \cdots a_n \neq 0$ , 由 $\text{Y}$  阵的乘法直 可以验证

$$\begin{array}{ccccccccc} & a_1 & 0 & \cdots & 0 & \frac{1}{a_1} & 0 & \cdots & 0 \\ \textcircled{O} & 0 & a_2 & \cdots & 0 & 0 & \frac{1}{a_2} & \cdots & 0 \\ @ & \vdots & \vdots & & \vdots & \vdots & \vdots & & \vdots \\ & & & & & & & & \end{array} =$$

$$\begin{array}{ccccccccc} & 0 & 0 & \cdots & 1 & a_n & 0 & 0 & \cdots & 1 & \frac{1}{a_n} \\ \textcircled{O} & \frac{1}{a_1} & 0 & \cdots & 0 & a_1 & 0 & \cdots & 0 & & \\ @ & 0 & \frac{1}{a_2} & \cdots & 0 & 0 & a_2 & \cdots & 0 & \\ & \vdots & \vdots & & \vdots & \vdots & \vdots & & \vdots \\ & 0 & 0 & \cdots & \frac{1}{a_n} & 0 & 0 & \cdots & a_n & \end{array} =$$



习题1.3( $P_{36} - P_{38}$ )

2(1)证 设  $a_1 a_2 \cdots a_n \neq 0$ , 由 $\text{Y}$  阵的乘法直 可以验证

$$\begin{array}{ccccccccc} a_1 & 0 & \cdots & 0 & \frac{1}{a_1} & 0 & \cdots & 0 \\ 0 & a_2 & \cdots & 0 & 0 & \frac{1}{a_2} & \cdots & 0 \\ \vdots & \vdots & & \vdots & \vdots & \vdots & & \vdots \end{array} =$$

$$\begin{array}{ccccccccc} 0 & 0 & \cdots & 1 & 0 & 0 & \cdots & 1 & \frac{1}{a_n} \\ \frac{1}{a_1} & 0 & \cdots & 0 & a_1 & 0 & \cdots & 0 & 1 \\ 0 & \frac{1}{a_2} & \cdots & 0 & 0 & a_2 & \cdots & 0 & 0 \\ \vdots & \vdots & & \vdots & \vdots & \vdots & & \vdots & \vdots \\ 0 & 0 & \cdots & \frac{1}{a_n} & 0 & 0 & \cdots & a_n & 1 \end{array}$$



习题1.3( $P_{36} - P_{38}$ )

2(1)证 设  $a_1 a_2 \cdots a_n \neq 0$ , 由 $\tilde{Y}$ 阵的乘法直 可以验证

$$\begin{array}{ccccccc|ccccc} a_1 & 0 & \cdots & 0 & \frac{1}{a_1} & 0 & \cdots & 0 \\ 0 & a_2 & \cdots & 0 & 0 & \frac{1}{a_2} & \cdots & 0 \\ \vdots & \vdots & & \vdots & \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & 1 & 0 & 0 & \cdots & 1 \end{array} =$$

$$\begin{array}{ccccccc|ccccc} \frac{1}{a_1} & 0 & \cdots & 0 & a_1 & 0 & \cdots & 0 & 1 \\ 0 & \frac{1}{a_2} & \cdots & 0 & 0 & a_2 & \cdots & 0 & 0 \\ \vdots & \vdots & & \vdots & \vdots & \vdots & & \vdots & \vdots \\ 0 & 0 & \cdots & \frac{1}{a_n} & 0 & 0 & \cdots & a_n & 0 & \cdots & 1 \end{array} =$$

以 $\tilde{Y}$ 阵 $A$ 可逆, 且其逆为 给定的 $\tilde{Y}$ 阵.



习题1.3( $P_{36} - P_{38}$ )

2(1)证 设  $a_1 a_2 \cdots a_n \neq 0$ , 由 $\tilde{Y}$ 阵的乘法直 可以验证

$$\begin{array}{ccccccc|ccccc} & a_1 & 0 & \cdots & 0 & \frac{1}{a_1} & 0 & \cdots & 0 \\ \textcircled{O} & 0 & a_2 & \cdots & 0 & 0 & \frac{1}{a_2} & \cdots & 0 \\ @ & \vdots \\ & & & & & & & & & & & = \end{array}$$

$$\begin{array}{ccccccc|ccccc} & 0 & 0 & \cdots & 1 & a_n & 0 & 0 & \cdots & 1 & \frac{1}{a_n} \\ \textcircled{O} & \frac{1}{a_1} & 0 & \cdots & 0 & a_1 & 0 & \cdots & 0 & 1 & 0 \\ @ & 0 & \frac{1}{a_2} & \cdots & 0 & 0 & a_2 & \cdots & 0 & \cdots & 0 \\ & \vdots & \ddots & \vdots \\ & 0 & 0 & \cdots & \frac{1}{a_n} & 0 & 0 & \cdots & a_n & 0 & \cdots & 1 \end{array}$$

以 $\tilde{Y}$ 阵 $A$ 可逆, 且其逆为 给定的 $\tilde{Y}$ 阵.

若  $a_1 a_2 \cdots a_n = 0$ , 存  $\exists a_k = 0$ ,  $\tilde{Y}$ 阵 $A$ 的第 $k$ 行全为0, 时对任意的 $n$  方阵 $B$ ,



习题1.3( $P_{36} - P_{38}$ )

2(1)证 设  $a_1 a_2 \cdots a_n \neq 0$ , 由 $\bar{Y}$ 阵的乘法直 可以验证

$$\begin{array}{ccccccc|ccccc} & a_1 & 0 & \cdots & 0 & \frac{1}{a_1} & 0 & \cdots & 0 \\ \textcircled{O} & 0 & a_2 & \cdots & 0 & 0 & \frac{1}{a_2} & \cdots & 0 \\ @ & \vdots \\ & & & & & & & & & & & = \end{array}$$

$$\begin{array}{ccccccc|ccccc} & 0 & 0 & \cdots & 1 & a_n & 0 & 0 & \cdots & 1 & \frac{1}{a_n} \\ \textcircled{O} & \frac{1}{a_1} & 0 & \cdots & 0 & a_1 & 0 & \cdots & 0 & 0 & 1 \\ @ & 0 & \frac{1}{a_2} & \cdots & 0 & 0 & a_2 & \cdots & 0 & 0 & \cdots & 0 \\ & \vdots & \ddots & \vdots \\ & 0 & 0 & \cdots & \frac{1}{a_n} & 0 & 0 & \cdots & a_n & 0 & \cdots & 1 \end{array}$$

以 $\bar{Y}$ 阵 $A$ 可逆, 且其逆为 给定的 $\bar{Y}$ 阵.

若  $a_1 a_2 \cdots a_n = 0$ , 存  $\exists a_k = 0$ ,  $\bar{Y}$ 阵 $A$ 的第 $k$ 行全为0, 时对任意的 $n$  方阵 $B$ , 由 $\bar{Y}$ 阵的乘法,  $\bar{Y}$ 阵 $AB$ 的第 $k$ 行也是0,



习题1.3( $P_{36} - P_{38}$ )

阵 $A$ 不可能是可逆 $\text{Y}$ 阵.



习题1.3( $P_{36} - P_{38}$ )

阵 $A$ 不可能是可逆阵. 以 $\exists$ 阵 $A$ 可逆,  $\nabla$   
有 $a_1 a_2 \cdots a_n \neq 0$ .





习题1.3( $P_{36} - P_{38}$ )

阵 $A$ 不可能是可逆阵. 以 $\bar{Y}$ 阵 $A$ 可逆,  $\leftarrow$   
有 $a_1 a_2 \cdots a_n \neq 0$ . 以 $\bar{Y}$ 阵 $A$ 可逆的充要条件是 $a_1 a_2 \cdots a_n \neq 0$ .

2.(2)

习题1.3( $P_{36} - P_{38}$ )

阵 $A$ 不可能是可逆阵. 以 $\bar{Y}$ 阵 $A$ 可逆,  $\leftarrow$   
有 $a_1 a_2 \cdots a_n \neq 0$ . 以 $\bar{Y}$ 阵 $A$ 可逆的充要条件是 $a_1 a_2 \cdots a_n \neq 0$ .

2.(2)证

习题1.3( $P_{36} - P_{38}$ )

阵 $A$ 不可能是可逆 $\bar{Y}$ 阵. 以 $\bar{Y}$ 阵 $A$ 可逆,  $\leftarrow$

有 $a_1 a_2 \cdots a_n \neq 0$ . 以 $\bar{Y}$ 阵 $A$ 可逆的充要条件是 $a_1 a_2 \cdots a_n \neq 0$ .

2(2)证 设 $a_1 a_2 \cdots a_n \neq 0$ , 由 $\bar{Y}$ 阵的乘法直 可以验证

$$\begin{matrix} 0 & \cdots & 0 & a_1 & 0 & \cdots & 0 & \frac{1}{a_n} \\ \textcircled{B} & 0 & \cdots & a_2 & 0 & \textcircled{B} & 0 & \cdots & \frac{1}{a_{n-1}} & 0 \\ @ & \vdots & & \vdots & \textcircled{A} & @ & \vdots & & \vdots & \textcircled{A} \\ a_n & \cdots & 0 & 0 & \frac{1}{a_1} & \cdots & 0 & 0 \end{matrix} =$$



### 习题1.3( $P_{36} - P_{38}$ )

阵 $A$ 不可能是可逆矩阵. 以矩阵 $A$ 可逆,  $K$

有  $a_1 a_2 \cdots a_n \neq 0$ . 以  $\bar{Y}$  阵  $A$  可逆的充要条件是  $a_1 a_2 \cdots a_n \neq 0$ .

2(2) 证 设  $a_1 a_2 \cdots a_n \neq 0$ , 由矩阵的乘法直 可以验证

$$\begin{matrix} 0 & \cdots & 0 & a_1 & 0 & \cdots & 0 \\ 0 & \cdots & a_2 & 0 & 0 & \cdots & \frac{1}{a_{n-1}} \\ \vdots & & \vdots & \vdots & \vdots & & \vdots \end{matrix} = \begin{matrix} \frac{1}{a_n} \\ 0 \\ \vdots \end{matrix}$$

$$\begin{matrix} \textcircled{O} & a_n & \cdots & 0 & 0 & 1 & \frac{1}{a_1} & \cdots & 0 & 0 & 1 \\ \textcircled{O} & 0 & \cdots & 0 & \frac{1}{a_n} & 0 & \cdots & 0 & a_1 & 0 \\ \textcircled{B} & 0 & \cdots & \frac{1}{a_{n-1}} & 0 & 0 & \cdots & a_2 & 0 & 0 \\ @ & \vdots & & \vdots & \vdots & \vdots & \vdots & @ & \vdots & \vdots \\ \textcircled{A} & \frac{1}{a_1} & \cdots & 0 & 0 & a_n & \cdots & 0 & 0 & 0 \end{matrix}$$



### 习题1.3( $P_{36} - P_{38}$ )

阵 $A$ 不可能是可逆矩阵. 以矩阵 $A$ 可逆,  $K$

有  $a_1 a_2 \cdots a_n \neq 0$ . 以  $\bar{Y}$  阵  $A$  可逆的充要条件是  $a_1 a_2 \cdots a_n \neq 0$ .

2(2)证 设  $a_1 a_2 \cdots a_n \neq 0$ , 由矩阵的乘法直 可以验证

$$\begin{matrix} 0 & \cdots & 0 & a_1 & 0 & \cdots & 0 & \frac{1}{a_n} \\ 0 & \cdots & a_2 & 0 & 0 & \cdots & \frac{1}{a_{n-1}} & 0 \\ \vdots & & \vdots & \vdots & \vdots & & \vdots & \vdots \end{matrix} =$$

$$\begin{matrix} \textcircled{O} & a_n & \cdots & 0 & 0 & 1 & \frac{1}{a_1} & \cdots & 0 & 1 & 0 \\ \textcircled{O} & 0 & \cdots & 0 & \frac{1}{a_n} & 0 & \cdots & 0 & a_1 & 0 & \textcircled{O} \\ \textcircled{B} & 0 & \cdots & \frac{1}{a_{n-1}} & 0 & 0 & \cdots & a_2 & 0 & \textcircled{B} & 1 & \cdots & 0 \\ @: & \vdots & & \vdots & \textcircled{A} & @: & & \vdots & \textcircled{A} & @: & \ddots & & \vdots \\ \textcircled{A} & \frac{1}{a_1} & \cdots & 0 & 0 & a_n & \cdots & 0 & 0 & 0 & \textcircled{A} & 0 & \cdots & 1 \end{matrix}$$



习题1.3( $P_{36} - P_{38}$ )

阵 $A$ 不可能是可逆 $\check{Y}$ 阵. 以 $\check{Y}$ 阵 $A$ 可逆,  $\leftarrow$

有 $a_1 a_2 \cdots a_n \neq 0$ . 以 $\check{Y}$ 阵 $A$ 可逆的充要条件是 $a_1 a_2 \cdots a_n \neq 0$ .

2(2)证 设 $a_1 a_2 \cdots a_n \neq 0$ , 由 $\check{Y}$ 阵的乘法直 可以验证

$$\begin{array}{ccccccccc} 0 & \cdots & 0 & a_1 & 0 & \cdots & 0 & \frac{1}{a_n} \\ \textcircled{B} & 0 & \cdots & a_2 & 0 & \textcircled{B} & 0 & \cdots & \frac{1}{a_{n-1}} & 0 \\ @ & \vdots & & \vdots & \textcircled{A} & @ & \vdots & & \vdots & \textcircled{A} \\ & & & \textcircled{A} & & & & & \end{array} =$$

$$\begin{array}{ccccccccc} a_n & \cdots & 0 & 0 & \frac{1}{a_1} & \cdots & 0 & 0 \\ \textcircled{B} & 0 & \cdots & 0 & \frac{1}{a_n} & \textcircled{B} & 0 & \cdots & 0 \\ @ & \vdots & & \vdots & \textcircled{A} & @ & \vdots & & \vdots & \textcircled{A} \\ & & & \textcircled{A} & & & & & \end{array} = \begin{array}{ccccccccc} 0 & & & 1 & & & & & 1 \\ \textcircled{B} & 1 & \cdots & 0 & \textcircled{B} & 1 & \cdots & 0 & \textcircled{B} \\ @ & \vdots & & \vdots & \textcircled{A} & @ & \vdots & & \vdots & \textcircled{A} \\ & & & \textcircled{A} & & & & & \end{array}$$

$$\frac{1}{a_1} \cdots 0 0 a_n \cdots 0 0$$

以 $\check{Y}$ 阵 $A$ 可逆, 且其逆为 给定的 $\check{Y}$ 阵.



习题1.3( $P_{36} - P_{38}$ )

若  $a_1 a_2 \cdots a_n = 0$ , 存  $\exists a_k = 0$ , 阵  $A$  的第  $k$  行全为 0, 时对任意的  $n$  方阵  $B$ ,

习题1.3( $P_{36} - P_{38}$ )

若  $a_1 a_2 \cdots a_n = 0$ , 且存在  $\exists a_k = 0$ , 则阵  $A$  的第  $k$  行全为 0, 且时对任意的  $n$  方阵  $B$ , 由阵的乘法, 且阵  $AB$  的第  $k$  行也是 0,

习题1.3( $P_{36} - P_{38}$ )

若  $a_1 a_2 \cdots a_n = 0$ , 则存在  $\exists a_k = 0$ , 使得矩阵  $A$  的第  $k$  行全为 0, 此时对任意的  $n$  方阵  $B$ , 由矩阵的乘法, 则矩阵  $AB$  的第  $k$  行也是 0, 即对任意矩阵  $B$ , 都有矩阵  $AB$  不是单位矩阵, 此时矩阵  $A$  不可能是可逆矩阵.

习题1.3( $P_{36} - P_{38}$ )

若  $a_1 a_2 \cdots a_n = 0$ , 则存在  $\exists a_k = 0$ , 使得矩阵  $A$  的第  $k$  行全为 0, 此时对任意的  $n$  方阵  $B$ , 由矩阵的乘法, 则矩阵  $AB$  的第  $k$  行也是 0, 即对任意矩阵  $B$ , 都有矩阵  $AB$  不是单位矩阵, 此时矩阵  $A$  不可能是可逆矩阵. 以矩阵  $A$  可逆, 则有  $a_1 a_2 \cdots a_n \neq 0$ .



习题1.3( $P_{36} - P_{38}$ )

若  $a_1 a_2 \cdots a_n = 0$ , 则存在  $\exists a_k = 0$ , 使得矩阵  $A$  的第  $k$  行全为 0, 此时对任意的  $n$  方阵  $B$ , 由矩阵的乘法, 则矩阵  $AB$  的第  $k$  行也是 0, 即对任意矩阵  $B$ , 都有矩阵  $AB$  不是单位矩阵, 此时矩阵  $A$  不可能是可逆矩阵. 以矩阵  $A$  可逆, 则有  $a_1 a_2 \cdots a_n \neq 0$ . 以矩阵  $A$  可逆的充要条件是  $a_1 a_2 \cdots a_n \neq 0$ .

2.(3)

习题1.3( $P_{36} - P_{38}$ )

若  $a_1 a_2 \cdots a_n = 0$ , 则存在  $\exists a_k = 0$ , 使得矩阵  $A$  的第  $k$  行全为 0, 此时对任意的  $n$  方阵  $B$ , 由矩阵的乘法, 则矩阵  $AB$  的第  $k$  行也是 0, 即对任意矩阵  $B$ , 都有矩阵  $AB$  不是单位矩阵, 此时矩阵  $A$  不可能是可逆矩阵. 以矩阵  $A$  可逆, 则有  $a_1 a_2 \cdots a_n \neq 0$ . 以矩阵  $A$  可逆的充要条件是  $a_1 a_2 \cdots a_n \neq 0$ .

$$\text{2.(3))} \\ \begin{array}{ccc|cc} \textcircled{O} & 1 & -1 & \textcircled{O} & 1 \\ 2 & 0 & 0 & \frac{1}{2} & 0 & 1 \\ \textcircled{B} & 0 & 5 & 0 & 1 & 0 \\ @0 & 5 & 0 & @0 & \frac{1}{5} & 0 \\ \textcircled{A} & & & \textcircled{C} & & \\ 0 & 0 & 6 & 0 & 0 & \frac{1}{6} \end{array}$$



习题1.3( $P_{36} - P_{38}$ )

若  $a_1 a_2 \cdots a_n = 0$ , 则存在  $\exists a_k = 0$ , 使得矩阵  $A$  的第  $k$  行全为 0, 此时对任意的  $n$  方阵  $B$ , 由矩阵的乘法, 则矩阵  $AB$  的第  $k$  行也是 0, 即对任意矩阵  $B$ , 都有矩阵  $AB$  不是单位矩阵, 此时  $\square$   $\square$



### 习题1.3( $P_{36} - P_{38}$ )

若  $a_1 a_2 \cdots a_n = 0$ , 则存在  $3 a_k = 0$ , 使得矩阵  $A$  的第  $k$  行全为 0, 此时对任意的  $n$  方阵  $B$ , 由矩阵的乘法, 有矩阵  $AB$  的第  $k$  行也是 0, 即对任意矩阵  $B$ , 都有矩阵  $AB$  不是单位矩阵, 此时矩阵  $A$  不可能是可逆矩阵. 以矩阵  $A$  可逆, 有  $a_1 a_2 \cdots a_n \neq 0$ . 以矩阵  $A$  可逆的充要条件是  $a_1 a_2 \cdots a_n \neq 0$ .

$$\begin{matrix} \textcircled{O} & \textcolor{red}{2.(3))} & \begin{matrix} 1 \\ -1 \end{matrix} \\ \begin{matrix} 2 \\ B \\ @0 \\ 0 \end{matrix} & \begin{matrix} 0 \\ 5 \\ 0 \\ 6 \end{matrix} & \textcircled{A} \end{matrix} = \begin{matrix} \textcircled{O} & \begin{matrix} \frac{1}{2} \\ 0 \\ \frac{1}{5} \\ 0 \end{matrix} & \begin{matrix} 1 \\ 0 \\ \frac{1}{5} \\ 0 \end{matrix} \\ \textcircled{B} & \textcircled{C} \\ @0 & 0 \end{matrix}, \quad \begin{matrix} \textcircled{O} & \begin{matrix} 0 \\ 0 \\ 5 \\ 0 \end{matrix} & \begin{matrix} 2 \\ 0 \\ 0 \\ 0 \end{matrix} \\ \textcircled{B} & \textcircled{C} \\ @0 & 0 \end{matrix} = \begin{matrix} \textcircled{O} & \begin{matrix} 0 \\ 0 \\ \frac{1}{5} \\ \frac{1}{2} \end{matrix} & \begin{matrix} 1 \\ 0 \\ 0 \\ 0 \end{matrix} \\ \textcircled{B} & \textcircled{C} \\ @0 & 0 \end{matrix}.$$



习题1.3( $P_{36} - P_{38}$ )

3.



习题1.3( $P_{36} - P_{38}$ )

3. 证



习题1.3( $P_{36} - P_{38}$ )

3. 证 若  $ab \neq 0$ , 由 $\text{Y}$ 阵的乘法, 直 验证:

习题1.3( $P_{36} - P_{38}$ )

3. 证 若  $ab \neq 0$ , 由 $\text{Y}$ 阵的乘法, 直 验证:

$$\begin{matrix} a & c & \frac{1}{a} & -\frac{c}{ab} \\ 0 & b & 0 & \frac{1}{b} \end{matrix} =$$



习题1.3( $P_{36} - P_{38}$ )

3. 证 若  $ab \neq 0$ , 由 $\text{Y}$ 阵的乘法, 直 验证:

$$\begin{matrix} a & c & \frac{1}{a} & -\frac{c}{ab} \\ 0 & b & 0 & \frac{1}{b} \end{matrix} = \begin{matrix} \frac{1}{a} & -\frac{c}{ab} \\ 0 & \frac{1}{b} \end{matrix} \quad \begin{matrix} a & c \\ 0 & b \end{matrix} =$$



习题1.3( $P_{36} - P_{38}$ )

3. 证 若  $ab \neq 0$ , 由 $\text{Y}$ 阵的乘法, 直 验证:

$$\begin{matrix} a & c & \frac{1}{a} & -\frac{c}{ab} \\ 0 & b & 0 & \frac{1}{b} \end{matrix} = \begin{matrix} \frac{1}{a} & -\frac{c}{ab} \\ 0 & \frac{1}{b} \end{matrix} \quad \begin{matrix} a & c \\ 0 & b \end{matrix} = \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$$



习题1.3( $P_{36} - P_{38}$ )

3. 证 若  $ab \neq 0$ , 由 $\hat{Y}$ 阵的乘法, 直 验证:

$$\begin{matrix} a & c & \frac{1}{a} & -\frac{c}{ab} \\ 0 & b & 0 & \frac{1}{b} \end{matrix} = \begin{matrix} \frac{1}{a} & -\frac{c}{ab} \\ 0 & \frac{1}{b} \end{matrix} \quad \begin{matrix} a & c \\ 0 & b \end{matrix} = \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$$

以 $\hat{Y}$ 阵 $A$ 可逆, 且其逆 $\hat{Y}$ 阵是 给定 $\hat{Y}$ 阵.



习题1.3( $P_{36} - P_{38}$ )

3. 证 若  $ab \neq 0$ , 由 $\tilde{Y}$ 阵的乘法, 直 验证:

$$\begin{matrix} a & c & \frac{1}{a} & -\frac{c}{ab} \\ 0 & b & 0 & \frac{1}{b} \end{matrix} = \begin{matrix} \frac{1}{a} & -\frac{c}{ab} \\ 0 & \frac{1}{b} \end{matrix} \begin{matrix} a & c \\ 0 & b \end{matrix} = \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$$

以 $\tilde{Y}$ 阵 $A$ 可逆, 且其逆 $\tilde{Y}$ 阵是 给定 $\tilde{Y}$ 阵.

若  $a = 0$ , 则 $\tilde{Y}$ 阵 $A$ 的第一列为0, 从而对任意的 $2 \times 2$   $\tilde{Y}$ 阵 $B$ , 都有 $BA$ 的第一列全为0, 从而对任意的 $2 \times 2$   $\tilde{Y}$ 阵 $B$ , 都有 $BA$ 不是单位 $\tilde{Y}$ 阵, 以 $A$ 不可逆;



习题1.3( $P_{36} - P_{38}$ )

3. 证 若  $ab \neq 0$ , 由 $\tilde{Y}$ 阵的乘法, 直验证:

$$\begin{array}{cc|cc} a & c & \frac{1}{a} & -\frac{c}{ab} \\ 0 & b & 0 & \frac{1}{b} \end{array} = \begin{array}{cc|cc} \frac{1}{a} & -\frac{c}{ab} & a & c \\ 0 & \frac{1}{b} & 0 & b \end{array} = \begin{array}{cc} 1 & 0 \\ 0 & 1 \end{array}$$

以 $\tilde{Y}$ 阵 $A$ 可逆, 且其逆 $\tilde{Y}$ 阵是给定 $\tilde{Y}$ 阵.

若  $a = 0$ , 则 $\tilde{Y}$ 阵 $A$ 的第一列为0, 从而对任意的 $2 \times 2$ 阵 $B$ , 都有 $BA$ 的第一列全为0, 从而对任意的 $2 \times 2$ 阵 $B$ , 都有 $BA$ 不是单位 $\tilde{Y}$ 阵, 以 $A$ 不可逆;

若  $b = 0$ , 则 $\tilde{Y}$ 阵 $A$ 的第二行为0, 从而对任意的 $2 \times 2$ 阵 $B$ , 都有 $AB$ 的第二行全为0, 从而对任意的 $2 \times 2$ 阵 $B$ , 都有 $AB$ 不是单位 $\tilde{Y}$ 阵, 以 $A$ 不可逆;



习题1.3( $P_{36} - P_{38}$ )

3. 证 若  $ab \neq 0$ , 由 $\tilde{Y}$ 阵的乘法, 直验证:

$$\begin{array}{cc|cc} a & c & \frac{1}{a} & -\frac{c}{ab} \\ 0 & b & 0 & \frac{1}{b} \end{array} = \begin{array}{cc|cc} \frac{1}{a} & -\frac{c}{ab} & a & c \\ 0 & \frac{1}{b} & 0 & b \end{array} = \begin{array}{cc} 1 & 0 \\ 0 & 1 \end{array}$$

以 $\tilde{Y}$ 阵 $A$ 可逆, 且其逆 $\tilde{Y}$ 阵是给定 $\tilde{Y}$ 阵.

若  $a = 0$ ,  $\because$   $\tilde{Y}$ 阵 $A$ 的第一列为0, 从而对任意的 $2 \times 2$   $\tilde{Y}$ 阵 $B$ , 都有 $BA$ 的第一列全为0, 从而对任意的 $2 \times 2$   $\tilde{Y}$ 阵 $B$ , 都有 $BA$ 不是单位 $\tilde{Y}$ 阵, 以 $A$ 不可逆;

若  $b = 0$ ,  $\because$   $\tilde{Y}$ 阵 $A$ 的第二行为0, 从而对任意的 $2 \times 2$   $\tilde{Y}$ 阵 $B$ , 都有 $AB$ 的第二行全为0, 从而对任意的 $2 \times 2$   $\tilde{Y}$ 阵 $B$ , 都有 $AB$ 不是单位 $\tilde{Y}$ 阵, 以 $A$ 不可逆;

从而  $ab = 0$  时,  $A$ 不是可逆 $\tilde{Y}$ 阵, 即,  $A$ 可逆,  $\Leftrightarrow ab \neq 0$ .



习题1.3( $P_{36} - P_{38}$ )

3. 证 若  $ab \neq 0$ , 由 $\tilde{Y}$ 阵的乘法, 直验证:

$$\begin{array}{cc|cc} a & c & \frac{1}{a} & -\frac{c}{ab} \\ 0 & b & 0 & \frac{1}{b} \end{array} = \begin{array}{cc|cc} \frac{1}{a} & -\frac{c}{ab} & a & c \\ 0 & \frac{1}{b} & 0 & b \end{array} = \begin{array}{cc} 1 & 0 \\ 0 & 1 \end{array}$$

以 $\tilde{Y}$ 阵 $A$ 可逆, 且其逆 $\tilde{Y}$ 阵是给定 $\tilde{Y}$ 阵.

若  $a = 0$ ,  $\because$   $\tilde{Y}$ 阵 $A$ 的第一列为0, 从而对任意的 $2 \times 2$   $\tilde{Y}$ 阵 $B$ , 都有 $BA$ 的第一列全为0, 从而对任意的 $2 \times 2$   $\tilde{Y}$ 阵 $B$ , 都有 $BA$ 不是单位 $\tilde{Y}$ 阵, 以 $A$ 不可逆;

若  $b = 0$ ,  $\because$   $\tilde{Y}$ 阵 $A$ 的第二行为0, 从而对任意的 $2 \times 2$   $\tilde{Y}$ 阵 $B$ , 都有 $AB$ 的第二行全为0, 从而对任意的 $2 \times 2$   $\tilde{Y}$ 阵 $B$ , 都有 $AB$ 不是单位 $\tilde{Y}$ 阵, 以 $A$ 不可逆;

从而  $ab = 0$  时,  $A$ 不是可逆 $\tilde{Y}$ 阵, 即,  $A$ 可逆,  $\Leftrightarrow ab \neq 0$ .

以,  $A$ 可逆的充要条件是  $ab \neq 0$

习题1.3( $P_{36} - P_{38}$ )

4.(1)



习题1.3( $P_{36} - P_{38}$ )

4.(1)证 记 $AB = C; BA = D.$



习题1.3( $P_{36} - P_{38}$ )

4.(1)证 记 $AB = C; BA = D$ .假设 $C; D$ 都是可逆矩阵,

习题1.3( $P_{36} - P_{38}$ )

4.(1)证 记 $AB = C; BA = D$ .假设 $C; D$ 都是可逆矩阵，  
因为 $AB = C$ 且 $A$ 是可逆矩阵， $\exists AB = C \Leftrightarrow$ 两边同时左  
乘 $A^{-1}$ ，得 $A^{-1}(AB) = A^{-1}C$ ，即 $B = A^{-1}C$ .

习题1.3( $P_{36} - P_{38}$ )

4.(1)证 记 $AB = C; BA = D$ .假设 $C; D$ 都是可逆矩阵,

因为 $AB = C$ 且 $A$ 是可逆矩阵, 3 $AB = C$ ü边同时左乘 $A^{-1}$ , 得 $A^{-1}(AB) = A^{-1}C$ , 即 $B = A^{-1}C$ .

可逆矩阵之积仍是可逆矩阵, 以 $B = A^{-1}C$ 为可逆矩阵,  
ü与 $B$ 不可逆 盾.



习题1.3( $P_{36} - P_{38}$ )

4.(1)证 记 $AB = C; BA = D$ .假设 $C; D$ 都是可逆矩阵,

因为 $AB = C$ 且 $A$ 是可逆矩阵, 3 $AB = C$ ü边同时左乘 $A^{-1}$ , 得 $A^{-1}(AB) = A^{-1}C$ , 即 $B = A^{-1}C$ .

可逆矩阵之积仍是可逆矩阵, 以 $B = A^{-1}C$ 为可逆矩阵,  
ü与 $B$ 不可逆 盾. 以 $AB$ 不可逆.



习题1.3( $P_{36} - P_{38}$ )

4.(1)证 记 $AB = C; BA = D$ .假设 $C; D$ 都是可逆矩阵,

因为 $AB = C$ 且 $A$ 是可逆矩阵, 3 $AB = C$ ü边同时左乘 $A^{-1}$ , 得 $A^{-1}(AB) = A^{-1}C$ , 即 $B = A^{-1}C$ .

可逆矩阵之积仍是可逆矩阵, 以 $B = A^{-1}C$ 为可逆矩阵, ü与 $B$ 不可逆 盾. 以 $AB$ 不可逆.

因为 $BA = D$ 且 $A$ 是可逆矩阵, 3 $BA = D$ ü边同时右乘 $A^{-1}$ , 得 $(BA)A^{-1} = DA^{-1}$ , 即 $B = DA^{-1}$ .



习题1.3( $P_{36} - P_{38}$ )

4.(1)证 记 $AB = C; BA = D$ .假设 $C; D$ 都是可逆 $\bar{Y}$ 阵,

因为 $AB = C$ 且 $A$ 是可逆 $\bar{Y}$ 阵, 3 $AB = C$ ü边同时左乘 $A^{-1}$ , 得 $A^{-1}(AB) = A^{-1}C$ , 即 $B = A^{-1}C$ .

可逆 $\bar{Y}$ 阵之积仍是可逆 $\bar{Y}$ 阵, 以 $B = A^{-1}C$ 为可逆 $\bar{Y}$ 阵,  
ù与 $B$ 不可逆 盾. 以 $AB$ 不可逆.

因为 $BA = D$ 且 $A$ 是可逆 $\bar{Y}$ 阵, 3 $BA = D$ ü边同时右乘 $A^{-1}$ , 得 $(BA)A^{-1} = DA^{-1}$ , 即 $B = DA^{-1}$ .

可逆 $\bar{Y}$ 阵之积仍是可逆 $\bar{Y}$ 阵, 以 $B = DA^{-1}$ 为可逆 $\bar{Y}$ 阵,  
ù与 $B$ 不可逆 盾.



习题1.3( $P_{36} - P_{38}$ )

4.(1)证 记 $AB = C; BA = D$ .假设 $C; D$ 都是可逆 $\bar{Y}$ 阵,

因为 $AB = C$ 且 $A$ 是可逆 $\bar{Y}$ 阵,  $\exists AB = C \text{ 与 } A^{-1}$ 边同时左乘 $A^{-1}$ , 得 $A^{-1}(AB) = A^{-1}C$ , 即 $B = A^{-1}C$ .

可逆 $\bar{Y}$ 阵之积仍是可逆 $\bar{Y}$ 阵, 以 $B = A^{-1}C$ 为可逆 $\bar{Y}$ 阵,  
 与 $B$ 不可逆 盾. 以 $AB$ 不可逆.

因为 $BA = D$ 且 $A$ 是可逆 $\bar{Y}$ 阵,  $\exists BA = D \text{ 与 } A^{-1}$ 边同时右乘 $A^{-1}$ , 得 $(BA)A^{-1} = DA^{-1}$ , 即 $B = DA^{-1}$ .

可逆 $\bar{Y}$ 阵之积仍是可逆 $\bar{Y}$ 阵, 以 $B = DA^{-1}$ 为可逆 $\bar{Y}$ 阵,  
 与 $B$ 不可逆 盾. 以 $BA$ 不可逆.

## 4.(2)

习题1.3( $P_{36} - P_{38}$ )

**4.(1)证** 记 $AB = C; BA = D$ . 假设 $C; D$ 都是可逆 $\hat{Y}$ 阵,

因为 $AB = C$ 且 $A$ 是可逆 $\hat{Y}$ 阵,  $\exists AB = C \hat{U}$ 边同时左乘 $A^{-1}$ , 得 $A^{-1}(AB) = A^{-1}C$ , 即 $B = A^{-1}C$ .

可逆 $\hat{Y}$ 阵之积仍是可逆 $\hat{Y}$ 阵, 以 $B = A^{-1}C$ 为可逆 $\hat{Y}$ 阵,  
 $\hat{U}$ 与 $B$ 不可逆 盾. 以 $AB$ 不可逆.

因为 $BA = D$ 且 $A$ 是可逆 $\hat{Y}$ 阵,  $\exists BA = D \hat{U}$ 边同时右乘 $A^{-1}$ , 得 $(BA)A^{-1} = DA^{-1}$ , 即 $B = DA^{-1}$ .

可逆 $\hat{Y}$ 阵之积仍是可逆 $\hat{Y}$ 阵, 以 $B = DA^{-1}$ 为可逆 $\hat{Y}$ 阵,  
 $\hat{U}$ 与 $B$ 不可逆 盾. 以 $BA$ 不可逆.

**4.(2)证** 因为 $A; AB$ 都是可逆 $\hat{Y}$ 阵, 以 $A^{-1}(AB)$ 是可逆 $\hat{Y}$ 阵,



习题1.3( $P_{36} - P_{38}$ )

**4.(1)证** 记 $AB = C; BA = D$ . 假设 $C; D$ 都是可逆 $\bar{Y}$ 阵,

因为 $AB = C$ 且 $A$ 是可逆 $\bar{Y}$ 阵,  $\exists AB = C \text{ 与 } A^{-1}$ 边同时左乘 $A^{-1}$ , 得 $A^{-1}(AB) = A^{-1}C$ , 即 $B = A^{-1}C$ .

可逆 $\bar{Y}$ 阵之积仍是可逆 $\bar{Y}$ 阵, 以 $B = A^{-1}C$ 为可逆 $\bar{Y}$ 阵,  
 与 $B$ 不可逆 盾. 以 $AB$ 不可逆.

因为 $BA = D$ 且 $A$ 是可逆 $\bar{Y}$ 阵,  $\exists BA = D \text{ 与 } A^{-1}$ 边同时右乘 $A^{-1}$ , 得 $(BA)A^{-1} = DA^{-1}$ , 即 $B = DA^{-1}$ .

可逆 $\bar{Y}$ 阵之积仍是可逆 $\bar{Y}$ 阵, 以 $B = DA^{-1}$ 为可逆 $\bar{Y}$ 阵,  
 与 $B$ 不可逆 盾. 以 $BA$ 不可逆.

**4.(2)证** 因为 $A; AB$ 都是可逆 $\bar{Y}$ 阵, 以 $A^{-1}(AB)$ 是可逆 $\bar{Y}$ 阵, 即 $B = A^{-1}(AB)$ 是可逆 $\bar{Y}$ 阵.

习题1.3( $P_{36} - P_{38}$ )

4.(3)



习题1.3( $P_{36} - P_{38}$ )

4.(3)证 假设 $A$ 规范 梯形 $\mathbf{Y}$ 阵中 有0行,

习题1.3( $P_{36} - P_{38}$ )

4.(3)证 假设 $A$ 规范 梯形 $\bar{Y}$ 阵中 有0行, 由于 $A$ 是  
 $n \times n$  $\bar{Y}$ 阵, 以 $\bar{Y}$ 阵 $A$ 的规范 梯形 $\bar{Y}$ 阵中, 一行都有一个  
主 , 且主 应该分布 $\exists$  一列,

习题1.3( $P_{36} - P_{38}$ )

**4.(3)证** 假设 $A$ 规范 梯形 $\tilde{Y}$ 阵中 有0行, 由于 $A$ 是  
 $n \times n$  $\tilde{Y}$ 阵, 以 $\tilde{Y}$ 阵 $A$ 的规范 梯形 $\tilde{Y}$ 阵中, 一行都有一个  
 主 , 且主 应该分布于 一列, 从而 $A$ 的规范 梯形只能是单  
 位 $\tilde{Y}$ 阵,

习题1.3( $P_{36} - P_{38}$ )

**4.(3)证** 假设 $A$ 规范 梯形 $\tilde{Y}$ 阵中 有0行, 由于 $A$ 是  
 $n \times n$  $\tilde{Y}$ 阵, 以 $\tilde{Y}$ 阵 $A$ 的规范 梯形 $\tilde{Y}$ 阵中, 一行都有一个  
 主 , 且主 应该分布于 一列, 从而 $A$ 的规范 梯形只能是单  
 位 $\tilde{Y}$ 阵, 即存于初等 $\tilde{Y}$ 阵 $P_1; P_2; \dots; P_s$ , 使得

$$P_s \cdots P_2 P_1 A = I;$$



习题1.3( $P_{36} - P_{38}$ )

4.(3)证 假设 $A$ 规范 梯形 $\tilde{Y}$ 阵中 有0行, 由于 $A$ 是  
 $n \times n$  $\tilde{Y}$ 阵, 以 $\tilde{Y}$ 阵 $A$ 的规范 梯形 $\tilde{Y}$ 阵中, 一行都有一个  
主 , 且主 应该分布于 一列, 从而 $A$ 的规范 梯形只能是单  
位 $\tilde{Y}$ 阵,  $\square$

习题1.3( $P_{36} - P_{38}$ )

**4.(3)证** 假设 $A$ 规范 梯形 $\bar{Y}$ 阵中 有0行, 由于 $A$ 是  
 $n \times n\bar{Y}$ 阵, 以 $\bar{Y}$ 阵 $A$ 的规范 梯形 $\bar{Y}$ 阵中, 一行都有一个  
 主 , 且主 应该分布 $\exists$  一列, 从而 $A$ 的规范 梯形只能是单  
 位 $\bar{Y}$ 阵, 即存 $\exists$ 初等 $\bar{Y}$ 阵 $P_1; P_2; \dots; P_s$ , 使得

$$P_s \cdots P_2 P_1 A = I; A = P_1^{-1} P_2^{-1} \cdots P_s^{-1}$$

为可逆 $\bar{Y}$ 阵之积, 为可逆 $\bar{Y}$ 阵,  $\therefore$ 与已知 盾.

以不可逆方阵的规范 梯形中, 必有0行.

**4.(4)**

习题1.3( $P_{36} - P_{38}$ )

**4.(3)证** 假设 $A$ 规范 梯形 $\bar{Y}$ 阵中 有0行, 由于 $A$ 是 $n \times n$  $\bar{Y}$ 阵, 以 $\bar{Y}$ 阵 $A$ 的规范 梯形 $\bar{Y}$ 阵中, 一行都有一个主 , 且主 应该分布于 一列, 从而 $A$ 的规范 梯形只能是单位 $\bar{Y}$ 阵, 即存于初等 $\bar{Y}$ 阵 $P_1; P_2; \dots; P_s$ , 使得

$$P_s \cdots P_2 P_1 A = I; A = P_1^{-1} P_2^{-1} \cdots P_s^{-1}$$

为可逆 $\bar{Y}$ 阵之积, 为可逆 $\bar{Y}$ 阵, 与已知 盾.

以不可逆方阵的规范 梯形中, 必有0行.

**4.(4)证** 若 $A; B$ 都可逆, 而可逆 $\bar{Y}$ 阵之积仍可逆, 从而 $AB$ 可逆.

设 $AB$ 可逆, 若 $A$ 不可逆, 由**4.(3)**的(论,  $A$ 的规范梯形中必有0行,



习题1.3( $P_{36} - P_{38}$ )

**4.(3)证** 假设 $A$ 规范 梯形 $\bar{Y}$ 阵中 有0行, 由于 $A$ 是 $n \times n$  $\bar{Y}$ 阵, 以 $\bar{Y}$ 阵 $A$ 的规范 梯形 $\bar{Y}$ 阵中, 一行都有一个主 , 且主 应该分布于 一列, 从而 $A$ 的规范 梯形只能是单位 $\bar{Y}$ 阵, 即存3初等 $\bar{Y}$ 阵 $P_1; P_2; \dots; P_s$ , 使得

$$P_s \cdots P_2 P_1 A = I; A = P_1^{-1} P_2^{-1} \cdots P_s^{-1}$$

为可逆 $\bar{Y}$ 阵之积, 为可逆 $\bar{Y}$ 阵, 与已知 盾.

以不可逆方阵的规范 梯形中, 必有0行.

**4.(4)证** 若 $A; B$ 都可逆, 而可逆 $\bar{Y}$ 阵之积仍可逆, 从而 $AB$ 可逆.

设 $AB$ 可逆, 若 $A$ 不可逆, 由**4.(3)**的(论,  $A$ 的规范梯形中必有0行, 设 $A$ 的规范 梯形为 $C$ , 从而存3初等 $\bar{Y}$ 阵 $P_1; P_2; \dots; P_s$ , 使得 $P_s \cdots P_2 P_1 A = C$ ,

习题1.3( $P_{36} - P_{38}$ )

4.(3)证 假设 $A$ 规范 梯形 $\tilde{Y}$ 阵中 有0行, 由于 $A$ 是  
 $n \times n$  $\tilde{Y}$ 阵, 以 $\tilde{Y}$ 阵 $A$ 的规范 梯形 $\tilde{Y}$ 阵中, 一行都有一个  
主 , 且主 应该分布于 一列, 从而 $A$ 的规范 梯形只能是单  
位 $\tilde{Y}$ 阵,

习题1.3( $P_{36} - P_{38}$ )

2由4.(1)的(论,  $AB = (P_1^{-1}P_2^{-1}\cdots P_s^{-1})(BC)$ 不可逆, 与已知盾.



习题1.3( $P_{36} - P_{38}$ )

2由4.(1)的(论,  $AB = (P_1^{-1}P_2^{-1}\cdots P_s^{-1})(BC)$ 不可逆, 与已知盾.

若 $A$ 可逆而 $B$ 不可逆,



习题1.3( $P_{36} - P_{38}$ )

2由4.(1)的(论,  $AB = (P_1^{-1}P_2^{-1}\cdots P_s^{-1})(BC)$ 不可逆, 与已知盾.

若 $A$ 可逆而 $B$ 不可逆, 由4.(1)的(论,  $KAB$ 不可逆, 与已知盾.



习题1.3( $P_{36} - P_{38}$ )

2由4.(1)的(论,  $AB = (P_1^{-1}P_2^{-1}\cdots P_s^{-1})(BC)$ 不可逆, 与已知盾.

若 $A$ 可逆而 $B$ 不可逆, 由4.(1)的(论,  $KAB$ 不可逆, 与已知盾.

以 $AB$ 可逆时, 必有 $A; B$ 都可逆.



习题1.3( $P_{36} - P_{38}$ )

2由4.(1)的(论,  $AB = (P_1^{-1}P_2^{-1}\cdots P_s^{-1})(BC)$ 不可逆, 与已知盾.

若 $A$ 可逆而 $B$ 不可逆, 由4.(1)的(论,  $KAB$ 不可逆, 与已知盾.

以 $AB$ 可逆时, 必有 $A; B$ 都可逆.

5.

习题1.3( $P_{36} - P_{38}$ )

2由4.(1)的(论,  $AB = (P_1^{-1}P_2^{-1}\cdots P_s^{-1})(BC)$ 不可逆, 与已知盾.

若 $A$ 可逆而 $B$ 不可逆, 由4.(1)的(论,  $KAB$ 不可逆, 与已知盾.

以 $AB$ 可逆时, 必有 $A; B$ 都可逆.

○ 5.) | 用矩阵的乘法, 方程组可以表示为

$$A \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix},$$

$$\begin{matrix} & 3 \\ x_3 & \end{matrix}$$



习题1.3( $P_{36} - P_{38}$ )

由4.(1)的论， $AB = (P_1^{-1}P_2^{-1}\cdots P_s^{-1})(BC)$ 不可逆，与已知盾.

若 $A$ 可逆而 $B$ 不可逆，由4.(1)的论， $AB$ 不可逆，与已知盾.

以 $AB$ 可逆时，必有 $A, B$ 都可逆.

○ 5.) | 用阵的乘法，方程组可以表示为

$$A \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \text{ 左边同时左乘 } A^{-1}, \text{ 得}$$

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$



习题1.3( $P_{36} - P_{38}$ )

由4.(1)的论， $AB = (P_1^{-1}P_2^{-1}\cdots P_s^{-1})(BC)$ 不可逆，与已知盾.

若 $A$ 可逆而 $B$ 不可逆，由4.(1)的论， $AB$ 不可逆，与已知盾.

以 $AB$ 可逆时，必有 $A, B$ 都可逆.

○ 5.) | 用 $\text{Y}$ 阵的乘法，方程组可以表示为

$$A \begin{pmatrix} x_1 \\ B \\ @x_2 \end{pmatrix} C = \begin{pmatrix} 1 \\ B \\ @2 \end{pmatrix}, \text{ ⑤} \quad \text{边同时左乘} A^{-1}, \text{ 得}$$

$$\begin{matrix} x_3 & 1 & 3 \\ \textcircled{O} & 1 & \textcircled{O} & 1 \\ x_1 & B \\ @x_2 & A^{-1} & B \\ & & @2 \end{matrix} =$$

$$x_3 \qquad \qquad \qquad 3$$

习题1.3( $P_{36} - P_{38}$ )

由4.(1)的论， $AB = (P_1^{-1}P_2^{-1}\cdots P_s^{-1})(BC)$ 不可逆，与已知盾.

若 $A$ 可逆而 $B$ 不可逆，由4.(1)的论， $AB$ 不可逆，与已知盾.

以 $AB$ 可逆时，必有 $A, B$ 都可逆.

○ 5.) | 用 $\text{Y}$ 阵的乘法，方程组可以表示为

$$A \begin{pmatrix} x_1 \\ B \\ @x_2 \\ C \end{pmatrix} = \begin{pmatrix} 1 \\ B \\ @2 \\ C \end{pmatrix}, \text{ 左边同时左乘 } A^{-1}, \text{ 得}$$

$$\begin{array}{ccccccccc} & x_3 & & 3 & & & & & \\ \textcircled{O} & 1 & & & \textcircled{O} & 1 & & & \textcircled{O} & 1 \\ & x_1 & & & 1 & & 1 & & 1 \\ \textcircled{B} & @x_2 & \textcircled{C} & = & \textcircled{B} & @2 & \textcircled{C} & = & \textcircled{B} & @2 & \textcircled{C} \\ & & & & 1 & & 0 & & 1 \\ & & & & & 1 & & 1 & \\ & & & & & & 1 & & \\ & x_3 & & 3 & & 0 & 1 & 1 & 3 \end{array}$$



习题1.3( $P_{36} - P_{38}$ )

由4.(1)的论， $AB = (P_1^{-1}P_2^{-1}\cdots P_s^{-1})(BC)$ 不可逆，与已知盾.

若 $A$ 可逆而 $B$ 不可逆，由4.(1)的论， $AB$ 不可逆，与已知盾.

以 $AB$ 可逆时，必有 $A, B$ 都可逆.

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$$A \begin{matrix} x_1 \\ B \\ @x_2 \end{matrix} C = \begin{matrix} 1 \\ B \\ @2 \end{matrix} C, \text{ 左边同时左乘 } A^{-1}, \text{ 得}$$

$$\begin{matrix} x_3 \\ 0 \\ 1 \\ 3 \\ x_1 \\ @x_2 \end{matrix} C = A^{-1} \begin{matrix} 0 \\ 1 \\ @2 \end{matrix} C = \begin{matrix} 0 \\ 1 \\ 0 \\ 1 \\ 1 \\ @1 \end{matrix} C \begin{matrix} 1 \\ 0 \\ 1 \\ 1 \\ 1 \\ @2 \end{matrix} C = \begin{matrix} 0 \\ 1 \\ 4 \\ @6 \end{matrix} C.$$



习题1.3( $P_{36} - P_{38}$ )

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习题1.3( $P_{36} - P_{38}$ )

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 $\begin{matrix} & 0 & 0 & 2 \\ \text{又因为 } B - 2I = & \begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix} & ; \\ & 2 & 0 & 0 \end{matrix}$



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又因为  $B - 2I = \begin{pmatrix} 0 & 0 & 2 \\ 0 & 2 & 0 \end{pmatrix}$ ;  $(2I)^{-1} = \frac{1}{2}I$

$$\begin{matrix} 0 & 0 & 0 \\ 0 & 0 & -1 \end{matrix}$$

$$\begin{matrix} & 0 & 0 & 1 \\ B & 0 & 1 & 0 \\ C & 0 & 0 & 1 \end{matrix}$$

$$\text{以 } (A - I)^{-1} = \begin{pmatrix} B & 0 \\ 0 & C \end{pmatrix}.$$

$$1 \mid 0 \quad 0$$

$$10.) \sim \text{如} A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}; B = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix},$$



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又因为  $B - 2I = \begin{pmatrix} 0 & 0 & 2 \\ 0 & 2 & 0 \end{pmatrix}$ ;  $(2I)^{-1} = \frac{1}{2}I$

$$(A - I)^{-1} = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\text{以 } (A - I)^{-1} = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}.$$

$$10.) \sim \text{如 } A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}; B = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix},$$

$\sim A, B$ 都是可逆矩阵, 且  $A^{-1} = A, B^{-1} = B$ ,

习题1.3( $P_{36} - P_{38}$ )

$$A + B = \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 1 & 1 \end{matrix} & , \text{ 规范 } \end{matrix} \quad \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 0 & 0 \end{matrix} & , \end{matrix}$$



习题1.3( $P_{36} - P_{38}$ )

$A + B = \begin{matrix} & 1 \\ 1 & 1 \\ 1 & 1 \end{matrix}^!$ , 规范 梯形为  $\begin{matrix} & 1 \\ 1 & 0 \\ 0 & 0 \end{matrix}^!$ ,  $A + B$  不可逆.

习题1.3( $P_{36} - P_{38}$ )

$A + B = \begin{matrix} & 1 \\ 1 & 1 \\ 1 & 1 \end{matrix}^!$ , 规范 梯形为  $\begin{matrix} & 1 \\ 1 & 1 \\ 0 & 0 \end{matrix}^!$ ,  $A + B$ 不可逆.

11.

习题1.3( $P_{36} - P_{38}$ )

$A + B = \begin{matrix} & 1 \\ 1 & 1 \\ 1 & 1 \end{matrix}^!$ , 规范 梯形为  $\begin{matrix} & 1 \\ 1 & 0 \\ 0 & 0 \end{matrix}^!$ ,  $A + B$ 不可逆.

11. 证 若 $A + B$ 可逆,  $\nabla A^{-1}(A + B)B^{-1}$ 可逆,

习题1.3( $P_{36} - P_{38}$ )

$A + B = \begin{matrix} & 1 \\ 1 & 1 \\ & 1 \end{matrix}^!$ , 规范 梯形为  $\begin{matrix} & 1 \\ 1 & 0 \\ & 0 \end{matrix}^!$ ,  $A + B$ 不可逆.

11. 证 若 $A + B$ 可逆, 则 $A^{-1}(A + B)B^{-1}$ 可逆,

而 $A^{-1}(A + B)B^{-1} = A^{-1} + B^{-1}$ , 以 $A^{-1} + B^{-1}$ 可逆;



习题1.3( $P_{36} - P_{38}$ )

$$A + B = \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 1 & 1 \end{matrix} & , \text{ 规范 梯形为 } \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 0 & 0 \end{matrix} & , A + B \text{ 不可逆.} \end{matrix} \end{matrix}$$

**11. 证** 若  $A + B$  可逆,  $\mathbb{K} A^{-1}(A + B)B^{-1}$  可逆,

而  $A^{-1}(A + B)B^{-1} = A^{-1} + B^{-1}$ , 以  $A^{-1} + B^{-1}$  可逆;

若  $A^{-1} + B^{-1}$  可逆,  $\mathbb{K} A(A^{-1} + B^{-1})B$  可逆,

习题1.3( $P_{36} - P_{38}$ )

$$A + B = \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 1 & 1 \end{matrix} & , \text{ 规范 梯形为 } \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 0 & 0 \end{matrix} & , A + B \text{ 不可逆.} \end{matrix} \end{matrix}$$

**11. 证** 若  $A + B$  可逆,  $\mathbb{K} A^{-1}(A + B)B^{-1}$  可逆,

而  $A^{-1}(A + B)B^{-1} = A^{-1} + B^{-1}$ , 以  $A^{-1} + B^{-1}$  可逆;

若  $A^{-1} + B^{-1}$  可逆,  $\mathbb{K} A(A^{-1} + B^{-1})B$  可逆,

而  $A(A^{-1} + B^{-1})B = A + B$  可逆, 以  $A + B$  可逆.



### 习题1.3( $P_{36} - P_{38}$ )

$$A + B = \begin{matrix} & 1 \\ 1 & 1 \\ & 1 \end{matrix}, \text{ 规范 梯形为 } \begin{matrix} & 1 \\ 1 & 0 \\ & 0 \end{matrix}, A + B \text{ 不可逆.}$$

11. 证 若  $A + B$  可逆,  $KA^{-1}(A + B)B^{-1}$  可逆,

而  $A^{-1}(A+B)B^{-1} = A^{-1} + B^{-1}$ , 以  $A^{-1} + B^{-1}$  可逆;

若  $A^{-1} + B^{-1}$  可逆, 则  $A(A^{-1} + B^{-1})B$  可逆,

而  $A(A^{-1} + B^{-1})B = A + B$  可逆, 以  $A + B$  可逆.

$$(A+B)^{-1} = [A(A^{-1} + B^{-1})B]^{-1} = B^{-1}(A^{-1} + B^{-1})^{-1}A^{-1}$$

习题1.3( $P_{36} - P_{38}$ )

$$A + B = \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 1 & 1 \end{matrix} & , \text{ 规范 梯形为 } \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 0 & 0 \end{matrix} & , A + B \text{ 不可逆.} \end{matrix} \end{matrix}$$

11. 证 若  $A + B$  可逆,  $\mathbb{K} A^{-1}(A + B)B^{-1}$  可逆,

而  $A^{-1}(A + B)B^{-1} = A^{-1} + B^{-1}$ , 以  $A^{-1} + B^{-1}$  可逆;

若  $A^{-1} + B^{-1}$  可逆,  $\mathbb{K} A(A^{-1} + B^{-1})B$  可逆,

而  $A(A^{-1} + B^{-1})B = A + B$  可逆, 以  $A + B$  可逆.

$$(A + B)^{-1} = [A(A^{-1} + B^{-1})B]^{-1} = B^{-1}(A^{-1} + B^{-1})^{-1}A^{-1}$$

12.

习题1.3( $P_{36} - P_{38}$ )

$$A + B = \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 1 & 1 \end{matrix} & , \text{ 规范 梯形为 } \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 0 & 0 \end{matrix} & , A + B \text{ 不可逆.} \end{matrix} \end{matrix}$$

11. 证 若  $A + B$  可逆,  $\mathbb{K} A^{-1}(A + B)B^{-1}$  可逆,

而  $A^{-1}(A + B)B^{-1} = A^{-1} + B^{-1}$ , 以  $A^{-1} + B^{-1}$  可逆;

若  $A^{-1} + B^{-1}$  可逆,  $\mathbb{K} A(A^{-1} + B^{-1})B$  可逆,

而  $A(A^{-1} + B^{-1})B = A + B$  可逆, 以  $A + B$  可逆.

$$(A + B)^{-1} = [A(A^{-1} + B^{-1})B]^{-1} = B^{-1}(A^{-1} + B^{-1})^{-1}A^{-1}$$

12.) 因为  $P_1A = B$ ;  $P_2B = I$ ,



习题1.3( $P_{36} - P_{38}$ )

$$A + B = \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 1 & 1 \end{matrix} & , \text{ 规范 梯形为 } \begin{matrix} & ! \\ \begin{matrix} 1 & 1 \\ 0 & 0 \end{matrix} & , A + B \text{ 不可逆.} \end{matrix} \end{matrix}$$

**11.** 证 若  $A + B$  可逆,  $\mathbb{K}A^{-1}(A + B)B^{-1}$  可逆,

而  $A^{-1}(A + B)B^{-1} = A^{-1} + B^{-1}$ , 以  $A^{-1} + B^{-1}$  可逆;

若  $A^{-1} + B^{-1}$  可逆,  $\mathbb{K}A(A^{-1} + B^{-1})B$  可逆,

而  $A(A^{-1} + B^{-1})B = A + B$  可逆, 以  $A + B$  可逆.

$$(A + B)^{-1} = [A(A^{-1} + B^{-1})B]^{-1} = B^{-1}(A^{-1} + B^{-1})^{-1}A^{-1}$$

**12.** 因为  $P_1A = B$ ;  $P_2B = I$ ,

以  $(P_2P_1)A = I$ ,

习题1.3( $P_{36} - P_{38}$ )

$A + B = \begin{matrix} & 1 \\ 1 & 1 \\ & 1 \end{matrix}^!$ , 规范 梯形为  $\begin{matrix} & 1 \\ 1 & 0 \\ & 0 \end{matrix}^!$ ,  $A + B$ 不可逆.

11. 证 若  $A + B$ 可逆,  $K A^{-1}(A + B)B^{-1}$ 可逆,

而  $A^{-1}(A + B)B^{-1} = A^{-1} + B^{-1}$ , 以  $A^{-1} + B^{-1}$ 可逆;

若  $A^{-1} + B^{-1}$ 可逆,  $K A(A^{-1} + B^{-1})B$ 可逆,

而  $A(A^{-1} + B^{-1})B = A + B$ 可逆, 以  $A + B$ 可逆.

$$(A + B)^{-1} = [A(A^{-1} + B^{-1})B]^{-1} = B^{-1}(A^{-1} + B^{-1})^{-1}A^{-1}$$

12.) 因为  $P_1 A = B$ ;  $P_2 B = I$ ,

$$\text{以 } (P_2 P_1)A = I, A = (P_2 P_1)^{-1} = P_1^{-1}P_2^{-1}.$$



习题1.4( $P_{39} - P_{41}$ )

1.(1)



习题1.4( $P_{39} - P_{41}$ )

1.(1)) 
$$\begin{array}{ccc|c} \textcircled{O} & 0 & -2 & 1 \\ \textcircled{B} & 3 & 0 & -2 \\ \textcircled{C} & @ & & \end{array} \xrightarrow{\substack{\text{换1、2行} \\ \text{第3行加到第1行}}} \begin{array}{ccc|c} -2 & 3 & 0 & \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

1.(1)) 
$$\begin{array}{ccc|c} \textcircled{O} & 0 & -2 & 1 \\ \textcircled{B} & 3 & 0 & -2 \\ \textcircled{C} & @ & & \end{array} \xrightarrow{\substack{\text{换1、2行} \\ \text{第3行加到第1行}}} \begin{array}{ccc|c} \textcircled{O} & 1 & 3 & -2 \\ \textcircled{B} & 0 & -2 & 1 \\ \textcircled{C} & @ & & \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccc}
 & \textcircled{O} & 0 & -2 & 1 & 1 \\
 & \textcircled{B} & @ & 3 & 0 & -2 \\
 1.(1)) & \textcircled{C} & @ & 3 & 0 & -2 \\
 & & & -2 & 3 & 0
 \end{array}
 \xrightarrow{\substack{\text{换1、2行} \\ \text{第3行加到第1行}}}
 \begin{array}{ccc}
 & \textcircled{O} & 1 & 3 & -2 & 1 \\
 & \textcircled{B} & @ & 0 & -2 & 1 \\
 & \textcircled{C} & @ & 3 & 0 & 0
 \end{array}$$

第1行的2倍加到第3行

→

第2行的4倍加到第3行

### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccc|c}
 & 0 & -2 & 1 \\
 1.(1)) & \textcircled{B} @ 3 & 0 & -2 \\
 & -2 & 3 & 0
 \end{array}
 \xrightarrow{\substack{\text{换1、2行} \\ \text{第3行加到第1行}}}
 \begin{array}{ccc|c}
 & 1 & 3 & -2 \\
 & \textcircled{B} @ 0 & -2 & 1 \\
 & -2 & 3 & 0
 \end{array}$$

第1行的2倍加到第3行

$$\xrightarrow{\substack{\text{第1行的2倍加到第3行} \\ \text{第2行的4倍加到第3行}}}
 \begin{array}{ccc|c}
 & 1 & 3 & -2 \\
 & \textcircled{B} @ 0 & -2 & 1 \\
 & 0 & 1 & 0
 \end{array}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc}
 & \textcircled{O} & 0 & -2 & 1 & \textcircled{1} & \\
 1.(1)) & \textcircled{B} & 3 & 0 & -2 & \textcircled{A} & \xrightarrow{\text{换1、2行}} & \textcircled{O} & 1 & 3 & -2 & \textcircled{1} \\
 & -2 & 3 & 0 & & & \xrightarrow{\text{第3行加到第1行}} & -2 & 3 & 0 \\
 & \text{第1行的2倍加到第3行} & & \textcircled{1} & 3 & -2 & \xrightarrow{\text{换2、3行}} \\
 & \xrightarrow{\text{第2行的4倍加到第3行}} & & \textcircled{B} & 0 & -2 & \textcircled{A} & \xrightarrow{} & 0 & 1 & 0 & \text{第2行的2倍加到第3行}
 \end{array}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc}
 & \textcircled{O} & 0 & -2 & 1 & \textcircled{C} & \\
 1.(1)) & \textcircled{B} & @3 & 0 & -2 & \textcircled{A} & \xrightarrow{\text{换1、2行}} \\
 & -2 & 3 & 0 & & & \xrightarrow{\text{第3行加到第1行}} \\
 & \textcircled{O} & 1 & 3 & -2 & \textcircled{C} & \xrightarrow{\text{换2、3行}} \\
 & \textcircled{B} & @0 & -2 & 1 & \textcircled{A} & \xrightarrow{} \\
 & \textcircled{O} & 1 & 3 & -2 & \textcircled{C} & \\
 & \textcircled{B} & @0 & 1 & 0 & \textcircled{A} & \xrightarrow{\text{第2行的2倍加到第3行}} \\
 & 0 & 0 & 1 & & & \\
 \end{array}$$



### 习题1.4( $P_{39} - P_{41}$ )



### 习题1.4( $P_{39} - P_{41}$ )

对应的初等 $\gamma$ 阵分别是



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix};$$

习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix};$$

习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}; P_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 2 & 0 & 1 \end{pmatrix};$$



## 习题1

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}; P_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix};$$

$$P_4 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix};$$

$$\begin{matrix} 0 & 4 & 1 \end{matrix}$$





习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}; P_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix};$$

$$P_4 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_5 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_6 = \begin{pmatrix} 2 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix};$$

$$\begin{matrix} 0 & 4 & 1 \\ 0 & 1 & 0 \\ 0 & 2 & 1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}; P_3 = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix};$$

$$P_4 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix}; P_5 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix}; P_6 = \begin{pmatrix} 2 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix};$$

$$P_7 = \begin{pmatrix} 0 & 4 & 1 \\ 1 & 0 & 2 \\ 0 & 1 & 0 \end{pmatrix};$$

$$\begin{matrix} 0 & 0 & 1 \end{matrix}$$

习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}; P_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix};$$

$$P_4 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_5 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_6 = \begin{pmatrix} 2 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix};$$

$$P_7 = \begin{pmatrix} 0 & 4 & 1 \\ 1 & 0 & 2 \\ 0 & 1 & 0 \end{pmatrix}; P_8 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & -3 & 0 \\ 0 & 1 & 0 \end{pmatrix};$$

$$\begin{matrix} 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

习题1.4( $P_{39} - P_{41}$ )

1.(2)

习题1.4( $P_{39} - P_{41}$ )

$$\textcircled{1}(2)$$

$$\begin{matrix} & 0 & 2 & -3 & 1 & 1 \\ \textcircled{B} @ 0 & 3 & -4 & 3 & \textcircled{C} \\ & 0 & 4 & -7 & -1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

1(2)

$$\textcircled{O} \begin{matrix} 0 & 2 & -3 & 1 & 1 \\ @B & 0 & 3 & -4 & 3 \end{matrix} \xrightarrow{\text{换1、2行}} \textcircled{A}$$

0 4 -7 -1 第2行(-1)倍加到第1行



习题1.4( $P_{39} - P_{41}$ )

1(2)

$$\textcircled{O} \begin{matrix} 0 & 2 & -3 & 1 \\ @0 & 3 & -4 & 3 \end{matrix} \textcircled{A} \quad \xrightarrow{\substack{\text{换1、2行} \\ \text{第2行}(-1) \text{倍加到第1行}}} \quad \begin{matrix} 0 & 4 & -7 & -1 \\ @0 & 2 & -3 & 1 \end{matrix} \textcircled{C}$$

$$\textcircled{O} \begin{matrix} 0 & 1 & -1 & 2 \\ @0 & 2 & -3 & 1 \end{matrix} \textcircled{C} \quad \begin{matrix} 0 & 4 & -7 & 1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

1(2)

$$\textcircled{O} \begin{matrix} 0 & 2 & -3 & 1 \\ @0 & 3 & -4 & 3 \end{matrix} \textcircled{A} \quad \xrightarrow{\substack{\text{换 } 1, 2 \text{ 行} \\ \text{第 } 2 \text{ 行 } (-1) \text{ 倍加到第 } 1 \text{ 行}}} \quad \begin{matrix} 0 & 1 & -1 & 2 \\ @0 & 2 & -3 & 1 \end{matrix} \textcircled{C}$$

第1行(-2)倍加到第2行



第1行(-4)倍加到第3行

$$\textcircled{O} \begin{matrix} 0 & 1 & -1 & 2 \\ @0 & 2 & -3 & 1 \end{matrix} \textcircled{C} \quad \begin{matrix} 0 & 4 & -7 & 1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

1(2)

$$\textcircled{O} \begin{matrix} 0 & 2 & -3 & 1 \\ \textcircled{B} @0 & 3 & -4 & 3 \end{matrix} \textcircled{C} \begin{matrix} 1 \\ \textcircled{A} \end{matrix} \rightarrow \begin{matrix} \text{换1、2行} \end{matrix}$$

$$\textcircled{O} \begin{matrix} 0 & 1 & -1 & 2 \\ \textcircled{B} @0 & 2 & -3 & 1 \end{matrix} \textcircled{C} \begin{matrix} 1 \\ \textcircled{A} \end{matrix}$$

$$0 \quad 4 \quad -7 \quad -1 \quad \textcircled{O} \begin{matrix} \text{第2行}(-1) \text{倍加到第1行} \end{matrix} \begin{matrix} 1 \\ 0 & 4 & -7 & 1 \end{matrix}$$

$$\begin{matrix} \text{第1行}(-2) \text{倍加到第2行} \\ \rightarrow \end{matrix} \textcircled{B} \begin{matrix} 0 & 1 & -1 & 2 \\ @0 & 0 & -1 & -3 \end{matrix} \textcircled{C} \begin{matrix} \textcircled{A} \end{matrix}$$

$$\begin{matrix} \text{第1行}(-4) \text{倍加到第3行} \\ \rightarrow \end{matrix} \begin{matrix} 0 & 0 & -3 & -7 \end{matrix}$$



### 习题1.4( $P_{39} - P_{41}$ )

1.(2))

$$\begin{array}{r} \textcircled{1}(2) \\ \textcircled{2} @ 0 \end{array} \begin{array}{ccccccc} 0 & 2 & -3 & 1 & 1 \\ B & 3 & -4 & 3 & C \end{array} \rightarrow \text{换1、2行}$$

换1、2行

$$\begin{array}{ccccc} O & & & & 1 \\ @0 & 1 & -1 & 2 & \\ B & & & & \\ @0 & 2 & -3 & 1 & \\ \hline C & & & & A \end{array}$$

$$\begin{array}{cccccc}
 0 & 4 & -7 & -1 & \text{第2行}(-1) \text{倍加到第1行} & 0 & 4 & -7 & 1 \\
 \text{第1行}(-2) \text{倍加到第2行} & \xrightarrow{\textcircled{O}} & 0 & 1 & -1 & 2 & \text{第2行}(-3) \text{倍加到第3行} \\
 \xrightarrow{\longrightarrow} & \textcircled{B} @ 0 & 0 & -1 & -3 \textcircled{C} & \longrightarrow \\
 \text{第1行}(-4) \text{倍加到第3行} & 0 & 0 & -3 & -7 & \text{第3行乘} \frac{1}{2}
 \end{array}$$



### 习题1.4( $P_{39} - P_{41}$ )

1.(2))

$$\begin{array}{cccc|c} \textcircled{1} & (2) & & & 1 \\ 0 & 2 & -3 & 1 & \\ \textcircled{2} & 0 & 3 & -4 & 3 \\ \hline & & & & C \end{array} \xrightarrow{\text{换 } 1, 2 \text{ 与 } 3} \quad \Rightarrow$$

換1、2行

$$\begin{array}{ccccc} O & & & & 1 \\ 0 & 1 & -1 & 2 & \\ B & & & & \\ @0 & 2 & -3 & 1 & A \end{array}$$

$$\begin{array}{cccc|c} 0 & 4 & -7 & -1 & \\ \text{第1行}(-2) \text{倍加到第2行} & 0 & 1 & -1 & 2 \end{array} \quad \text{第2行}(-1) \text{倍加到第1行} \quad \begin{array}{cccc|c} 0 & 4 & -7 & 1 & \\ 0 & 1 & -1 & 2 & \end{array} \quad \text{第2行}(-3) \text{倍加到第3行}$$

第1行(-2)倍加到第2行

$$\text{B} \xrightarrow{@0} \begin{matrix} 0 & 1 & -1 & 2 \\ 0 & 0 & -1 & -3 \end{matrix} \quad \text{第2行}(-3) \text{倍加到第3行}$$

第2行(-3)倍加到第3行

$$\text{第1行}(-4) \text{倍加到第3行} \quad 0 \ 0 \ -3 \ -7 \quad \text{第3行乘 } \frac{1}{2}$$

第1行(-4)倍加到第3行

$$0 \quad 0 \quad -3 \quad -7 \quad \text{第3行乘} \frac{1}{3}$$

$$\begin{array}{ccccc} & 0 & 1 & -1 & 2 \\ \mathbb{B} @ 0 & 0 & -1 & -3 & \mathbb{C} \\ & A & & & \end{array}$$

$$\begin{array}{cccc} 0 & 1 & -1 & 2 \\ \mathbb{B} @ 0 & 0 & -1 & -3 \\ & & & \mathbb{C} \end{array}$$

0 0 0 1



### 习题1.4( $P_{39} - P_{41}$ )

1.(2))

$$\begin{array}{cccc|c} \textcircled{1} & (2) & & & 1 \\ 0 & 2 & -3 & 1 & \\ \textcircled{2} & 0 & 3 & -4 & 3 \\ \hline & & & & C \end{array} \xrightarrow{\text{换 } 1, 2 \text{ 与行}}$$

換1、2行

$$\begin{array}{ccccc} O & & & & 1 \\ 0 & 1 & -1 & 2 & \\ B @ 0 & 2 & -3 & 1 & A \end{array}$$

$$\begin{array}{cccc|c} 0 & 4 & -7 & -1 & \\ \text{第1行}(-2) \text{倍加到第2行} & 0 & 1 & -1 & 2 \end{array} \quad \text{第2行}(-1) \text{倍加到第1行} \quad \begin{array}{cccc|c} 0 & 4 & -7 & 1 & \\ 0 & 1 & -1 & 2 & \end{array} \quad \text{第2行}(-3) \text{倍加到第3行}$$

第1行(-2)倍加到第2行

$$\text{B} \xrightarrow{@0} \begin{matrix} 0 & 1 & -1 & 2 \\ 0 & 0 & -1 & -3 \end{matrix} \quad \text{第2行}(-3) \text{倍加到第3行}$$

第2行(-3)倍加到第3行

$$\text{第1行}(-4) \text{倍加到第3行} \quad 0 \ 0 \ -3 \ -7 \quad \text{第3行乘 } \frac{1}{2}$$

第1行(-4)倍加到第3行

$$\text{B} \xrightarrow{@0} \begin{matrix} 0 & 1 & -1 & 2 \\ 0 & 0 & -1 & -3 \end{matrix} \quad \text{C} \rightarrow$$

第3行3倍加到第2行

0 0 0 1 第3行(-2)倍加到第1行



### 习题1.4( $P_{39} - P_{41}$ )

1.(2))

$$\begin{array}{cccc|c} & & & & 1 \\ \textcircled{1} & 0 & 2 & -3 & 1 \\ \textcircled{2} & 0 & 3 & -4 & 3 \end{array} \xrightarrow{\text{换1、2行}} \begin{array}{cccc|c} & & & & 1 \\ \textcircled{2} & 0 & 3 & -4 & 3 \\ \textcircled{1} & 0 & 2 & -3 & 1 \end{array}$$

換1、2行

$$\begin{array}{ccccc} O & & & & 1 \\ \begin{matrix} 0 \\ B \\ @0 \end{matrix} & 1 & -1 & 2 & \begin{matrix} C \\ 1 \\ A \end{matrix} \\ \hline & 2 & -3 & & \end{array}$$

$$\begin{array}{cccc|c} 0 & 4 & -7 & -1 & \\ \text{第1行}(-2) \text{倍加到第2行} & 0 & 1 & -1 & 2 \end{array} \quad \text{第2行}(-1) \text{倍加到第1行} \quad \begin{array}{cccc|c} 0 & 4 & -7 & 1 & \\ 0 & 1 & -1 & 2 & \end{array} \quad \text{第2行}(-3) \text{倍加到第3行}$$

第1行(-2)倍加到第2行

$$\text{B} \xrightarrow{\text{第2行}(-3)\text{倍加到第3行}} \text{C}$$

第2行(-3)倍加到第3行

$$\text{第1行}(-4) \text{倍加到第3行} \quad 0 \ 0 \ -3 \ -7 \quad \text{第3行乘} \frac{1}{2} \quad 1$$

$$0 \ 1 \ -1 \ 2 \quad \text{第3行3倍加到第2行} \quad 0 \ 1 \ -1 \ 0$$

$$@0 \ 0 \ -1 \ -3 \rightarrow @0 \ 0 \ -1 \ 0$$

$$0 \quad 0 \quad -3 \quad -7$$

$$\text{第3行乘} \frac{1}{2}$$

|                   |    |   |    |   |                   |
|-------------------|----|---|----|---|-------------------|
| $\textcircled{O}$ | 0  | 1 | -1 | 0 | 1                 |
| $\textcircled{B}$ | @0 | 0 | -1 | 0 | $\textcircled{C}$ |
|                   |    |   |    |   | $\textcircled{A}$ |

第3行3倍加到第2行

$$\mathbb{B}_{@0} \quad 0 \quad -1 \quad -3 \mathbb{A} \rightarrow$$

B @ 0 0 -1 0 C A

$$0 \ 0 \ 0 \ 1 \quad \text{第3行}(-2) \text{倍加到第1行} \quad 0 \ 0 \ 0 \ 1$$



### 习题1.4( $P_{39} - P_{41}$ )

1(2))

$$\begin{array}{cccc|c} & & & & 1 \\ \textcircled{1} & 0 & 2 & -3 & 1 \\ \textcircled{2} & 0 & 3 & -4 & 3 \end{array} \xrightarrow{\text{换1、2行}} \begin{array}{cccc|c} & & & & 1 \\ \textcircled{2} & 0 & 3 & -4 & 3 \\ \textcircled{1} & 0 & 2 & -3 & 1 \end{array}$$

換1、2行

$$\begin{array}{ccccc} O & & & & 1 \\ \downarrow 0 & 1 & -1 & 2 \\ B & & & & C \\ \downarrow 0 & 2 & -3 & 1 \\ A & & & & \end{array}$$

$$\begin{array}{cccc|c} 0 & 4 & -7 & -1 & \\ \text{第2行}(-1) \text{倍加到第1行} & \textcircled{1} & 0 & 1 & -1 & 2 \\ \hline 0 & 4 & -7 & 1 & \\ \text{第1行}(-2) \text{倍加到第2行} & & 0 & 1 & -1 & 2 & \\ \text{第2行}(-3) \text{倍加到第3行} & & & 1 & -1 & 2 & \end{array}$$

第1行(-2)倍加到第2行

$$\text{第2行}(-3) \text{倍加到第3行}$$

第1行(-4)倍加到第3行

$$\text{第1行}(-4) \text{倍加到第3行} \quad 0 \ 0 \ -3 \ -7 \quad \text{第3行乘} \frac{1}{2} \quad 1$$

$$0 \ 1 \ -1 \ 2 \quad \text{第3行3倍加到第2行} \quad 0 \ 1 \ -1 \ 0$$

$$@0 \ 0 \ -1 \ -3 \rightarrow @0 \ 0 \ -1 \ 0$$

$$0 \quad 0 \quad -3 \quad -7$$

$$\text{第3行乘} \frac{1}{2}$$

|                   |    |   |    |   |                   |
|-------------------|----|---|----|---|-------------------|
| $\textcircled{O}$ | 0  | 1 | -1 | 0 | 1                 |
| $\textcircled{B}$ | @0 | 0 | -1 | 0 | $\textcircled{C}$ |
|                   |    |   |    |   | $\textcircled{A}$ |

$$0 \quad 0 \quad 0 \quad 1 \quad \text{第3行}(-2) \text{倍加到第1行} \quad 0 \quad 0 \quad 0 \quad 1$$

第2行乘(-1)

→

第2行加到第1行



习题1.4( $P_{39} - P_{41}$ )

1(2)

$$\begin{array}{cccc|c} & & & & 1 \\ \textcircled{O} & 0 & 2 & -3 & 1 \\ \textcircled{B} & @0 & 3 & -4 & 3 \\ & & & & \textcircled{C} \end{array} \xrightarrow{\substack{\text{换 } 1, 2 \text{ 行}}} \begin{array}{cccc|c} & & & & 1 \\ & 0 & 1 & -1 & 2 \\ \textcircled{B} & @0 & 2 & -3 & 1 \\ & & & & \textcircled{C} \end{array}$$

$$\begin{array}{cccc|c} 0 & 4 & -7 & -1 & \\ & & & & 1 \\ \textcircled{O} & 0 & 1 & -1 & 2 \\ \textcircled{B} & @0 & 0 & -1 & -3 \\ & & & & \textcircled{C} \end{array} \xrightarrow{\substack{\text{第 } 2 \text{ 行 } (-1) \text{ 倍加到第 } 1 \text{ 行}}} \begin{array}{cccc|c} 0 & 4 & -7 & 1 & \\ & & & & 1 \\ & 0 & 1 & -1 & 2 \\ \textcircled{B} & @0 & 0 & -1 & -3 \\ & & & & \textcircled{C} \end{array}$$

$$\xrightarrow{\substack{\text{第 } 1 \text{ 行 } (-2) \text{ 倍加到第 } 2 \text{ 行}}} \begin{array}{cccc|c} 0 & 1 & -1 & 2 & \\ & & & & 1 \\ \textcircled{B} & @0 & 0 & -1 & -3 \\ & & & & \textcircled{C} \end{array} \xrightarrow{\substack{\text{第 } 2 \text{ 行 } (-3) \text{ 倍加到第 } 3 \text{ 行}}}$$

$$\xrightarrow{\substack{\text{第 } 1 \text{ 行 } (-4) \text{ 倍加到第 } 3 \text{ 行}}} \begin{array}{cccc|c} 0 & 0 & -3 & -7 & \\ & & & & 1 \\ \textcircled{O} & 0 & 1 & -1 & 2 \\ \textcircled{B} & @0 & 0 & -1 & -3 \\ & & & & \textcircled{C} \end{array} \xrightarrow{\substack{\text{第 } 3 \text{ 行 } 3 \text{ 倍加到第 } 2 \text{ 行}}} \begin{array}{cccc|c} 0 & 1 & -1 & 0 & \\ & & & & 1 \\ \textcircled{B} & @0 & 0 & -1 & 0 \\ & & & & \textcircled{C} \end{array}$$

$$\xrightarrow{\substack{\text{第 } 2 \text{ 行乘 } (-1)}} \begin{array}{cccc|c} 0 & 0 & 0 & 1 & \\ & & & & 1 \\ \textcircled{O} & 0 & 1 & 0 & 0 \\ \textcircled{B} & @0 & 0 & 1 & 0 \\ & & & & \textcircled{C} \end{array} \xrightarrow{\substack{\text{第 } 3 \text{ 行 } (-2) \text{ 倍加到第 } 1 \text{ 行}}} \begin{array}{cccc|c} 0 & 0 & 0 & 1 & \\ & & & & 1 \\ & 0 & 1 & 0 & 0 \\ \textcircled{B} & @0 & 0 & 1 & 0 \\ & & & & \textcircled{C} \end{array}$$

$$\xrightarrow{\substack{\text{第 } 2 \text{ 行加到第 } 1 \text{ 行}}} \begin{array}{cccc|c} 0 & 0 & 0 & 1 & \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix};$$

习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix};$$



### 习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} O & 1 & -1 & 0 \\ B & @0 & 1 & 0 \\ \vdots & 0 & 0 & 1 \end{pmatrix}$$

$$\begin{array}{cccc} O & & & 1 \\ B & 1 & 0 & 0 \\ @-2 & & 1 & 0 \\ C & & & A \\ \hline & 0 & 0 & 1 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & -1 & 0 & 1 \\ 0 & 1 & 0 & 0 \end{pmatrix}; P_3 = \begin{pmatrix} 1 & 0 & 0 & 1 \\ -2 & 1 & 0 & 0 \end{pmatrix}$$

$$P_4 = \begin{pmatrix} 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix};$$

$$\begin{matrix} -4 & 0 & 1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
 \textcircled{O} & 0 & 1 & 0 & 1 \\
 \textcircled{B} & @1 & 0 & 0 \textcircled{C} \\
 P_1 = & \textcircled{A} & & & \\
 \textcircled{O} & 1 & -1 & 0 & 1 \\
 \textcircled{B} & @0 & 1 & 0 \textcircled{C} \\
 P_2 = & \textcircled{A} & & & \\
 \textcircled{O} & 1 & 0 & 0 & 1 \\
 \textcircled{B} & @-2 & 1 & 0 \textcircled{C} \\
 P_3 = & \textcircled{A} & & & \\
 \textcircled{O} & 0 & 0 & 1 & 1 \\
 \textcircled{B} & @1 & 0 & 0 \textcircled{C} \\
 P_4 = & \textcircled{A} & & & \\
 \textcircled{O} & 0 & 0 & 1 & 1 \\
 \textcircled{B} & @0 & 1 & 0 \textcircled{C} \\
 P_5 = & \textcircled{A} & & & \\
 -4 & 0 & 1 & & \\
 & 0 & -3 & 1 &
 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
 \textcircled{O} & 0 & 1 & 0 & 1 \\
 \textcircled{B} & @1 & 0 & 0 \textcircled{C} \\
 P_1 = & \end{array}
 \quad
 \begin{array}{c}
 \textcircled{O} & 1 & -1 & 0 & 1 \\
 \textcircled{B} & @0 & 1 & 0 \textcircled{C} \\
 P_2 = & \end{array}
 \quad
 \begin{array}{c}
 \textcircled{O} & 1 & 0 & 0 & 1 \\
 \textcircled{B} & @-2 & 1 & 0 \textcircled{C} \\
 P_3 = & \end{array}$$
  

$$\begin{array}{c}
 \textcircled{O} & 0 & 0 & 1 & 1 \\
 \textcircled{B} & @1 & 0 & 0 \textcircled{C} \\
 P_4 = & \end{array}
 \quad
 \begin{array}{c}
 \textcircled{O} & 0 & 0 & 1 & 1 \\
 \textcircled{B} & @0 & 1 & 0 \textcircled{C} \\
 P_5 = & \end{array}
 \quad
 \begin{array}{c}
 \textcircled{O} & 0 & 0 & 1 & 1 \\
 \textcircled{B} & @0 & 1 & 0 \textcircled{C} \\
 P_6 = & \end{array}$$
  

$$\begin{array}{c}
 -4 & 0 & 1 \\
 & 0 & -3 & 1 \\
 & 0 & 0 & \frac{1}{2}
 \end{array}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}, P_2 = \begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & 0 \end{pmatrix}, P_3 = \begin{pmatrix} 1 & 0 & 0 \\ -2 & 1 & 0 \end{pmatrix}$$

$$P_4 = \begin{matrix} \textcircled{0} & 0 & 1 \\ 1 & 0 & 0 \end{matrix} ; P_5 = \begin{matrix} \textcircled{0} & 0 & 1 \\ 1 & 0 & 0 \end{matrix} ; P_6 = \begin{matrix} \textcircled{0} & 0 & 1 \\ 1 & 0 & 0 \end{matrix}$$

$$P_7 = \begin{pmatrix} 0 & -4 & 0 & 1 \\ 1 & 0 & 0 \\ @0 & 1 & 3 \end{pmatrix}; \quad \begin{pmatrix} 0 & -3 & 1 \\ 0 & 0 & \frac{1}{2} \end{pmatrix}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}, P_2 = \begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & 0 \end{pmatrix}, P_3 = \begin{pmatrix} 1 & 0 & 0 \\ -2 & 1 & 0 \end{pmatrix}$$

$$P_4 = \begin{matrix} \textcircled{0} & 0 & 1 \\ 1 & 0 & 0 \end{matrix} ; P_5 = \begin{matrix} \textcircled{0} & 0 & 1 \\ 1 & 0 & 0 \end{matrix} ; P_6 = \begin{matrix} \textcircled{0} & 0 & 1 \\ 1 & 0 & 0 \end{matrix}$$

$$P_7 = \begin{smallmatrix} & -4 & 0 & 1 \\ \mathbb{B} & 1 & 0 & 0 \end{smallmatrix}; P_8 = \begin{smallmatrix} & 0 & -3 & 1 \\ \mathbb{B} & 1 & 0 & -2 \end{smallmatrix};$$

$$0 \quad 0 \quad 1 \qquad \qquad 0 \quad 0 \quad 1$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_3 = \begin{pmatrix} 1 & 0 & 0 \\ -2 & 1 & 0 \end{pmatrix}$$

$$P_4 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_5 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_6 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$$

$$P_7 = \begin{pmatrix} -4 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 3 \end{pmatrix}; P_8 = \begin{pmatrix} 0 & -3 & 1 \\ 1 & 0 & -2 \\ 0 & 1 & 0 \end{pmatrix}; P_9 = \begin{pmatrix} 0 & 0 & \frac{1}{2} \\ 1 & 0 & 0 \\ 0 & -1 & 0 \end{pmatrix}$$

$$\begin{matrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_3 = \begin{pmatrix} 1 & 0 & 0 \\ -2 & 1 & 0 \end{pmatrix}$$

$$P_4 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_5 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_6 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$$

$$P_7 = \begin{pmatrix} -4 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 3 \end{pmatrix}; P_8 = \begin{pmatrix} 0 & -3 & 1 \\ 1 & 0 & -2 \\ 0 & 1 & 0 \end{pmatrix}; P_9 = \begin{pmatrix} 0 & 0 & \frac{1}{2} \\ 1 & 0 & 0 \\ 0 & -1 & 0 \end{pmatrix}$$

$$P_{10} = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$



习题1.4( $P_{39} - P_{41}$ )

1.(3)

习题1.4( $P_{39} - P_{41}$ )

1.(3))

习题1.4( $P_{39} - P_{41}$ )

○ 1.(3))

$$\begin{array}{cccccc|c}
 & & & & & & 1 \\
 \text{B} & 2 & -1 & -1 & 1 & 2 & C \\
 \text{B} & 1 & 1 & -2 & 1 & 4 & C \\
 @4 & 3 & -6 & 2 & -2 & 4 & A \\
 & 3 & 6 & -6 & 7 & 9 &
 \end{array} \xrightarrow{\substack{\text{换1、2行} \\ \text{第1行(-2)倍加到第2行}}}$$



习题1.4( $P_{39} - P_{41}$ )

$$\textcircled{O} \quad \begin{matrix} & \textcolor{red}{1.(3)} \\ \begin{matrix} 2 & -1 & -1 & 1 & 2 \\ \textcircled{B} & 1 & -2 & 1 & 4 \\ \textcircled{B} & @4 & -6 & 2 & -2 \\ 3 & 6 & -6 & 7 & 9 \end{matrix} & \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{C} \\ \textcircled{A} \end{matrix} \end{matrix} \xrightarrow{\substack{\text{换1、2行} \\ \text{第1行}(-2) \text{倍加到第2行}}} \quad \begin{matrix} & \\ \begin{matrix} 1 & 1 & -2 & 1 & 4 \\ \textcircled{B} & 0 & -3 & 3 & -1 \\ \textcircled{B} & @4 & -6 & 2 & -2 \\ 3 & 6 & -6 & 7 & 9 \end{matrix} & \begin{matrix} 1 \\ \textcircled{C} \\ \textcircled{C} \\ \textcircled{A} \end{matrix} \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$\textcircled{O} \begin{array}{cccccc} & \textcolor{red}{1.(3)} & & & & & \\ \begin{matrix} 2 \\ \parallel \\ 1 \\ @4 \\ 3 \end{matrix} & \begin{matrix} -1 \\ 1 \\ -6 \\ 6 \end{matrix} & \begin{matrix} -1 \\ -2 \\ 2 \\ -6 \\ -6 \end{matrix} & \begin{matrix} 1 \\ 1 \\ -2 \\ 7 \\ 9 \end{matrix} & \begin{matrix} 2 \\ 4 \\ 4 \\ 4 \\ 9 \end{matrix} & \begin{matrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{matrix} & \textcircled{C} \\ \xrightarrow{\substack{\text{换1、2行} \\ \text{第1行}(-2) \text{倍加到第2行}}} & & & & & & \textcircled{A} \end{array}$$

$$\textcircled{O} \begin{array}{cccccc} & & & & & & \\ \begin{matrix} 1 \\ \parallel \\ 0 \\ @4 \\ 3 \end{matrix} & \begin{matrix} 1 \\ -3 \\ -6 \\ -6 \\ 6 \end{matrix} & \begin{matrix} -2 \\ 3 \\ -1 \\ 2 \\ -6 \end{matrix} & \begin{matrix} 1 \\ -1 \\ -1 \\ -2 \\ 7 \end{matrix} & \begin{matrix} 4 \\ -6 \\ -6 \\ -2 \\ 9 \end{matrix} & \begin{matrix} 1 \\ -3 \\ -1 \\ 2 \\ 7 \end{matrix} & \textcircled{C} \\ \xrightarrow{\substack{\text{第1行}(-4) \text{倍加到第3行} \\ \text{第1行}(-3) \text{倍加到第4行}}} & & & & & & \textcircled{A} \end{array}$$

第1行(-4)倍加到第3行



第1行(-3)倍加到第4行

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc|c}
 & \textcircled{O} & \textcolor{red}{1.(3)} & & & & \\
 & 2 & -1 & -1 & 1 & 2 & 1 \\
 & \textcircled{B} & 1 & 1 & -2 & 1 & 4 \\
 & @4 & -6 & 2 & -2 & 4 & \textcircled{A} \\
 & 3 & 6 & -6 & 7 & 9 & \\
 \xrightarrow{\substack{\text{换1、2行}}} & & & & & & \\
 & \textcircled{O} & & & & & \\
 & 1 & 1 & -2 & 1 & 4 & 1 \\
 & \textcircled{B} & 0 & -3 & 3 & -1 & -6 \\
 & @4 & -6 & 2 & -2 & 4 & \textcircled{A} \\
 & 3 & 6 & -6 & 7 & 9 & \\
 \xrightarrow{\substack{\text{第1行}(-2)\text{倍加到第2行}}} & & & & & & \\
 & \textcircled{O} & & & & & \\
 & 1 & 1 & -2 & 1 & 4 & 1 \\
 & \textcircled{B} & 0 & -3 & 3 & -1 & -6 \\
 & @0 & -10 & 10 & -6 & -12 & \textcircled{A} \\
 & 0 & 3 & 0 & 4 & -3 & \\
 \xrightarrow{\substack{\text{第1行}(-4)\text{倍加到第3行}}} & & & & & & \\
 \xrightarrow{} & & & & & & \\
 \xrightarrow{\substack{\text{第1行}(-3)\text{倍加到第4行}}} & & & & & & 
 \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc}
 & \text{1.(3)} & & & & \\
 \textcircled{O} & 2 & -1 & -1 & 1 & 2 & 1 \\
 \textcircled{B} & 1 & 1 & -2 & 1 & 4 & \\
 @4 & -6 & 2 & -2 & 4 & \textcircled{A} & \\
 3 & 6 & -6 & 7 & 9 & & \\
 \end{array}
 \xrightarrow{\substack{\text{换1、2行} \\ \text{第1行(-2)倍加到第2行}}}
 \begin{array}{cccccc}
 & & & & & 1 \\
 \textcircled{O} & 1 & 1 & -2 & 1 & 4 & 1 \\
 \textcircled{B} & 0 & -3 & 3 & -1 & -6 & \\
 @4 & -6 & 2 & -2 & 4 & \textcircled{A} & \\
 3 & 6 & -6 & 7 & 9 & & \\
 \end{array}$$

第1行(-4)倍加到第3行

$$\xrightarrow{\substack{\text{第1行(-3)倍加到第4行}}}
 \begin{array}{cccccc}
 & & & & & 1 \\
 \textcircled{O} & 1 & 1 & -2 & 1 & 4 & 1 \\
 \textcircled{B} & 0 & -3 & 3 & -1 & -6 & \\
 @0 & -10 & 10 & -6 & -12 & \textcircled{A} & \\
 0 & 3 & 0 & 4 & -3 & & \\
 \end{array}$$

### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc} \textcircled{O} & \textcolor{red}{1.(3)} & & & & 1 \\ \textcircled{B} & 2 & -1 & -1 & 1 & 2 \\ \textcircled{C} & 1 & 1 & -2 & 1 & 4 \\ @4 & -6 & 2 & -2 & 4 & \text{换1、2行} \\ \textcircled{A} & 3 & 6 & -6 & 7 & 9 \\ & & & & & \xrightarrow{\quad\quad\quad} \\ & & & & & \text{第1行}(-2) \times \end{array}$$

$$\begin{array}{cccccc}
 & 1 & 1 & -2 & 1 & 4 \\
 \text{第1行}(-4) \text{倍加到第3行} & \xrightarrow{\quad} & 0 & -3 & 3 & -1 & -6 \\
 \longrightarrow & & @0 & -10 & 10 & -6 & -12 \\
 & 0 & 0 & 0 & -4 & 0 & \\
 \text{第1行}(-3) \text{倍加到第4行} & & & & & & \text{换2、3行}
 \end{array}$$

$$\begin{array}{cccccc} O & & & & & 1 \\ 1 & 1 & -2 & 1 & 4 & \textcircled{G} \\ 0 & -1 & 1 & -3 & 6 & \textcircled{G} \\ @0 & -3 & 3 & -1 & -6 & A \\ 0 & 3 & 0 & 4 & -3 & \end{array}$$

|    |    |    |    |    |   |   |
|----|----|----|----|----|---|---|
| O  |    |    |    |    |   | 1 |
| 1  | 1  | -2 | 1  | 4  | C |   |
| 0  | -3 | 3  | -1 | -6 | G |   |
| @4 | -6 | 2  | -2 | 4  | A |   |
| 3  | 6  | -6 | 7  | 9  |   |   |

$$\left( \begin{array}{ccccc} 1 & 1 & -2 & 1 & 4 \\ 0 & -3 & 3 & -1 & -6 \\ @0 & -10 & 10 & -6 & -12 \\ 1 & 0 & 3 & 0 & 4 & -3 \end{array} \right) \xrightarrow{\substack{\text{第2行}(-3)\text{倍加到第3行} \\ \text{换2、3行}}} \left( \begin{array}{ccccc} 1 & 1 & -2 & 1 & 4 \\ 0 & -3 & 3 & -1 & -6 \\ 0 & 0 & 16 & -5 & -12 \\ 1 & 0 & 3 & 0 & 4 & -3 \end{array} \right)$$



习题1.4( $P_{39} - P_{41}$ )

○ 1.(3))

$$\begin{array}{cccccc} 2 & -1 & -1 & 1 & 2 \\ \text{B} \\ 1 & 1 & -2 & 1 & 4 \\ @4 & -6 & 2 & -2 & 4 & 1 & 1 & 2 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

换3、4行



第4行乘 $\frac{1}{8}$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
 \text{换 } 3, 4 \text{ 行} \\
 \longrightarrow \\
 \text{第4行乘 } \frac{1}{8}
 \end{array}
 \left( \begin{array}{ccccc}
 1 & 1 & -2 & 1 & 4 \\
 0 & -1 & 1 & -3 & 6 \\
 0 & 0 & 3 & -5 & 15 \\
 0 & 0 & 0 & 1 & -3
 \end{array} \right)$$



习题1.4( $P_{39} - P_{41}$ )

换3、4行  
 $\xrightarrow{\quad}$   
 第4行乘 $\frac{1}{8}$

|  |            |                |             |           |                  |                   |
|--|------------|----------------|-------------|-----------|------------------|-------------------|
|  | $\bigcirc$ | $\blacksquare$ | $\triangle$ | $\square$ | $\bigtriangleup$ |                   |
|  | 1          | 1              | -2          | 1         | 4                | 1                 |
|  | 0          | -1             | 1           | -3        | 6                | $\curvearrowleft$ |
|  | 0          | 0              | 3           | -5        | 15               | $\curvearrowleft$ |
|  | 0          | 0              | 0           | 1         | -3               | $\curvearrowleft$ |

第4行5倍加到第3行  
 第4行3倍加到第2行  
 $\longrightarrow$   
 第4行(-1)倍加到第1行



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc}
 & \textcircled{O} & & & & & 1 \\
 & 1 & 1 & -2 & 1 & 4 & & \\
 \xrightarrow{\substack{\text{换 } 3, 4 \text{ 行}}} & 0 & -1 & 1 & -3 & 6 & & \\
 \xrightarrow{\substack{\text{第 } 4 \text{ 行 } 3 \text{ 倍加到第 } 2 \text{ 行}}} & @0 & 0 & 3 & -5 & 15 & & \\
 \xrightarrow{\substack{\text{第 } 4 \text{ 行 } (-1) \text{ 倍加到第 } 1 \text{ 行}}} & 0 & 0 & 0 & 1 & -3 & & \\
 \end{array}$$

$$\begin{array}{ccccccc|c}
 & & & 0 & 1 & 0 & 0 & 1 & -3 \\
 \textcircled{O} & 1 & 1 & -2 & 0 & 7 & & & \\
 \textcircled{B} & 0 & -1 & 1 & 0 & -3 & & & \\
 @0 & 0 & 0 & 3 & 0 & 0 & A & & \\
 & 0 & 0 & 0 & 1 & -3 & & &
 \end{array}$$

第4行(-1)倍加到第1行



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc}
 & \textcircled{O} & & & & & 1 \\
 & 1 & 1 & -2 & 1 & 4 & \\
 \xrightarrow{\substack{\text{换 } 3, 4 \text{ 行}}} & \textcircled{B} & 0 & -1 & 1 & -3 & 6 \\
 & @0 & 0 & 3 & -5 & 15 & \textcircled{A} \\
 & \textcircled{O} & 0 & 1 & 0 & 1 & -3 \\
 & 1 & 1 & -2 & 0 & 7 & \\
 & 0 & -1 & 1 & 0 & -3 & \\
 @0 & 0 & 3 & 0 & 0 & \textcircled{A} & \longrightarrow
 \end{array}$$

第4行5倍加到第3行  
第4行3倍加到第2行

→

第4行乘 $\frac{1}{8}$

$$\begin{array}{ccccccc}
 & 0 & 1 & 0 & 0 & 1 & -3 \\
 & 1 & 1 & -2 & 0 & 7 & \\
 & 0 & -1 & 1 & 0 & -3 & \\
 @0 & 0 & 3 & 0 & 0 & \textcircled{A} & \longrightarrow \\
 & 0 & 0 & 0 & 1 & -3 & \text{第3行 } 2 \text{ 倍加到第1行}
 \end{array}$$

第3行乘 $\frac{1}{3}$   
第3行(-1)倍加到第2行

→



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc}
 & O & & & & 1 \\
 & 1 & 1 & -2 & 1 & 4 & \text{第4行5倍加到第3行} \\
 B & 0 & -1 & 1 & -3 & 6 & \text{第4行3倍加到第2行} \\
 @0 & 0 & 3 & -5 & 15 & A & \rightarrow \\
 \end{array}$$

$$\begin{array}{ccccccc}
 & & 0 & 1 & 0 & 0 & 1 & -3 \\
 \textcircled{O} & & & & & & & \text{第4行}(-1) \text{倍加到第1行} \\
 1 & 1 & -2 & 0 & 7 & & & \text{第3行} \times \frac{1}{3} \\
 \textcircled{B} 0 & -1 & 1 & 0 & -3 & & & \text{第3行}(-1) \text{倍加到第2行} \\
 @0 & 0 & 3 & 0 & 0 & \xrightarrow{\text{A}} & & \\
 0 & 0 & 0 & 1 & -3 & & & \text{第3行}2 \text{倍加到第1行} \\
 \end{array}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc}
 & O & & & & 1 \\
 & 1 & 1 & -2 & 1 & 4 & \text{第4行5倍加到第3行} \\
 B & 0 & -1 & 1 & -3 & 6 & \text{第4行3倍加到第2行} \\
 @0 & 0 & 3 & -5 & 15 & A & \rightarrow \\
 \end{array}$$

$$\begin{array}{ccccccc}
 & & & 0 & 1 & 0 & 0 \\
 & & & 1 & & & -3 \\
 \textcircled{O} & 1 & 1 & -2 & 0 & 7 & \text{第3行乘}\frac{1}{3} \\
 \textcircled{B} & 0 & -1 & 1 & 0 & -3 & \text{第3行}(-1)\text{倍加到第2行} \\
 @0 & 0 & 3 & 0 & 0 & \text{A} & \rightarrow \\
 0 & 0 & 0 & 1 & -3 & \text{第3行2倍加到第1行} \\
 \end{array}$$

第2行加到第1行

→

第2行乘(-1)



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc} & \textcircled{O} & & & & 1 \\ & 1 & 1 & -2 & 1 & 4 & \text{第4行5倍加到第3行} \\ \text{换3、4行} & \textcircled{B} & 0 & -1 & 1 & -3 & 6 & \text{第4行3倍加到第2行} \\ \rightarrow & \textcircled{C} & 0 & 0 & -2 & -5 & -15 & \end{array}$$

$$\begin{array}{ccccccc}
 & \text{第4行乘} \frac{1}{8} & & 0 & 1 & 0 & 0 & 1 & -3 \\
 \textcircled{O} & & & & & & & & \textcircled{O} \\
 1 & 1 & -2 & 0 & 7 & & & & 1 & 1 & 0 & 0 & 7 \\
 \textcircled{B} 0 & -1 & 1 & 0 & -3 & & & & \textcircled{B} 0 & -1 & 0 & 0 & -3 \\
 @0 & 0 & 3 & 0 & 0 & & \xrightarrow{\quad} & @0 & 0 & 1 & 0 & 0 \\
 0 & 0 & 0 & 1 & -3 & & \text{第3行2倍加到第1行} & 0 & 0 & 0 & 1 & -3
 \end{array}$$

$$\begin{array}{l} \text{第2行加到第1行} \\ \xrightarrow{\quad} \\ \text{第2行乘}(-1) \end{array} \quad \left( \begin{array}{ccccc} 1 & 0 & 0 & 0 & 4 \\ 0 & 1 & 0 & 0 & 3 \\ @0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & -3 \end{array} \right) \quad A$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{换 } 3, 4 \text{ 行} \rightarrow \begin{array}{cccccc} & & & & & 1 \\ 1 & 1 & -2 & 1 & 4 & \\ 0 & -1 & 1 & -3 & 6 & \\ @0 & 0 & 3 & -5 & 15 & A \end{array} \begin{array}{l} \text{第4行5倍加到第3行} \\ \text{第4行3倍加到第2行} \end{array}$$

$$\text{第4行乘 } \frac{1}{8} \rightarrow \begin{array}{cccccc} & 0 & 1 & 0 & 0 & 1 & -3 \\ 1 & 1 & -2 & 0 & 7 & & \\ 0 & -1 & 1 & 0 & -3 & & \\ @0 & 0 & 3 & 0 & 0 & A \end{array} \begin{array}{l} \text{第4行(-1)倍加到第1行} \end{array}$$

$$\begin{array}{cccccc} & 1 & 1 & 0 & 0 & 7 & \\ 1 & 1 & 0 & 0 & 7 & & \\ 0 & -1 & 0 & 0 & -3 & & \\ @0 & 0 & 1 & 0 & 0 & A \end{array} \begin{array}{l} \text{第3行乘 } \frac{1}{3} \\ \text{第3行(-1)倍加到第2行} \end{array}$$

$$\begin{array}{cccccc} & 0 & 0 & 0 & 1 & -3 & \\ 0 & 0 & 0 & 1 & -3 & & \\ 0 & 0 & 0 & 1 & -3 & & \\ @0 & 0 & 0 & 1 & -3 & A \end{array} \begin{array}{l} \text{第3行2倍加到第1行} \end{array}$$

$$\begin{array}{l} \text{第2行加到第1行} \\ \rightarrow \end{array} \begin{array}{cccccc} & 1 & 0 & 0 & 0 & 4 & \\ 1 & 0 & 0 & 0 & 3 & & \\ @0 & 0 & 1 & 0 & 0 & A \end{array}$$

$$\begin{array}{l} \text{第2行乘 } (-1) \\ \rightarrow \end{array} \begin{array}{cccccc} & 0 & 0 & 0 & 1 & -3 & \end{array}$$

其对应的初等Y阵为

习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & & & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}; P_2 = \begin{pmatrix} 0 & 1 & 0 & 0 \\ -2 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix};$$



### 习题1.4( $P_{39} - P_{41}$ )



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
 \text{O} & & 1 \\
 \text{---} & & \text{---} \\
 0 & 1 & 0 & 0 & 0 & \text{C} \\
 @ & & & & & \text{A} \\
 P_1 = & & ; P_2 = & & ; P_3 = & \\
 1 & 0 & 0 & 0 & 0 & \text{C} \\
 @ & & & & & \text{A} \\
 0 & 0 & 1 & 0 & 0 & \text{C} \\
 @ & & & & & \text{A} \\
 0 & 0 & 0 & 1 & 0 & \text{C} \\
 @ & & & & & \text{A} \\
 \text{O} & & 1 \\
 \text{---} & & \text{---} \\
 0 & 0 & 0 & 0 & 0 & \text{C} \\
 @ & & & & & \text{A} \\
 P_4 = & & ; \\
 1 & 0 & 0 & 0 & 0 & \text{C} \\
 @ & & & & & \text{A} \\
 0 & 1 & 0 & 0 & 0 & \text{C} \\
 @ & & & & & \text{A} \\
 0 & 0 & 1 & 0 & 0 & \text{C} \\
 @ & & & & & \text{A} \\
 -3 & 0 & 0 & 1 & 0 & \text{C} \\
 @ & & & & & \text{A}
 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \quad \begin{matrix} 1 \\ \text{C} \\ \text{A} \end{matrix}$$

$$\begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \quad \begin{matrix} 1 \\ \text{C} \\ \text{A} \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
 \textcircled{O} & & 1 \\
 @& 0 & 1 & 0 & 0 \\
 & 1 & 0 & 0 & 0 \\
 @& 0 & 0 & 1 & 0 \\
 & 0 & 0 & 0 & 1 \\
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & 0 & 1 & 0 & 0 \\
 @& 0 & 0 & 1 & 0 \\
 & -3 & 0 & 0 & 1
 \end{array}
 ;
 \begin{array}{c}
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & -2 & 1 & 0 & 0 \\
 @& 0 & 0 & 1 & 0 \\
 & 0 & 0 & 0 & 1 \\
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & 0 & 1 & 0 & 0 \\
 @& 0 & 0 & 1 & 0 \\
 & 0 & 0 & 0 & 1
 \end{array}
 ;
 \begin{array}{c}
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & 0 & 1 & 0 & 0 \\
 @& -4 & 0 & 1 & 0 \\
 & 0 & 0 & 0 & 1 \\
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & 0 & 0 & 1 & 0 \\
 @& 0 & 0 & 0 & 1 \\
 & 0 & 0 & 0 & 1
 \end{array}
 ;$$
  

$$\begin{array}{c}
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & 0 & 1 & 0 & 0 \\
 @& 0 & 0 & 1 & 0 \\
 & 0 & 0 & 0 & 1 \\
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & 0 & 1 & 0 & 0 \\
 @& 0 & 0 & 1 & 0 \\
 & 0 & 0 & 0 & 1
 \end{array}
 ;
 \begin{array}{c}
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & 0 & 1 & 0 & 0 \\
 @& 0 & -3 & 1 & 0 \\
 & 0 & 0 & 0 & 1 \\
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & 0 & 0 & 1 & 0 \\
 @& 0 & 0 & 0 & 1 \\
 & 0 & 0 & 0 & 1
 \end{array}
 ;
 \begin{array}{c}
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & 0 & 1 & 0 & 0 \\
 @& 0 & 0 & 1 & 0 \\
 & 0 & 0 & 0 & 1 \\
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 & 0 & 0 & 1 & 0 \\
 @& 0 & 0 & 0 & 1 \\
 & 0 & 0 & 0 & 1
 \end{array}
 ;$$



习题1.4( $P_{39} - P_{41}$ )

$$P_7 = \begin{pmatrix} 0 & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & -3 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix};$$





习题1.4( $P_{39} - P_{41}$ )

$$P_7 = \begin{array}{c} \textcircled{O} \\ \text{---} \\ 1 & 0 & 0 & 0 \\ @ \\ 0 & 1 & 0 & 0 \\ @ \\ 0 & -3 & 1 & 0 \\ @ \\ 0 & 0 & 0 & 1 \end{array}; P_8 = \begin{array}{c} \textcircled{O} \\ \text{---} \\ 1 & 0 & 0 & 0 \\ @ \\ 0 & 1 & 0 & 0 \\ @ \\ 0 & 0 & 1 & 0 \\ @ \\ 0 & 3 & 0 & 1 \end{array}; P_9 = \begin{array}{c} \textcircled{O} \\ \text{---} \\ 1 & 0 & 0 & 0 \\ @ \\ 0 & 1 & 0 & 0 \\ @ \\ 0 & 0 & 0 & 1 \\ @ \\ 0 & 0 & 1 & 0 \end{array};$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 @& 0 & 1 & 0 & 0 \\
 @& 0 & -3 & 1 & 0 \\
 @& 0 & 0 & 0 & 1 \\
 \textcircled{O} & & 1
 \end{array}
 ;
 \begin{array}{c}
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 @& 0 & 1 & 0 & 0 \\
 @& 0 & 0 & 1 & 0 \\
 @& 0 & 3 & 0 & 1 \\
 \textcircled{O} & & 1
 \end{array}
 ;
 \begin{array}{c}
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 \\
 @& 0 & 1 & 0 & 0 \\
 @& 0 & 0 & 0 & 1 \\
 @& 0 & 0 & 1 & 0 \\
 \textcircled{O} & & 1
 \end{array}
 ;$$
  

$$P_{10} = 
 \begin{array}{c}
 \textcircled{B} & 1 & 0 & 0 & 0 \\
 @& 0 & 1 & 0 & 0 \\
 @& 0 & 0 & 1 & 0 \\
 @& 0 & 0 & 0 & \frac{1}{8}
 \end{array}
 ;$$

### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{l}
 P_7 = \begin{pmatrix} O & 1 & 0 & 0 & 0 \\ @ & 0 & 1 & 0 & 0 \\ @ & 0 & -3 & 1 & 0 \\ @ & 0 & 0 & 0 & 1 \\ O & 0 & 0 & 0 & 1 \end{pmatrix}; P_8 = \begin{pmatrix} O & 1 & 0 & 0 & 0 \\ @ & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \\ @ & 0 & 0 & 0 & 1 \\ O & 0 & 0 & 0 & 1 \end{pmatrix}; P_9 = \begin{pmatrix} O & 1 & 0 & 0 & 0 \\ @ & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 0 & 1 \\ @ & 0 & 0 & 0 & 1 \\ O & 0 & 0 & 1 & 0 \end{pmatrix} \\
 P_{10} = \begin{pmatrix} O & 1 & 0 & 0 & 0 \\ @ & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \\ @ & 0 & 0 & 0 & 1 \\ O & 0 & 0 & 0 & 1 \end{pmatrix}; P_{11} = \begin{pmatrix} O & 1 & 0 & 0 & 0 \\ @ & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 1 & 5 \\ @ & 0 & 0 & 0 & 1 \\ O & 0 & 0 & 0 & 1 \end{pmatrix};
 \end{array}$$



### 习题1.4( $P_{39} - P_{41}$ )



习题1.4( $P_{39} - P_{41}$ )

$$P_{13} = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix},$$



习题1.4( $P_{39} - P_{41}$ )

$$P_{13} = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, P_{14} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & \frac{1}{3} & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix},$$

习题1.4( $P_{39} - P_{41}$ )

$$P_{13} = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, P_{14} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & \frac{1}{3} & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, P_{15} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix},$$



### 习题1.4( $P_{39} - P_{41}$ )

$$P_{13} = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, P_{14} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & \frac{1}{3} & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, P_{15} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix},$$

$$P_{16} = \begin{pmatrix} 1 & 0 & 2 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$P_{13} = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ \text{O} & & & \end{pmatrix}, P_{14} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & \frac{1}{3} & 0 \\ 0 & 0 & 0 & 1 \\ \text{O} & & & \end{pmatrix}, P_{15} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ \text{O} & & & \end{pmatrix},$$

$$P_{16} = \begin{array}{c} \text{B} \\ \text{1} & 0 & 2 & 0 \\ \text{0} & 1 & 0 & 0 \\ \text{0} & 0 & 1 & 0 \\ \text{0} & 0 & 0 & 1 \\ @ \end{array} ; P_{17} = \begin{array}{c} \text{B} \\ \text{1} & 1 & 0 & 0 \\ \text{0} & 1 & 0 & 0 \\ \text{0} & 0 & 1 & 0 \\ \text{0} & 0 & 0 & 1 \\ @ \end{array} \quad A$$



习题1.4( $P_{39} - P_{41}$ )

$$P_{13} = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, P_{14} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & \frac{1}{3} & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

习题1.4( $P_{39} - P_{41}$ )

1.(4))



习题1.4( $P_{39} - P_{41}$ )

$$\textcircled{O} \quad \begin{matrix} & \textcolor{red}{1.(4)} \\ \textcircled{B} & 1 & -1 & 3 & -4 & 3 & 1 \\ \textcircled{C} & 3 & -3 & 5 & -4 & 1 & \\ @2 & -2 & 3 & -2 & 0 & & \\ & 3 & -3 & 4 & -2 & -1 & \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

○ 1.(4))

$$\begin{array}{cccccc|c} 1 & -1 & 3 & -4 & 3 & 1 \\ 3 & -3 & 5 & -4 & 1 & \curvearrowleft \\ @2 & -2 & 3 & -2 & 0 & \curvearrowleft \\ 3 & -3 & 4 & -2 & -1 & \rightarrow \end{array}$$

第1行(-3)倍加到第2行  
第1行(-2)倍加到第3行  
第1行(-3)倍加到第4行



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc}
 \textcircled{O} & \textcolor{red}{1.(4)} & & & & & & 1 \\
 \textcircled{B} & 1 & -1 & 3 & -4 & 3 & & \textcircled{C} & \text{第1行} \\
 \textcircled{B} & 3 & -3 & 5 & -4 & 1 & & \textcircled{C} & \text{第1行} \\
 @2 & -2 & 3 & -2 & 0 & & & \textcircled{A} & \longrightarrow \\
 & 3 & -3 & 4 & -2 & -1 & & & \text{第1行}
 \end{array}$$

第1行(-3)倍加到第2行

第1行(-2)倍加到第3行

→

第1行(-3)倍加到第4行

| O  | 1   |
|----|-----|
| 1  | -1  |
| 0  | 3   |
| 0  | -4  |
| @0 | 8   |
| 0  | -8  |
| 0  | A   |
| 0  | 6   |
| 0  | -6  |
| 0  | 10  |
| 0  | -10 |



### 习题1.4( $P_{39} - P_{41}$ )

$$\text{○ } \begin{array}{cccccc} & 1 & & & & & \\ & -1 & 3 & -4 & 3 & 1 & \\ \text{B} & 3 & -3 & 5 & -4 & 1 & \text{C} \\ @2 & -2 & 3 & -2 & 0 & \text{A} & \longrightarrow \\ & 3 & -3 & 4 & -2 & -1 & \end{array}$$

第1行(-3)倍加到第2行  
第1行(-2)倍加到第3行  
第1行(-3)倍加到第4行

第2行乘 $(-\frac{1}{4})$

第2行3倍加到第3行

→

第2行5倍加到第4行

第2行(-3)倍加到第1行

| O  | 1   |
|----|-----|
| 1  | -1  |
| 0  | 3   |
| @0 | -4  |
| 0  | 3   |
| 0  | 0   |
| 0  | -8  |
| 0  | -6  |
| 0  | 8   |
| 0  | -3  |
| 0  | 6   |
| 0  | -5  |
| 0  | 10  |
| 0  | -10 |



习题1.4( $P_{39} - P_{41}$ )

○ 1.(4)

$$\begin{array}{cccccc|c} & & & & & & 1 \\ \textcircled{1} & 1 & -1 & 3 & -4 & 3 & \\ \textcircled{3} & 3 & -3 & 5 & -4 & 1 & \\ @2 & -2 & 3 & -2 & 0 & & \\ \hline 3 & -3 & 4 & -2 & -1 & & \end{array}$$

第1行(-3)倍加到第2行  
第1行(-2)倍加到第3行  
 $\rightarrow$

$$\begin{array}{cccccc|c} & & & & & & 1 \\ \textcircled{1} & 1 & -1 & 3 & -4 & 3 & \\ \textcircled{0} & 0 & 0 & -4 & 8 & -8 & \\ @0 & 0 & 0 & -3 & 6 & -6 & \\ \hline 0 & 0 & 0 & -5 & 10 & -10 & \end{array}$$

第2行乘 $(-\frac{1}{4})$ 

第2行3倍加到第3行

 $\rightarrow$ 

第2行5倍加到第4行

第2行(-3)倍加到第1行

$$\begin{array}{cccccc|c} & & & & & & 1 \\ \textcircled{1} & 1 & -1 & 0 & 2 & -3 & \\ \textcircled{0} & 0 & 0 & 1 & -2 & 2 & \\ @0 & 0 & 0 & 0 & 0 & 0 & \\ \hline 0 & 0 & 0 & 0 & 0 & 0 & \end{array},$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & & & 1 \\ 1 & 0 & 0 & 0 \\ -3 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{matrix} & & & 1 \\ & & & 0 \\ & 1 & 0 & 0 & 0 \\ & -3 & 1 & 0 & 0 \\ & 0 & 0 & 1 & 0 \\ & 0 & 0 & 0 & 1 \end{matrix}; P_2 = \begin{matrix} & & & 1 \\ & & & 0 \\ & 1 & 0 & 0 & 0 \\ & 0 & 1 & 0 & 0 \\ & -2 & 0 & 1 & 0 \\ & 0 & 0 & 0 & 1 \end{matrix};$$



### 习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 1 & 0 & 0 & 0 \\ -3 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ @ & & & A \end{pmatrix}; P_2 = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ -2 & 0 & 1 & 0 \\ @ & & & A \end{pmatrix}; P_3 = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ @ & & & A \end{pmatrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
 \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 & \textcircled{C} \\
 @& -3 & 1 & 0 & 0 & \textcircled{C} \\
 @& 0 & 0 & 1 & 0 & \textcircled{C} \\
 @& 0 & 0 & 0 & 1 & \textcircled{C} \\
 @& \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 & \textcircled{C} \\
 @& 0 & 1 & 0 & 0 & \textcircled{C} \\
 @& -2 & 0 & 1 & 0 & \textcircled{C} \\
 @& 0 & 0 & 0 & 1 & \textcircled{C} \\
 @& \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 & \textcircled{C} \\
 @& 0 & 1 & 0 & 0 & \textcircled{C} \\
 @& 0 & 0 & 1 & 0 & \textcircled{C} \\
 @& -3 & 0 & 0 & 1 & \textcircled{C} \\
 @& \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 & \textcircled{C} \\
 @& 0 & 1 & 0 & 0 & \textcircled{C} \\
 @& 0 & 0 & 1 & 0 & \textcircled{C} \\
 @& 0 & 0 & 0 & 1 & \textcircled{C} \\
 @& \textcircled{O} & & 1 \\
 @& 1 & 0 & 0 & 0 & \textcircled{C} \\
 @& 0 & -\frac{1}{4} & 0 & 0 & \textcircled{C} \\
 @& 0 & 0 & 1 & 0 & \textcircled{C} \\
 @& 0 & 0 & 0 & 1 & \textcircled{C} \\
 @& \textcircled{O} & & 1
 \end{array}$$

$; P_2 = ; P_3 = ; P_4 =$

### 习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{array}{c} \text{O} \\ \text{---} \\ 1 & 0 & 0 & 0 \\ @ \\ -3 & 1 & 0 & 0 \\ @ \\ 0 & 0 & 1 & 0 \\ @ \\ 0 & 0 & 0 & 1 \\ \text{O} \\ 1 \end{array}; P_2 = \begin{array}{c} \text{O} \\ \text{---} \\ 1 & 0 & 0 & 0 \\ @ \\ 0 & 1 & 0 & 0 \\ @ \\ -2 & 0 & 1 & 0 \\ @ \\ 0 & 0 & 0 & 1 \\ \text{O} \\ 1 \end{array}; P_3 = \begin{array}{c} \text{O} \\ \text{---} \\ 1 & 0 & 0 & 0 \\ @ \\ 0 & 1 & 0 & 0 \\ @ \\ 0 & 0 & 1 & 0 \\ @ \\ -3 & 0 & 0 & 1 \\ \text{O} \\ 1 \end{array};$$

$$P_4 = \begin{array}{c} \text{O} \\ \text{---} \\ 1 & 0 & 0 & 0 \\ @ \\ 0 & -\frac{1}{4} & 0 & 0 \\ @ \\ 0 & 0 & 1 & 0 \\ @ \\ 0 & 0 & 0 & 1 \\ \text{O} \\ 1 \end{array}; P_5 = \begin{array}{c} \text{O} \\ \text{---} \\ 1 & 0 & 0 & 0 \\ @ \\ 0 & 1 & 0 & 0 \\ @ \\ 0 & 3 & 1 & 0 \\ @ \\ 0 & 0 & 0 & 1 \\ \text{O} \\ 1 \end{array};$$



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
P_1 = \begin{matrix} O & 1 & 0 & 0 & 0 \\ @ & -3 & 1 & 0 & 0 \\ & 0 & 0 & 1 & 0 \\ & 0 & 0 & 0 & 1 \\ & @ & A \end{matrix}; P_2 = \begin{matrix} O & 1 & 0 & 0 & 0 \\ @ & 0 & 1 & 0 & 0 \\ & -2 & 0 & 1 & 0 \\ & 0 & 0 & 0 & 1 \\ & @ & A \end{matrix}; P_3 = \begin{matrix} O & 1 & 0 & 0 & 0 \\ @ & 0 & 1 & 0 & 0 \\ & 0 & 0 & 1 & 0 \\ & 0 & 0 & 0 & 1 \\ & @ & A \end{matrix}; \\
P_4 = \begin{matrix} O & 1 & 0 & 0 & 0 \\ @ & 0 & -\frac{1}{4} & 0 & 0 \\ & 0 & 0 & 1 & 0 \\ & 0 & 0 & 0 & 1 \\ & @ & A \end{matrix}; P_5 = \begin{matrix} O & 1 & 0 & 0 & 0 \\ @ & 0 & 1 & 0 & 0 \\ & 0 & 3 & 1 & 0 \\ & 0 & 0 & 0 & 1 \\ & @ & A \end{matrix}; P_6 = \begin{matrix} O & 1 & 0 & 0 & 0 \\ @ & 0 & 1 & 0 & 0 \\ & 0 & 0 & 1 & 0 \\ & 0 & 0 & 0 & 1 \\ & @ & A \end{matrix}; \\
\end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_7 = \begin{pmatrix} \textcircled{O} & & & & 1 \\ 1 & -3 & 0 & 0 & \\ \textcircled{B} 0 & 1 & 0 & 0 & \textcircled{C} \\ @0 & 0 & 1 & 0 & \textcircled{A} \\ 0 & 0 & 0 & 1 \end{pmatrix}.$$

习题1.4( $P_{39} - P_{41}$ )

$$P_7 = \begin{pmatrix} \textcircled{O} & & & & 1 \\ 1 & -3 & 0 & 0 & \\ \textcircled{B} 0 & 1 & 0 & 0 & \textcircled{C} \\ @0 & 0 & 1 & 0 & \textcircled{A} \\ 0 & 0 & 0 & 1 & \end{pmatrix}.$$

1.(5))

习题1.4( $P_{39} - P_{41}$ )

$$P_7 = \begin{pmatrix} & & & 1 \\ & 1 & -3 & 0 & 0 \\ & 0 & 1 & 0 & 0 \\ & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}.$$

1.(5))

$$\begin{pmatrix} & & & 1 \\ & 1 & 3 & 1 & 4 \\ & 2 & -3 & 8 & 2 \\ 2 & 12 & -2 & 12 \end{pmatrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_7 = \begin{pmatrix} O & & & 1 \\ @1 & -3 & 0 & 0 \\ @0 & 1 & 0 & 0 \\ @0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}.$$

1.(5))

$$\begin{array}{cccc|c} O & & & 1 & \\ @1 & 3 & 1 & 4 & \\ @2 & -3 & 8 & 2 & \end{array} \xrightarrow{\text{第1行}(-2)\text{倍加到第2行}}$$

$$\begin{array}{cccc|c} 2 & 12 & -2 & 12 & \end{array} \xrightarrow{\text{第1行}(-2)\text{倍加到第3行}}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_7 = \begin{pmatrix} & & & 1 \\ & 1 & -3 & 0 & 0 \\ \textcircled{B} & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \\ & 0 & 0 & 0 & 1 \end{pmatrix}.$$

1.(5))

$$\begin{array}{ccccc} & & & 1 & \\ & 1 & 3 & 1 & 4 \\ \textcircled{B} & 2 & -3 & 8 & 2 \\ @ & & & & \end{array} \xrightarrow{\substack{\text{第1行}(-2) \text{倍加到第2行} \\ \text{第1行}(-2) \text{倍加到第3行}}} \begin{array}{ccccc} & & & 1 & \\ & 1 & 3 & 1 & 4 \\ \textcircled{B} & 0 & -9 & 6 & -6 \\ @ & & & & \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_7 = \begin{pmatrix} & & & 1 \\ & 1 & -3 & 0 & 0 \\ \textcircled{B} & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \\ & 0 & 0 & 0 & 1 \end{pmatrix}.$$

1.(5))

$$\begin{pmatrix} & & & 1 \\ 1 & 3 & 1 & 4 \\ \textcircled{B} & 2 & -3 & 8 \\ @ & & 2 & 2 \end{pmatrix} \xrightarrow{\text{第1行}(-2) \text{倍加到第2行}}$$

$$\begin{pmatrix} & & & 1 \\ 1 & 3 & 1 & 4 \\ \textcircled{B} & 0 & -9 & 6 \\ @ & & -6 & -6 \end{pmatrix} \xrightarrow{\text{第1行}(-2) \text{倍加到第3行}}$$

第2行乘 $-\frac{1}{9}$ 

第2行(-6)倍加到第3行

 $\longrightarrow$ 

第2行(-3)倍加到第1行

习题1.4( $P_{39} - P_{41}$ )

$$P_7 = \begin{pmatrix} & & & 1 \\ & 1 & -3 & 0 & 0 \\ \textcircled{B} & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \\ & 0 & 0 & 0 & 1 \end{pmatrix}.$$

1.(5))

$$\begin{pmatrix} & & & 1 \\ & 1 & 3 & 1 & 4 \\ \textcircled{B} & 2 & -3 & 8 & 2 \\ @ & & & & \end{pmatrix} \xrightarrow{\text{第1行}(-2) \text{倍加到第2行}}$$

$$\begin{pmatrix} & & & 1 \\ & 1 & 3 & 1 & 4 \\ \textcircled{B} & 0 & -9 & 6 & -6 \\ @ & & & & \end{pmatrix}$$

$$\begin{pmatrix} & & & 1 \\ & 2 & 12 & -2 & 12 \\ @ & & & & \end{pmatrix} \xrightarrow{\text{第1行}(-2) \text{倍加到第3行}}$$

$$\begin{pmatrix} & & & 1 \\ & 0 & 6 & -4 & 4 \\ @ & & & & \end{pmatrix}$$

第2行乘 $-\frac{1}{9}$ 

第2行(-6)倍加到第3行

 $\rightarrow$ 

第2行(-3)倍加到第1行

$$\begin{pmatrix} & & & 1 \\ & 1 & 0 & 3 & 2 \\ \textcircled{B} & 0 & 1 & -\frac{2}{3} & \frac{2}{3} \\ @ & & & & \end{pmatrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & -2 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & -2 & 1 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ -2 & 0 & 1 & 0 \end{pmatrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 & 0 & 1 \\ 0 & -2 & 1 & 0 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \end{pmatrix}; P_3 =$$

$$\begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & -\frac{1}{9} & 0 \end{pmatrix}; \quad \begin{pmatrix} -2 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ -2 & 1 & 0 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}; P_3 =$$

$$P_4 = \begin{pmatrix} 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & -\frac{1}{9} & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{pmatrix}; P_4 = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & -6 & 1 & 0 \end{pmatrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{matrix} \textcircled{O} & 1 & 0 & 0 & 1 \\ \textcircled{B} & @-2 & 1 & 0 & \textcircled{C} \end{matrix}; P_2 = \begin{matrix} \textcircled{O} & 1 & 0 & 0 & 1 \\ \textcircled{B} & @0 & 1 & 0 & \textcircled{C} \end{matrix}; P_3 =$$

$$\begin{matrix} \textcircled{O} & 1 & 0 & 0 & 1 & \textcircled{O} & \bar{1}^2 & 0 & 1 & \textcircled{O} & 1 & -3 & 0 & 1 \\ \textcircled{B} & @0 & -\frac{1}{9} & 0 & \textcircled{C} & \textcircled{B} & @0 & 1 & 0 & \textcircled{C} & \textcircled{B} & @0 & 1 & 0 & \textcircled{C} \end{matrix}; P_4 = \begin{matrix} 0 & 0 & 1 & 0 & -6 & 1 \end{matrix}; P_5 = \begin{matrix} 0 & 0 & 1 \end{matrix}.$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{matrix} \textcircled{O} & 1 & 0 & 0 & 1 \\ \textcircled{B} & @-2 & 1 & 0 & \textcircled{C} \end{matrix}; P_2 = \begin{matrix} \textcircled{O} & 1 & 0 & 0 & 1 \\ \textcircled{B} & @0 & 1 & 0 & \textcircled{C} \end{matrix}; P_3 =$$

$$\begin{matrix} \textcircled{O} & 1 & 0 & 0 & 1 & \textcircled{O} & \bar{1}^2 & 0 & 1 & \textcircled{O} & 1 & -3 & 0 & 1 \\ \textcircled{B} & @0 & -\frac{1}{9} & 0 & \textcircled{C} & \textcircled{B} & @0 & 1 & 0 & \textcircled{C} & \textcircled{B} & @0 & 1 & 0 & \textcircled{C} \end{matrix}; P_4 = \begin{matrix} 0 & 0 & 1 \\ 0 & -6 & 1 \end{matrix}; P_5 = \begin{matrix} 0 & 0 & 1 \end{matrix}.$$

1.(6))



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{array}{ccccc} & \textcircled{O} & 1 & 0 & 0 \\ \textcircled{B} & @-2 & 1 & 0 & \textcircled{C} \end{array} ; P_2 = \begin{array}{ccccc} & \textcircled{O} & 1 & 0 & 0 \\ \textcircled{B} & @0 & 1 & 0 & \textcircled{C} \end{array} ; P_3 =$$

$$\begin{array}{ccccc} & \textcircled{O} & 0 & 0 & 1 \\ \textcircled{B} & 1 & 0 & 0 & \textcircled{C} \\ @0 & -\frac{1}{9} & 0 & \textcircled{A} \end{array} ; P_4 = \begin{array}{ccccc} & \textcircled{O} & 1 & 0 & 0 \\ \textcircled{B} & @0 & 1 & 0 & \textcircled{C} \end{array} ; P_5 = \begin{array}{ccccc} & \textcircled{O} & -2 & 0 & 1 \\ \textcircled{B} & @0 & 1 & -3 & 0 \\ @0 & 1 & 0 & \textcircled{C} \end{array} ;$$

$$\begin{array}{ccccc} 0 & 0 & 1 & & \\ 0 & -6 & 1 & & \\ 0 & 0 & 1 & & \end{array}$$

1.(6))

$$\begin{array}{ccccc} & \textcircled{O} & & & 1 \\ 3 & 2 & 1 & 0 & 4 \\ \textcircled{B} & 2 & 1 & 4 & 4 \\ @2 & 0 & 3 & 1 & -2 \\ 2 & 3 & -1 & 2 & 5 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @-2 \end{array} \begin{array}{cccc} 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \end{array} ; P_2 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @0 \end{array} \begin{array}{cccc} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{array} ; P_3 =$$

$$\begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @0 \end{array} \begin{array}{ccccc} 1 & 0 & 0 & 1 & 0 \\ -\frac{1}{9} & 0 & 0 & 1 & 0 \end{array} ; P_4 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @0 \end{array} \begin{array}{ccccc} 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{array} ; P_5 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @0 \end{array} \begin{array}{ccccc} 1 & -3 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \end{array} :$$

$$\begin{array}{ccccc} 0 & 0 & 1 & 0 & -6 \\ & & & 1 & \\ & & & 0 & 0 \\ & & & 0 & 1 \end{array}$$

1.(6))

$$\begin{array}{ccccc} \textcircled{O} & & & & 1 \\ \textcircled{B} & 3 & 2 & 1 & 0 & 4 \\ @2 & 2 & 1 & 4 & 4 & -3 \\ @2 & 0 & 3 & 1 & -2 & 5 \end{array} \xrightarrow{\quad} \begin{array}{l} \text{第2行(-1)倍加到第1行} \\ \text{第1行(-2)倍加到第2行} \\ \text{第1行(-2)倍加到第3行} \\ \text{第1行(-2)倍加到第4行} \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

$$P_1 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @-2 \end{array} \begin{array}{cccc} 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \end{array} ; P_2 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @0 \end{array} \begin{array}{cccc} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{array} ; P_3 =$$

$$\begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @0 \end{array} \begin{array}{cccc} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ -\frac{1}{9} & 0 & 1 & 0 \end{array} ; P_4 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @0 \end{array} \begin{array}{cccc} 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \end{array} ; P_5 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @0 \end{array} \begin{array}{cccc} 1 & -3 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \end{array} ;$$

$$\begin{array}{ccc} 0 & 0 & 1 \\ 0 & -6 & 1 \\ 0 & 0 & 1 \end{array}$$

1.(6))

$$\begin{array}{ccccc} \textcircled{O} & & 1 & & 1 \\ \textcircled{B} & 3 & 2 & 1 & 0 & 4 \\ \textcircled{B} & 2 & 1 & 4 & 4 & -3 \\ @2 & 0 & 3 & 1 & -2 & 1 \end{array} \xrightarrow{\substack{\text{第2行}(-1) \text{倍加到第1行} \\ \text{第1行}(-2) \text{倍加到第2行} \\ \text{第1行}(-2) \text{倍加到第3行}}} \begin{array}{ccccc} \textcircled{O} & & 1 & & 1 \\ \textcircled{B} & 1 & 1 & -3 & -4 & 7 \\ \textcircled{B} & 0 & -1 & 10 & 12 & -17 \\ @2 & -2 & 9 & 9 & -16 & 1 \end{array}$$

第1行(-2)倍加到第4行



习题1.4( $P_{39} - P_{41}$ )

第2行(-2)倍加到第3行



第2行加到第4行

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
 \text{第2行}(-2) \text{倍加到第3行} \\
 \longrightarrow \\
 \text{第2行加到第4行}
 \end{array}
 \left( \begin{array}{ccccc|c}
 \textcircled{O} & 1 & 1 & -3 & -4 & 7 & 1 \\
 \textcircled{B} & 0 & -1 & 10 & 12 & -17 & \textcircled{C} \\
 @0 & 0 & 0 & -11 & -15 & 18 & \textcircled{C} \\
 0 & 0 & 15 & 22 & -26 & & \textcircled{A}
 \end{array} \right)$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc}
 & \textcircled{O} & & & & 1 \\
 & 1 & 1 & -3 & -4 & 7 & \\
 \xrightarrow{\substack{\text{第2行}(-2)\text{倍加到第3行} \\ \longrightarrow}} & 0 & -1 & 10 & 12 & -17 & \text{第4行乘3} \\
 & 0 & 0 & -11 & -15 & 18 & \text{第3行4倍加到第4行} \\
 & 0 & 0 & 15 & 22 & -26 & \xrightarrow{\substack{\text{第2行加到第4行} \\ \longrightarrow \\ \text{换3、4行}}} \\
 @ & & & & & &
 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc}
 & \textcircled{O} & & & & 1 \\
 & 1 & 1 & -3 & -4 & 7 & \\
 \xrightarrow{\substack{\text{第2行}(-2)\text{倍加到第3行} \\ \longrightarrow}} & 0 & -1 & 10 & 12 & -17 & \text{第4行乘3} \\
 & @0 & 0 & -11 & -15 & 18 & \text{第3行4倍加到第4行} \\
 & \text{第2行加到第4行} & & & & & \longrightarrow \\
 & \textcircled{O} & & 0 & 0 & 1 & \text{换3、4行} \\
 & 1 & 1 & -3 & -4 & 7 & \\
 & 0 & -1 & 10 & 12 & -17 & \\
 & @0 & 0 & 1 & 6 & -6 & \text{A} \\
 & 0 & 0 & -11 & -15 & 18 &
 \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc|c}
 & \textcircled{O} & & & & & 1 \\
 & 1 & 1 & -3 & -4 & 7 & \\
 \text{第2行}(-2) \text{倍加到第3行} & \textcircled{B} & 0 & -1 & 10 & 12 & -17 \\
 \longrightarrow & \textcircled{B} & 0 & 0 & -11 & -15 & 18 \\
 & \textcircled{A} & 0 & 0 & 1 & 15 & 22 & -26 & \xrightarrow{\text{换3、4行}} \\
 & & & & & & & \\
 & \textcircled{O} & 1 & 1 & -3 & -4 & 7 & \\
 & \textcircled{B} & 0 & -1 & 10 & 12 & -17 & \xrightarrow{\text{第3行}11\text{倍加到第4行}} \\
 & \textcircled{B} & 0 & 0 & 1 & 6 & -6 & \xrightarrow{\text{第4行乘}(-\frac{1}{51})} \\
 & \textcircled{A} & 0 & 0 & -11 & -15 & 18 & \xrightarrow{\text{第4行乘}(-6)\text{加到第3行}}
 \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc|c}
 & \textcircled{O} & & & & & 1 \\
 & 1 & 1 & -3 & -4 & 7 & \\
 \xrightarrow{\substack{\text{第2行}(-2)\text{倍加到第3行} \\ \longrightarrow}} & 0 & -1 & 10 & 12 & -17 & \\
 & @0 & 0 & -11 & -15 & 18 & \text{第3行4倍加到第4行} \\
 & \textcircled{O} & 0 & 0 & 1 & 15 & 22 & -26 & \xrightarrow{\substack{\text{第2行加到第4行} \\ \longrightarrow}} & \text{换3、4行} \\
 & 1 & 1 & -3 & -4 & 7 & \\
 \xrightarrow{\substack{\text{第3行}11\text{倍加到第4行} \\ \longrightarrow}} & 0 & -1 & 10 & 12 & -17 & \\
 & @0 & 0 & 1 & 6 & -6 & \xrightarrow{\substack{\text{第4行乘}(-\frac{1}{51}) \\ \longrightarrow}} \\
 & \textcircled{O} & 0 & 0 & -11 & -15 & 18 & \text{第4行乘}(-6)\text{加到第3行} \\
 & 1 & 1 & -3 & -4 & 7 & \\
 \xrightarrow{\substack{\text{第4行乘}(-6)\text{加到第3行} \\ \longrightarrow}} & 0 & -1 & 10 & 12 & -17 & \\
 & @0 & 0 & 1 & 0 & -\frac{6}{17} & \xrightarrow{\substack{\text{第4行乘}(-6)\text{加到第3行} \\ \longrightarrow}} \\
 & 0 & 0 & 0 & 1 & -\frac{16}{17} &
 \end{array}$$



### 习题1.4( $P_{39} - P_{41}$ )

第2行(-2)倍加到第3行

→

第2行加到第4行

Q

$$\begin{array}{cccccc|c} \textcircled{1} & 1 & 1 & -3 & -4 & 7 & 1 \\ \textcircled{2} & 0 & -1 & 10 & 12 & -17 & \\ \textcircled{3} & 0 & 0 & 11 & 15 & 18 & \end{array} \quad \begin{array}{l} \text{第4行乘3} \\ \text{第3行4倍加到第4行} \end{array}$$

### 第4行乘3

第3行4倍加到第4行

→

换3、4行

三

8

$$\begin{array}{rcl} -4 & 7 & \text{第3行} \\ 12 & -17 & \text{第4行} \\ 6 & -6 & \rightarrow \end{array}$$

8

-15 18 第4行乘(-6)加到第3行

□

mm

B  
@

$$\begin{array}{rcl} & 7 & \text{第4行乘}(-12) \text{加到第2行} \\ & -17 & \text{第4行乘}4 \text{加到第1行} \\ -\frac{6}{17} & \xrightarrow{\Delta} & \end{array}$$

$$-\frac{16}{17} \quad \text{第3行乘}(-10) \text{加到第2行}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc} \textcircled{O} & & & & & 1 \\ \textcircled{B} & 1 & 1 & -3 & 0 & \frac{55}{17} \\ \textcircled{B} & 0 & -1 & 0 & 0 & -\frac{37}{17} \\ \textcircled{A} & 0 & 0 & 1 & 0 & -\frac{6}{17} \\ 0 & 0 & 0 & 1 & -\frac{16}{17} \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc}
 \textcircled{O} & & & & & 1 \\
 \left| \begin{array}{ccccc} 1 & 1 & -3 & 0 & \frac{55}{17} \\ 0 & -1 & 0 & 0 & -\frac{37}{17} \\ 0 & 0 & 1 & 0 & -\frac{6}{17} \\ 0 & 0 & 0 & 1 & -\frac{16}{17} \end{array} \right| & \xrightarrow{\substack{\text{第3行乘3加到第1行} \\ \text{第2行加到第1行}}} & \longrightarrow & \xrightarrow{\substack{\text{第2行乘}(-1) \\ \text{A}}} & 
 \end{array}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc}
 & & & & & 1 \\
 \textcircled{O} & 1 & 1 & -3 & 0 & \frac{55}{17} & \text{第3行乘3加到第1行} \\
 \textcircled{B} & 0 & -1 & 0 & 0 & -\frac{37}{17} & \text{第2行加到第1行} \\
 @0 & 0 & 1 & 0 & -\frac{6}{17} & \xrightarrow{\Delta} & \\
 \textcircled{O} & 0 & 0 & 1 & -\frac{16}{17} & & \text{第2行乘}(-1)
 \end{array}$$

相应的初等 $\gamma$ 阵为：

$$P_1 = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & \frac{37}{17} \\ @0 & 0 & 1 & 0 & -\frac{6}{17} \\ 0 & 0 & 0 & 1 & -\frac{16}{17} \\ @0 & 1 & -1 & 0 & 0 \\ @0 & 0 & 1 & 0 & 0 \\ @0 & 0 & 0 & 1 & 0 \end{pmatrix} \text{A},$$

0 0 0 1



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc|c}
 & & & & & & 1 \\
 \textcircled{O} & 1 & 1 & -3 & 0 & \frac{55}{17} & \\
 \textcircled{B} & 0 & -1 & 0 & 0 & -\frac{37}{17} & \xrightarrow{\text{第3行乘3加到第1行}} \\
 @0 & 0 & 0 & 1 & 0 & -\frac{6}{17}A & \xrightarrow{\text{第2行加到第1行}} \\
 & 0 & 0 & 0 & 1 & -\frac{16}{17} & \xrightarrow{\text{第2行乘}(-1)} \\
 \textcircled{O} & 1 & 0 & 0 & 0 & 0 & \\
 \textcircled{B} & 0 & 1 & 0 & 0 & \frac{37}{17} & \\
 @0 & 0 & 1 & 0 & 0 & -\frac{6}{17}A & \xrightarrow{\text{相应的初等Y阵为:}}
 \end{array}$$

$$P_1 = \begin{array}{cccccc|c}
 & & & & & & 1 \\
 & 1 & -1 & 0 & 0 & 0 & \\
 \textcircled{B} & 0 & 1 & 0 & 0 & 0 & \\
 @0 & 0 & 1 & 0 & 0 & 0 & \\
 & 0 & 0 & 0 & 1 & 0 &
 \end{array}; P_2 = \begin{array}{cccccc|c}
 & & & & & & 1 \\
 & 1 & 0 & 0 & 0 & 0 & \\
 \textcircled{B} & -2 & 1 & 0 & 0 & 0 & \\
 @0 & 0 & 0 & 1 & 0 & 0 & \\
 & 0 & 0 & 0 & 1 & 0 &
 \end{array};$$







### 习题1.4( $P_{39} - P_{41}$ )

$$P_3 = \begin{matrix} O \\ \text{---} \\ 1 & 0 & 0 & 0 \\ \text{---} \\ 0 & 1 & 0 & 0 \\ \text{---} \\ @-2 & 0 & 1 & 0 \end{matrix}; P_4 = \begin{matrix} O \\ \text{---} \\ 1 & 0 & 0 & 0 \\ \text{---} \\ 0 & 1 & 0 & 0 \\ \text{---} \\ @0 & 0 & 1 & 0 \end{matrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_3 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ \textcircled{A} \\ @-2 \end{array} \begin{array}{cccc} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ \textcircled{C} & \textcircled{C} & \textcircled{C} & \textcircled{A} \end{array}; P_4 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ \textcircled{A} \\ @0 \end{array} \begin{array}{cccc} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ \textcircled{C} & \textcircled{C} & \textcircled{C} & \textcircled{A} \end{array};$$

$$P_5 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ \textcircled{A} \\ @0 \end{array} \begin{array}{cccc} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ \textcircled{C} & \textcircled{C} & \textcircled{C} & \textcircled{A} \end{array}; P_6 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ \textcircled{A} \\ @0 \end{array} \begin{array}{cccc} -2 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ \textcircled{C} & \textcircled{C} & \textcircled{C} & \textcircled{A} \end{array};$$

$$P_7 = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ \textcircled{A} \\ @0 \end{array} \begin{array}{cccc} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ \textcircled{C} & \textcircled{C} & \textcircled{C} & \textcircled{A} \end{array};$$

$$\begin{array}{cccc} 0 & 0 & 0 & 3 \end{array}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$P_5 = \begin{array}{c} \text{Diagram of } P_5 \\ \text{A directed graph with nodes } 0, 1, \dots, 6. \\ \text{Edges: } (0,1), (1,2), (2,3), (3,4), (4,5), (5,6), (6,0), (0,5), (1,4), (2,5), (3,6). \end{array}; P_6 = \begin{array}{c} \text{Diagram of } P_6 \\ \text{A directed graph with nodes } 0, 1, \dots, 6. \\ \text{Edges: } (0,1), (1,2), (2,3), (3,4), (4,5), (5,6), (6,0), (0,5), (1,4), (2,5), (3,6). \end{array}$$

$$P_7 = \begin{array}{c} \textcircled{0} \\ \textcircled{1} \\ \textcircled{0} \\ \textcircled{0} \\ \textcircled{0} \\ \textcircled{0} \\ \textcircled{0} \\ \textcircled{0} \end{array} \quad ; \quad P_8 = \begin{array}{c} \textcircled{0} \\ \textcircled{1} \\ \textcircled{0} \\ \textcircled{0} \\ \textcircled{0} \\ \textcircled{0} \\ \textcircled{0} \\ \textcircled{0} \end{array}$$

0 0 0 3

0 0 4 1



习题1.4( $P_{39} - P_{41}$ )

$$P_9 = \begin{pmatrix} \textcircled{O} & & & & 1 \\ @1 & 0 & 0 & 0 \\ @0 & 1 & 0 & 0 \\ @0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_9 = \begin{pmatrix} & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}; P_{10} = \begin{pmatrix} & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix};$$

$$\begin{matrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 11 & 1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_9 = \begin{pmatrix} & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}; P_{10} = \begin{pmatrix} & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix};$$

$$P_{11} = \begin{pmatrix} & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -\frac{1}{51} \end{pmatrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_9 = \begin{pmatrix} 0 & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}; P_{10} = \begin{pmatrix} 0 & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix};$$

$$P_{11} = \begin{pmatrix} 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{51} & \end{pmatrix}; P_{12} = \begin{pmatrix} 0 & 0 & 11 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & -6 & 0 \end{pmatrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_9 = \begin{pmatrix} 0 & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}; P_{10} = \begin{pmatrix} 0 & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix};$$

$$P_{11} = \begin{pmatrix} 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{pmatrix}; P_{12} = \begin{pmatrix} 0 & 0 & 11 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & -6 & 0 \end{pmatrix};$$

$$P_{13} = \begin{pmatrix} 0 & 0 & 0 & -\frac{1}{51} & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & -12 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$P_9 = \begin{matrix} O & & & 1 \\ 1 & 0 & 0 & 0 \\ B \\ 0 & 1 & 0 & 0 \\ @0 & 0 & 0 & 1 \end{matrix}; P_{10} = \begin{matrix} O & & & 1 \\ 1 & 0 & 0 & 0 \\ B \\ 0 & 1 & 0 & 0 \\ @0 & 0 & 1 & 0 \end{matrix};$$

$$P_{11} = \begin{matrix} 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ @0 & 0 & 1 & 0 \end{matrix}; P_{12} = \begin{matrix} 0 & 0 & 11 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ @0 & 0 & 1 & -6 \end{matrix};$$

$$P_{13} = \begin{pmatrix} 0 & 0 & 0 & -\frac{1}{51} \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & -12 \\ @0 & 0 & 1 & 0 \end{pmatrix}; P_{14} = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 4 \\ 0 & 1 & 0 & 0 \\ @0 & 0 & 1 & 0 \end{pmatrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_{15} = \begin{pmatrix} O & & & 1 \\ \parallel & 1 & 0 & 0 & 0 \\ \parallel & 0 & 1 & -10 & 0 \\ @ & 0 & 0 & 1 & 0 \\ O & 0 & 0 & 1 \end{pmatrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_{15} = \begin{pmatrix} 0 & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & -10 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}; P_{16} = \begin{pmatrix} 0 & & & 1 \\ 1 & 0 & 3 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$P_{15} = \begin{pmatrix} & & & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & -10 & 0 \\ @ & 0 & 1 & 0 \end{pmatrix}; P_{16} = \begin{pmatrix} & & & 1 \\ 1 & 0 & 3 & 0 \\ 0 & 1 & 0 & 0 \\ @ & 0 & 1 & 0 \end{pmatrix};$$

$$P_{17} = \begin{pmatrix} & & & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ @ & 0 & 1 & 0 \end{pmatrix};$$

$$\begin{matrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_{15} = \begin{array}{ccccc} & & & 1 & \\ & 1 & 0 & 0 & 0 \\ & 0 & 1 & -10 & 0 \\ & @0 & 0 & 1 & 0 \end{array} \text{C}; \quad P_{16} = \begin{array}{ccccc} & & & 1 & \\ & 1 & 0 & 3 & 0 \\ & 0 & 1 & 0 & 0 \\ & @0 & 0 & 1 & 0 \end{array} \text{C};$$

$$P_{17} = \begin{array}{ccccc} & 0 & 0 & 0 & 1 \\ & 1 & 1 & 0 & 0 \\ & 0 & 1 & 0 & 0 \\ & @0 & 0 & 1 & 0 \end{array} \text{A}; \quad P_{18} = \begin{array}{ccccc} & 0 & 0 & 0 & 1 \\ & 1 & 0 & 0 & 0 \\ & 0 & -1 & 0 & 0 \\ & @0 & 0 & 1 & 0 \end{array} \text{C};$$

$$\begin{array}{cccc} 0 & 0 & 0 & 1 \end{array}$$

$$\begin{array}{cccc} 0 & 0 & 0 & 1 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$P_{15} = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @ \end{array} \begin{matrix} 1 & 0 & 0 & 0 \\ 0 & 1 & -10 & 0 \\ 0 & 0 & 1 & 0 \end{matrix} \begin{array}{c} \textcircled{C} \\ \textcircled{C} \\ \textcircled{A} \end{array}; \quad P_{16} = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @ \end{array} \begin{matrix} 1 & 0 & 3 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{matrix} \begin{array}{c} \textcircled{C} \\ \textcircled{C} \\ \textcircled{A} \end{array};$$

$$P_{17} = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @ \end{array} \begin{matrix} 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{matrix} \begin{array}{c} \textcircled{C} \\ \textcircled{C} \\ \textcircled{A} \end{array}; \quad P_{18} = \begin{array}{c} \textcircled{O} \\ \textcircled{B} \\ @ \end{array} \begin{matrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{matrix} \begin{array}{c} \textcircled{C} \\ \textcircled{C} \\ \textcircled{A} \end{array};$$

$$\begin{matrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{matrix}$$

2.)

习题1.4( $P_{39} - P_{41}$ )

$$P_{15} = \begin{array}{ccccc} & & & 1 & \\ & 1 & 0 & 0 & 0 \\ & B & 0 & 1 & -10 \\ @ & 0 & 0 & 1 & 0 \\ & A & & & \end{array}; P_{16} = \begin{array}{ccccc} & & & 1 & \\ & 1 & 0 & 3 & 0 \\ & B & 0 & 1 & 0 \\ @ & 0 & 0 & 1 & 0 \\ & A & & & \end{array};$$

$$P_{17} = \begin{array}{ccccc} & 0 & 0 & 0 & 1 \\ & 1 & 1 & 0 & 0 \\ & B & 0 & 1 & 0 \\ @ & 0 & 0 & 1 & 0 \\ & A & & & \end{array}; P_{18} = \begin{array}{ccccc} & 0 & 0 & 0 & 1 \\ & 1 & 0 & 0 & 0 \\ & B & 0 & -1 & 0 \\ @ & 0 & 0 & 1 & 0 \\ & A & & & \end{array};$$

$$\begin{array}{ccccc} & 0 & 0 & 0 & 1 \\ & & & & \\ & & & & \end{array}$$

2.)

$$\begin{array}{ccccc} & 0 & & 1 & \\ & 1 & 0 & -1 & \\ & B & 1 & 3 & 0 \\ @ & 1 & 3 & 0 & A \\ & & & & \end{array}$$

$$\begin{array}{ccccc} & 0 & 2 & 1 & \\ & & & & \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

$$P_{15} = \begin{array}{cccc|c} & & & & 1 \\ & 1 & 0 & 0 & 0 \\ \textcircled{B} & 0 & 1 & -10 & 0 \\ @ & 0 & 0 & 1 & 0 \end{array} ; P_{16} = \begin{array}{cccc|c} & & & & 1 \\ & 1 & 0 & 3 & 0 \\ \textcircled{B} & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \end{array} ;$$

$$P_{17} = \begin{array}{cccc|c} & 0 & 0 & 0 & 1 \\ & 1 & 1 & 0 & 0 \\ \textcircled{B} & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \end{array} ; P_{18} = \begin{array}{cccc|c} & 0 & 0 & 0 & 1 \\ & 1 & 0 & 0 & 0 \\ \textcircled{B} & 0 & -1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \end{array} ;$$

$$\begin{array}{cccc} 0 & 0 & 0 & 1 \end{array} \quad \begin{array}{cccc} 0 & 0 & 0 & 1 \end{array}$$

2.)

$$\begin{array}{ccc|c} & & & 1 \\ & 1 & 0 & -1 \\ \textcircled{B} & 1 & 3 & 0 \end{array} \xrightarrow{\substack{\text{第1行乘}(-1)\text{加到第2行} \\ \text{第3行乘}(-1)\text{加到第2行}}}$$

$$\begin{array}{ccc} 0 & 2 & 1 \end{array} \quad \text{第2行乘}(-2)\text{加到第3行}$$

第3行加到第1行

习题1.4( $P_{39} - P_{41}$ )

$$P_{15} = \begin{array}{cccc|c} & & & 1 \\ & 1 & 0 & 0 & 0 \\ & 0 & 1 & -10 & 0 \\ @ & 0 & 0 & 1 & 0 \end{array} ; P_{16} = \begin{array}{cccc|c} & & & 1 \\ & 1 & 0 & 3 & 0 \\ & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \end{array} ;$$

$$P_{17} = \begin{array}{cccc|c} & 0 & 0 & 0 & 1 \\ & 1 & 1 & 0 & 0 \\ & 0 & 1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \end{array} ; P_{18} = \begin{array}{cccc|c} & 0 & 0 & 0 & 1 \\ & 1 & 0 & 0 & 0 \\ & 0 & -1 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 \end{array} ;$$

$$\begin{array}{cccc} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{array}$$

2.)

$$\begin{array}{ccc|c} & 1 & 0 & -1 & 1 \\ & 1 & 3 & 0 & 0 \\ @ & 0 & 2 & 1 & 0 \end{array} \rightarrow \begin{array}{ccc|c} & 1 & 0 & 0 & 1 \\ & 0 & 1 & 0 & 0 \\ & 0 & 0 & 1 & 0 \end{array}$$

第1行乘(-1)加到第2行  
第3行乘(-1)加到第2行  
第2行乘(-2)加到第3行  
第3行加到第1行

习题1.4( $P_{39} - P_{41}$ )

相应的初等 $\text{Y}$ 阵为

$$P_1 = \begin{pmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix};$$

习题1.4( $P_{39} - P_{41}$ )

相应的初等 $\text{Y}$ 阵为

$$P_1 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 1 \\ 0 & 0 & 1 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{pmatrix};$$

习题1.4( $P_{39} - P_{41}$ )

相应的初等 $\text{Y}$ 阵为

$$P_1 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 1 \\ 0 & 1 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & -1 \\ 0 & 1 & 0 \end{pmatrix};$$

$$P_3 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix};$$

$$\begin{matrix} 0 & -2 & 1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

相应的初等 $\text{Y}$ 阵为

$$P_1 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 1 \\ 0 & 0 & 1 \end{pmatrix}; P_2 = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{pmatrix};$$

$$P_3 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_4 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix};$$

$$\begin{matrix} 0 & -2 & 1 & 0 & 0 & 1 \end{matrix}$$

满足 $P_4P_3P_2P_1A$ 为规范 梯形 $\text{Y}$ 阵.



习题1.4( $P_{39} - P_{41}$ )

相应的初等 $\text{Y}$ 阵为

$$P_1 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 1 \\ 0 & 1 & 0 \end{pmatrix}; P_2 = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{pmatrix};$$

$$P_3 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}; P_4 = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix};$$

$$\begin{matrix} 0 & -2 & 1 \\ 0 & 0 & 1 \end{matrix}$$

满足 $P_4P_3P_2P_1A$ 为规范 梯形 $\text{Y}$ 阵.

3.)

习题1.4( $P_{39} - P_{41}$ )

相应的初等 $\text{Y}$ 阵为

$$P_1 = \begin{smallmatrix} 1 & 0 & 0 \\ 0 & -1 & 1 \\ 0 & 0 & 1 \end{smallmatrix}; P_2 = \begin{smallmatrix} 0 & 1 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{smallmatrix};$$

$$P_3 = \begin{smallmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{smallmatrix}; P_4 = \begin{smallmatrix} 0 & 0 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{smallmatrix};$$

$$\begin{matrix} 0 & -2 & 1 \\ 0 & 0 & 1 \end{matrix}$$

满足 $P_4 P_3 P_2 P_1 A$ 为规范梯形 $\text{Y}$ 阵.

3.) 记 $P_1 = \begin{smallmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{smallmatrix}$ :

$$\begin{matrix} 0 & 0 & 1 \end{matrix}$$

习题1.4( $P_{39} - P_{41}$ )

相应的初等 $\tilde{Y}$ 阵为

$$P_1 = \begin{smallmatrix} 1 & 0 & 0 \\ 0 & -1 & 1 & 0 \end{smallmatrix}; P_2 = \begin{smallmatrix} 0 & 1 & 0 & 1 \\ 0 & 1 & -1 \end{smallmatrix};$$

$$P_3 = \begin{smallmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{smallmatrix}; P_4 = \begin{smallmatrix} 0 & 0 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{smallmatrix};$$

$$\begin{matrix} 0 & -2 & 1 \\ & 0 & 0 & 1 \end{matrix}$$

满足 $P_4 P_3 P_2 P_1 A$ 为规范梯形 $\tilde{Y}$ 阵.

$$P_1 = \begin{smallmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{smallmatrix}; P_2 = \begin{smallmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{smallmatrix}, K$$

$$P_3 = \begin{smallmatrix} 0 & 0 & 1 \\ 0 & 1 & 1 \end{smallmatrix}$$



习题1.4( $P_{39} - P_{41}$ )

相应的初等 $\text{Y}$ 阵为

$$P_1 = \begin{smallmatrix} 1 & 0 & 0 \\ 0 & -1 & 1 \\ 0 & 0 & 1 \end{smallmatrix}; P_2 = \begin{smallmatrix} 0 & 1 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{smallmatrix};$$

$$P_3 = \begin{smallmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{smallmatrix}; P_4 = \begin{smallmatrix} 0 & 0 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{smallmatrix};$$

$$\begin{matrix} 0 & -2 & 1 \\ 0 & 0 & 1 \end{matrix}$$

满足 $P_4 P_3 P_2 P_1 A$ 为规范梯形 $\text{Y}$ 阵.

$$\begin{matrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{matrix} \quad \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{matrix}$$

3.) 记 $P_1 = \begin{smallmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{smallmatrix}; P_2 = \begin{smallmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \end{smallmatrix}, K$

$$\begin{matrix} 0 & 0 & 1 \\ 0 & 1 & 1 \end{matrix}$$

$$P_1 A = B; P_2 B = C,$$

习题1.4( $P_{39} - P_{41}$ )

相应的初等 $\text{Y}$ 阵为

$$P_1 = \begin{smallmatrix} 1 & 0 & 0 \\ 0 & -1 & 1 \\ 0 & 0 & 1 \end{smallmatrix}; P_2 = \begin{smallmatrix} 0 & 1 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{smallmatrix};$$

$$P_3 = \begin{smallmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{smallmatrix}; P_4 = \begin{smallmatrix} 0 & 0 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{smallmatrix};$$

$$\begin{matrix} 0 & -2 & 1 \\ 0 & 0 & 1 \end{matrix}$$

满足 $P_4P_3P_2P_1A$ 为规范梯形 $\text{Y}$ 阵.

$$\begin{matrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{matrix} \quad \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

3.) 记 $P_1 = \begin{smallmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{smallmatrix}; P_2 = \begin{smallmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \end{smallmatrix}, K$

$$\begin{matrix} 0 & 0 & 1 \\ 0 & 1 & 1 \end{matrix}$$

$P_1A = B; P_2B = C,$  以 $P_2P_1A = C,$

习题1.4( $P_{39} - P_{41}$ )

$$\text{取 } Q = P_2 P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix},$$
$$\begin{matrix} \textcircled{O} \\ \textcircled{B} \\ \textcircled{C} \end{matrix} \quad \begin{matrix} 1 \\ @1 \\ \textcircled{A} \end{matrix}$$

习题1.4( $P_{39} - P_{41}$ )

取  $Q = P_2 P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}$ , 则  $QA = C$ .

$$\begin{matrix} \textcircled{O} & & 1 \\ 0 & 1 & 0 \\ \textcircled{B} & @1 & 0 \\ 1 & 0 & 1 \\ \textcircled{C} & & \end{matrix}$$

习题1.4( $P_{39} - P_{41}$ )

$$\text{取 } Q = P_2 P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}, \text{ 使 } QA = C.$$

$$\begin{matrix} 0 & 1 & 1 \\ 1 & 0 & 1 \end{matrix}$$

4.(1))



### 习题1.4( $P_{39} - P_{41}$ )

$$\text{取 } Q = P_2 P_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}, \quad QA = C.$$

#### 4.(1)) 构作 $\mathbb{Y}$ 阵

$$(A \mid I) =$$

$$\begin{array}{cccc|c} 2 & 1 & 1 & 0 & \text{第1行乘}(\frac{1}{2}) \\ 3 & 4 & 0 & 1 & \text{第1行乘}(-3) \text{加到第2行} \\ & & & & \xrightarrow{\quad} \\ & & & & \text{第2行乘}(\frac{2}{5}) \\ & & & & \text{第2行乘}(-\frac{1}{2}) \text{加到第1行} \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{取 } Q = P_2 P_1 = \begin{matrix} \textcircled{0} & 1 & 0 \\ \textcircled{1} & 0 & 0 \\ \textcircled{1} & 0 & 1 \end{matrix}, \quad QA = C.$$

4.(1)) 构作Y阵

$$(A \ I) =$$

$$\begin{array}{cccc|c}
 2 & 1 & 1 & 0 & ! \\
 3 & 4 & 0 & 1 & \\
 \hline
 & & & & \\
 \end{array}
 \xrightarrow{\substack{\text{第1行乘}(\frac{1}{2}) \\ \text{第1行乘}(-3) \text{ 加到第2行} \\ \text{第2行乘}(\frac{2}{5})}}
 \begin{array}{cccc|c}
 1 & 0 & \frac{4}{5} & -\frac{1}{5} & ! \\
 0 & 1 & -\frac{3}{5} & \frac{2}{5} & \\
 \hline
 & & & & \\
 \end{array}$$

第2行乘 $(-\frac{1}{2})$ 加到第1行

习题1.4( $P_{39} - P_{41}$ )

$$\text{取 } Q = P_2 P_1 = \begin{matrix} \textcircled{0} & 1 & 0 \\ \textcircled{1} & 0 & 0 \\ \textcircled{1} & 0 & 1 \end{matrix}, \quad QA = C.$$

4.(1)) 构作 $\bar{Y}$ 阵

$$(A \ I) =$$

$$\begin{array}{cccc|c}
 2 & 1 & 1 & 0 & ! \\
 3 & 4 & 0 & 1 & !
 \end{array} \xrightarrow{\substack{\text{第1行乘}(\frac{1}{2}) \\ \text{第1行乘}(-3) \text{加到第2行}}} \begin{array}{cccc|c}
 1 & 0 & \frac{4}{5} & -\frac{1}{5} & ! \\
 0 & 1 & -\frac{3}{5} & \frac{2}{5} &
 \end{array}$$

第2行乘 $(\frac{2}{5})$

$$\begin{array}{ccccc|c}
 2 & 1 & -1 & & & ! \\
 3 & 4 & & & & !
 \end{array} = \begin{array}{ccccc|c}
 \frac{4}{5} & -\frac{1}{5} & & & & ! \\
 -\frac{3}{5} & \frac{2}{5} & & & &
 \end{array}$$

第2行乘 $(-\frac{1}{2})$ 加到第1行

习题1.4( $P_{39} - P_{41}$ )

4.(2))



习题1.4( $P_{39} - P_{41}$ )4.(2)) 构作 $\mathbf{Y}$ 阵

$$(A \ I) = \begin{array}{cccccc} \textcircled{O} & 2 & 2 & 3 & \textcolor{red}{1} & 0 & 0 \\ \textcircled{B} & 1 & -1 & 0 & \textcolor{red}{0} & 1 & 0 \\ \textcircled{C} & -1 & 2 & 1 & \textcolor{red}{0} & 0 & 1 \end{array}$$





习题1.4( $P_{39} - P_{41}$ )

4.(2) 构作Y阵

$$(A \ I) = \begin{array}{ccccccc} \textcircled{O} & 2 & 2 & 3 & \textcolor{red}{1} & 0 & 0 \\ \textcircled{B} & 1 & -1 & 0 & \textcolor{red}{0} & 1 & 0 \\ @ & -1 & 2 & 1 & \textcolor{red}{0} & 0 & 1 \end{array} \begin{array}{l} \text{换1、2行} \\ \text{第1行乘(-2)加到第2行} \\ \longrightarrow \\ \text{第1行加到第3行} \end{array}$$

$$\begin{array}{cccccc} \textcircled{O} & 1 & -1 & 0 & \textcolor{red}{0} & 1 & 1 \\ \textcircled{B} & 0 & 4 & 3 & \textcolor{red}{1} & -2 & 0 \\ @ & 0 & 1 & 1 & \textcolor{red}{0} & 1 & 1 \end{array}$$





习题1.4( $P_{39} - P_{41}$ )

4.(2) 构作Y阵

$$(A \ I) = \begin{array}{ccccccc} \textcircled{O} & 2 & 2 & 3 & \textcolor{red}{1} & 0 & 0 \\ \textcircled{B} & 1 & -1 & 0 & \textcolor{red}{0} & 1 & 0 \\ @ & -1 & 2 & 1 & \textcolor{red}{0} & 0 & 1 \end{array} \begin{array}{l} \text{换1、2行} \\ \text{第1行乘(-2)加到第2行} \\ \longrightarrow \\ \text{第1行加到第3行} \end{array}$$

$$\begin{array}{ccccccc} \textcircled{O} & 1 & -1 & 0 & \textcolor{red}{0} & 1 & 0 \\ \textcircled{B} & 0 & 4 & 3 & \textcolor{red}{1} & -2 & 0 \\ @ & 0 & 1 & 1 & \textcolor{red}{0} & 1 & 1 \end{array} \begin{array}{l} \text{换2、3行} \\ \text{第2行乘(-4)加到第3行} \\ \longrightarrow \end{array}$$

$$\begin{array}{ccccccc} \textcircled{O} & 1 & -1 & 0 & \textcolor{red}{0} & 1 & 0 \\ \textcircled{B} & 0 & 1 & 0 & \textcolor{red}{1} & -5 & -3 \\ @ & 0 & 0 & -1 & \textcolor{red}{1} & -6 & -4 \end{array} \begin{array}{l} \text{第3行加到第2行} \\ | \end{array}$$





习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc}
\textcircled{O} & 1 & 0 & 0 & 1 & -4 & -3 & 1 \\
\textcircled{B} & @0 & 1 & 0 & 1 & -5 & -3 & \textcircled{C} \\
& 0 & 0 & 1 & -1 & 6 & 4 & \textcircled{A}.
\end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\textcircled{O} \begin{matrix} 1 & 0 & 0 & 1 & -4 & -3 & 1 \\ \textcircled{B} @ 0 & 1 & 0 & 1 & -5 & -3 & \textcircled{C} \end{matrix} \text{A.}$$

$$\begin{matrix} 0 & 0 & 1 & -1 & 6 & 4 & 1 \\ \textcircled{O} & 2 & 2 & 3 & 1 & -1 & \textcircled{O} \\ \textcircled{B} @ & 1 & -1 & 0 & \textcircled{C} & = & \textcircled{B} @ 1 & -4 & -3 & \textcircled{C} \end{matrix} \text{A.}$$

$$\begin{matrix} -1 & 2 & 1 & -1 & 6 & 4 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$\textcircled{O} \begin{matrix} 1 & 0 & 0 & 1 & -4 & -3 & 1 \\ \textcircled{B} @ 0 & 1 & 0 & 1 & -5 & -3 & \textcircled{C} \end{matrix} \text{A.}$$

$$\begin{matrix} 0 & 0 & 1 & -1 & 6 & 4 & 1 \\ \textcircled{O} & 2 & 2 & 3 & 1 & -1 & \textcircled{O} \\ \textcircled{B} @ & 1 & -1 & 0 & \textcircled{C} & = @ & 1 & -4 & -3 & \textcircled{C} \\ -1 & 2 & 1 & & -1 & 6 & 4 \end{matrix}$$

4.(3))

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc} \textcircled{O} & 1 & 0 & 0 & 1 & -4 & -3 \\ \textcircled{B} & @0 & 1 & 0 & 1 & -5 & -3 \\ & & & & & & \textcircled{C} \\ & & & & & & \textcircled{A} \end{array}$$

$$\begin{array}{ccccccc} \textcircled{O} & 0 & 0 & 1 & -1 & 6 & 4 \\ \textcircled{O} & 2 & 2 & 3 & 1 & -1 & \\ \textcircled{B} & @1 & -1 & 0 \\ & & & \textcircled{C} & = & \textcircled{B} & 1 & -4 & -3 \\ & & & \textcircled{A} & @1 & -5 & -3 \\ & & & & & & \textcircled{C} \\ & & & & & & \textcircled{A} \\ & -1 & 2 & 1 & & -1 & 6 & 4 \end{array}$$

4.(3)) 构作 $\tilde{Y}$ 阵

$$(A \ I) = \begin{array}{ccccccc} \textcircled{O} & 1 & 0 & 0 & 1 & 0 & 0 \\ \textcircled{B} & @1 & 2 & 0 & 0 & 1 & 0 \\ & & & & & & \textcircled{C} \\ & & & & & & \textcircled{A} \\ & 1 & 2 & 3 & 0 & 0 & 1 \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

$$\textcircled{O} \begin{matrix} 1 & 0 & 0 & 1 & -4 & -3 & 1 \\ \textcircled{B} @ 0 & 1 & 0 & 1 & -5 & -3 & \textcircled{C} \\ @ 0 & 1 & 0 & 1 & -5 & -3 & \textcircled{A} \end{matrix}$$

$$\textcircled{O} \begin{matrix} 0 & 0 & 1 & -1 & 6 & 4 & 1 \\ \textcircled{O} & 2 & 2 & 3 & 1 & -1 & \textcircled{O} \\ @ 1 & -1 & 0 & \textcircled{C} & = @ 1 & -4 & -3 & \textcircled{C} \\ @ 1 & -1 & 0 & \textcircled{A} & = @ 1 & -5 & -3 & \textcircled{A} \end{matrix}$$

以

$$\begin{matrix} -1 & 2 & 1 & -1 & 6 & 4 \end{matrix}$$

4.(3)) 构作 $\tilde{Y}$ 阵

$$(A \quad I) = \begin{matrix} \textcircled{O} & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ \textcircled{B} & 1 & 2 & 0 & 0 & 1 & 0 & \textcircled{C} \\ @ 1 & 2 & 3 & 0 & 0 & 1 & \textcircled{A} \end{matrix}$$

第1行乘(-1)加到第2行  
第1行乘(-1)加到第3行  
 $\longrightarrow$   
第2行乘(-1)加到第3行

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc}
 & & & & & & 1 \\
 \textcircled{O} & 1 & 0 & 0 & \textcolor{red}{1} & 0 & 0 \\
 \textcircled{B} & @0 & 2 & 0 & \textcolor{red}{-1} & 1 & 0 \\
 & 0 & 0 & 3 & \textcolor{red}{0} & -1 & 1
 \end{array}
 \textcircled{C} \textcircled{A}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc|c}
 \textcircled{O} & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
 \textcircled{B} & @0 & 2 & 0 & -1 & 1 & 0 & \xrightarrow{\text{第2行乘}\frac{1}{2}\text{加到第2行}} \\
 \textcircled{C} & 0 & 0 & 3 & 0 & -1 & 1 & \xrightarrow{\text{第3行乘}\frac{1}{3}\text{加到第3行}}
 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{O} \begin{matrix} 1 & 0 & 0 & 1 & 0 & 0 \\ @0 & 2 & 0 & -1 & 1 & 0 \end{matrix} \text{C} \xrightarrow{\text{第2行乘}\frac{1}{2}\text{加到第2行}} \text{A.} \rightarrow$$

$$\text{O} \begin{matrix} 0 & 0 & 3 & 0 & -1 & 1 \\ 1 & 0 & 0 & 1 & 0 & 0 \\ @0 & 1 & 0 & -\frac{1}{2} & \frac{1}{2} & 0 \end{matrix} \text{C} \xrightarrow{\text{第3行乘}\frac{1}{3}\text{加到第3行}} \text{A.}$$

### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc} \textcircled{O} & 1 & 0 & 0 & 1 & 0 & 0 \\ \textcircled{B} & @0 & 2 & 0 & -1 & 1 & 0 \\ \textcircled{C} & & & & & & \end{array} \xrightarrow{\text{第2行乘 } \frac{1}{2} \text{ 加到第2行}}$$

$$\text{○} \begin{matrix} 0 & 0 & 3 & 0 & -1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ @0 & 1 & 0 & -\frac{1}{2} & \frac{1}{2} & 0 \end{matrix} \text{ 第3行乘 } \frac{1}{3} \text{ 加到第3行}$$

$$\begin{array}{ccccccccc} 0 & 0 & 1 & \textcolor{red}{0} & -\frac{1}{3} & \frac{1}{3} & & & \\ \textcircled{O} & & & \textcircled{O} & & & & & \\ 1 & 0 & 0 & 1 & -1 & & & & \\ \textcircled{B} @ 1 & \textcircled{C} @ 2 & \textcircled{A} @ 0 & = & \textcircled{B} @ -\frac{1}{2} & \textcircled{C} @ \frac{1}{2} & \textcircled{A} @ 0 \\ 1 & 2 & 3 & & & 0 & -\frac{1}{3} & \frac{1}{3} \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

4.(4))

习题1.4( $P_{39} - P_{41}$ )4.(4)) 构作 $\dot{Y}$ 阵

$$(A \ I) = \begin{pmatrix} 1 & 2 & 3 & 4 & 1 & 0 & 0 & 0 \\ 0 & 1 & 2 & 3 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 2 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$



第4行乘(-2)加到第3行

第4行乘(-3)加到第2行

第4行乘(-4)加到第1行



习题1.4( $P_{39} - P_{41}$ )

4.(4)) 构造Y阵

$$(A \quad I) = \begin{array}{ccccccccc} 1 & 2 & 3 & 4 & 1 & 0 & 0 & 0 & 1 \\ \textcircled{B} 0 & 1 & 2 & 3 & 0 & 1 & 0 & 0 & \textcircled{C} \\ @0 & 0 & 1 & 2 & 0 & 0 & 1 & 0 & \textcircled{A} \end{array} \xrightarrow{\substack{\text{第4行乘}(-2)\text{加到第3行} \\ \text{第4行乘}(-3)\text{加到第2行}}} \begin{array}{ccccccccc} 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ \textcircled{B} 1 & 2 & 3 & 0 & 1 & 0 & 0 & -4 & \\ @0 & 1 & 2 & 0 & 0 & 1 & 0 & -3 & \\ @0 & 0 & 1 & 0 & 0 & 0 & 1 & -2 & \textcircled{A} \end{array} \xrightarrow{\text{第4行乘}(-4)\text{加到第1行}} \begin{array}{ccccccccc} 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & \\ 1 & 2 & 3 & 0 & 1 & 0 & 0 & -4 & \\ @0 & 1 & 2 & 0 & 0 & 1 & 0 & -3 & \\ @0 & 0 & 1 & 0 & 0 & 0 & 1 & -2 & \textcircled{A} \end{array}$$

习题1.4( $P_{39} - P_{41}$ )4.(4)) 构作 $\text{Y}$ 阵

$$(A \quad I) = \begin{array}{ccccccccc} 1 & 2 & 3 & 4 & 1 & 0 & 0 & 0 & 1 \\ \textcircled{B} 0 & 1 & 2 & 3 & 0 & 1 & 0 & 0 & \textcircled{C} \\ @0 & 0 & 1 & 2 & 0 & 0 & 1 & 0 & \textcircled{A} \end{array} \xrightarrow{\quad} \begin{array}{ccccccccc} 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ \textcircled{O} & & & & & & & & 1 \\ 1 & 2 & 3 & 0 & 1 & 0 & 0 & -4 & \textcircled{C} \\ \textcircled{B} 0 & 1 & 2 & 0 & 0 & 1 & 0 & -3 & \textcircled{C} \\ @0 & 0 & 1 & 0 & 0 & 0 & 1 & -2 & \textcircled{A} \end{array} \xrightarrow{\quad} \begin{array}{ccccccccc} 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & \text{第2行乘(-2)加到第1行} \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & \text{第2行乘(-2)加到第1行} \end{array}$$

第4行乘(-2)加到第3行  
第4行乘(-3)加到第2行  
第4行乘(-4)加到第1行  
第3行乘(-2)加到第2行  
第3行乘(-3)加到第1行

习题1.4( $P_{39} - P_{41}$ )4.(4) 构造 $\dot{Y}$ 阵

$$(A \ I) = \begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{1} & 1 & 2 & 3 & 4 & \textcolor{red}{1} & 0 & 0 & 0 \\ \textcircled{2} & 0 & 1 & 2 & 3 & 0 & 1 & 0 & 0 \\ \textcircled{3} & @0 & 0 & 1 & 2 & 0 & 0 & 1 & 0 \end{array} \xrightarrow{\quad} \begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{1} & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ \textcircled{2} & 1 & 2 & 3 & 0 & \textcolor{red}{1} & 0 & 0 & -4 \\ \textcircled{3} & 0 & 1 & 2 & 0 & 0 & 1 & 0 & -3 \\ @0 & 0 & 1 & 0 & 0 & 0 & 1 & -2 \end{array} \xrightarrow{\quad} \begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{1} & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ \textcircled{2} & 1 & 0 & 0 & 0 & 1 & -2 & 1 & 0 \\ \textcircled{3} & 0 & 1 & 0 & 0 & 0 & 1 & -2 & 1 \\ @0 & 0 & 1 & 0 & 0 & 0 & 1 & -2 \end{array} \xrightarrow{\quad} \begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{1} & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ \textcircled{2} & 1 & 0 & 0 & 0 & 1 & -2 & 1 & 0 \\ \textcircled{3} & 0 & 1 & 0 & 0 & 0 & 1 & -2 & 1 \\ @0 & 0 & 1 & 0 & 0 & 0 & 1 & -2 \end{array} \xrightarrow{\quad} \begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{1} & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ \textcircled{2} & 1 & 0 & 0 & 0 & 1 & -2 & 1 & 0 \\ \textcircled{3} & 0 & 1 & 0 & 0 & 0 & 1 & -2 & 1 \\ @0 & 0 & 1 & 0 & 0 & 0 & 1 & -2 \end{array}$$

第4行乘(-2)加到第3行  
第4行乘(-3)加到第2行  
→  
第4行乘(-4)加到第1行  
→  
第3行乘(-2)加到第2行  
第3行乘(-3)加到第1行  
→  
第2行乘(-2)加到第1行  
→  
.



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
 \text{以} \\
 \left( \begin{array}{ccccc}
 \textcircled{O} & & & & \\
 1 & 2 & 3 & 4 & 1 \ -1 \\
 \textcircled{B} & & & & \textcircled{C} \\
 0 & 1 & 2 & 3 & \\
 @0 & 0 & 1 & 2 & \textcircled{A} \\
 0 & 0 & 0 & 1 &
 \end{array} \right) = \left( \begin{array}{ccccc}
 \textcircled{O} & & & & 1 \\
 1 & -2 & 1 & 0 & \\
 \textcircled{B} & & & & \textcircled{C} \\
 0 & 1 & -2 & 1 & \\
 @0 & 0 & 1 & -2 & \textcircled{A} \\
 0 & 0 & 0 & 1 &
 \end{array} \right)
 \end{array}$$

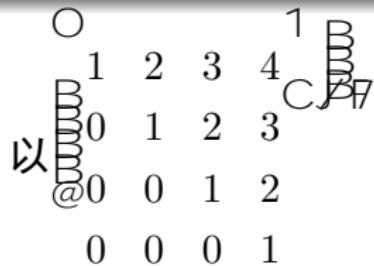


习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{c}
 \text{以} \\
 \left( \begin{array}{cccc|cc}
 0 & 1 & 2 & 3 & 4 & 1 & -1 \\
 0 & 0 & 1 & 2 & 3 & 0 & 1 \\
 @0 & 0 & 0 & 1 & 2 & 0 & 0
 \end{array} \right) = \left( \begin{array}{cccc|cc}
 0 & 1 & -2 & 1 & 0 & 1 \\
 0 & 1 & -2 & 1 & 1 & 0 \\
 @0 & 0 & 1 & -2 & 1 & 1
 \end{array} \right)
 \end{array}$$

4.(5))



习题1.4( $P_{39} - P_{41}$ )

P72

10.

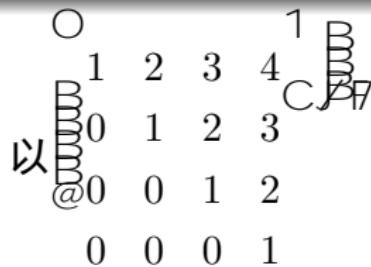
9091

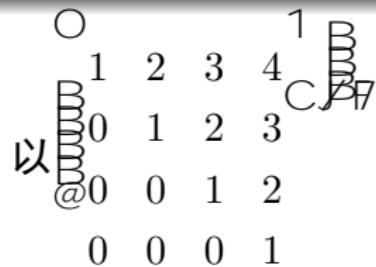
10

51.

706

52

习题1.4( $P_{39} - P_{41}$ )

习题1.4( $P_{39} - P_{41}$ )

C

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72

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110

51.

706

52



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccc}
 & \textcircled{O} & & \textcircled{O} & \\
 & 1 & 2 & 3 & 4 & = & 1 & -2 & 1 & 0 \\
 \text{以} & \textcircled{B} & & \textcircled{B} & & & \textcircled{B} & & \textcircled{B} \\
 & 0 & 1 & 2 & 3 & & 0 & 1 & -2 & 1 \\
 @ & 0 & 0 & 1 & 2 & & 0 & 0 & 1 & -2 \\
 & 0 & 0 & 0 & 1 & & 0 & 0 & 0 & 1
 \end{array}$$

## 4.(5) 构作Y阵

$$(A \ I) = 
 \begin{array}{ccccccccc}
 & & & & & & & & 1 \\
 & 2 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
 & \textcircled{B} & & & & \textcircled{B} & & & \\
 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
 @ & 0 & 0 & 2 & 5 & 0 & 0 & 1 & 0 \\
 & 0 & 0 & 1 & 3 & 0 & 0 & 0 & 1
 \end{array}
 \xrightarrow{\substack{\text{第2行乘}(-1)\text{加到第1行} \\ \text{第1行乘}(-1)\text{加到第2行}}}$$
  

$$\begin{array}{ccccccccc}
 & & & & & & & & 1 \\
 & 1 & 0 & 0 & 0 & 1 & -1 & 0 & 0 \\
 & \textcircled{B} & & & & \textcircled{B} & & & \\
 & 0 & 1 & 0 & 0 & -1 & 2 & 0 & 0 \\
 @ & 0 & 0 & 2 & 5 & 0 & 0 & 1 & 0 \\
 & 0 & 0 & 1 & 3 & 0 & 0 & 0 & 1
 \end{array}
 \xrightarrow{\substack{\text{第4行乘}(-1)\text{加到第3行} \\ \text{第3行乘}(-1)\text{加到第4行}}}$$
  

$$\begin{array}{ccccccccc}
 & & & & & & & & 1 \\
 & 1 & 0 & 0 & 0 & 1 & -1 & 0 & 0 \\
 & \textcircled{B} & & & & \textcircled{B} & & & \\
 & 0 & 0 & 2 & 5 & 0 & 0 & 1 & 0 \\
 & 0 & 0 & 1 & 3 & 0 & 0 & 0 & 1
 \end{array}
 \xrightarrow{\text{第4行乘}(-2)\text{加到第3行}}$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc}
 & & & & & & & & 1 \\
 \textcircled{O} & 1 & 0 & 0 & 0 & 1 & -1 & 0 & 0 \\
 \textcircled{B} & 0 & 1 & 0 & 0 & -1 & 2 & 0 & 0 \\
 @ & 0 & 0 & 1 & 0 & 0 & 0 & 3 & -5 \\
 & 0 & 0 & 0 & 1 & 0 & 0 & -1 & 2
 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{O} & 1 & 0 & 0 & 0 & 1 & -1 & 0 & 0 \\ \textcircled{B} & 0 & 1 & 0 & 0 & -1 & 2 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 & 0 & 0 & 3 & -5 \\ & & & & & & & & \textcircled{A} \end{array}.$$

$$\begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{O} & 0 & 0 & 0 & 1 & 0 & 0 & -1 & 2 \\ & & & & & & & & \textcircled{O} \\ & & & & & 1 & -1 & & \\ \textcircled{B} & 2 & 1 & 0 & 0 & & & 1 & -1 & 0 & 0 \\ & 1 & 1 & 0 & 0 & & = & -1 & 2 & 0 & 0 \\ @ & 0 & 0 & 2 & 5 & & & @ & 0 & 0 & 3 & -5 \\ & & & & & & & & & \textcircled{A} \\ & 0 & 0 & 1 & 3 & & & 0 & 0 & -1 & 2 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc} & \textcircled{O} & & & & & & & 1 \\ & 1 & 0 & 0 & 0 & 1 & -1 & 0 & 0 \\ \textcircled{B} & 0 & 1 & 0 & 0 & -1 & 2 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 & 0 & 0 & 3 & -5 \\ & & & & & & & & \textcircled{A} \end{array}.$$

$$\begin{array}{ccccccccc} & \textcircled{O} & & & & & & & 1 \\ & 0 & 0 & 0 & 1 & 0 & 0 & -1 & 2 \\ & & \textcircled{O} & & 1 & -1 & & & \\ & 2 & 1 & 0 & 0 & & 1 & -1 & 0 & 0 \\ \textcircled{B} & 1 & 1 & 0 & 0 & & -1 & 2 & 0 & 0 \\ @ & 0 & 0 & 2 & 5 & & 0 & 0 & 3 & -5 \\ & & & & & & & & \textcircled{A} \end{array} = \begin{array}{ccccccccc} & \textcircled{O} & & & & & & & 1 \\ & 1 & -1 & 0 & 0 & & & & \\ & -1 & 2 & 0 & 0 & & & & \\ @ & 0 & 0 & 3 & -5 & & & & \\ & & & & & & & & \textcircled{A} \end{array}.$$

$$\begin{array}{cccc} 0 & 0 & 1 & 3 \\ & & & & 0 & 0 & -1 & 2 \end{array}$$

5.(1))



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{O} & 1 & 0 & 0 & 0 & 1 & -1 & 0 & 0 \\ \textcircled{B} & 0 & 1 & 0 & 0 & -1 & 2 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 & 0 & 0 & 3 & -5 \\ & & & & & & & & \textcircled{A} \end{array}.$$

$$\begin{array}{ccccccccc} & & & & & & & & 1 \\ 0 & \textcircled{O} & 0 & 0 & 1 & 0 & 0 & -1 & 2 \\ & & 1 & & & 1 & -1 & \textcircled{O} & \\ \textcircled{B} & 2 & 1 & 0 & 0 & & & 1 & -1 & 0 & 0 \\ 1 & 1 & 0 & 0 & & = & -1 & 2 & 0 & 0 \\ @ & 0 & 0 & 2 & 5 & \textcircled{A} & @ & 0 & 0 & 3 & -5 \\ & & & & & & & & & \textcircled{A} \\ & 0 & 0 & 1 & 3 & & & 0 & 0 & -1 & 2 \end{array}$$

5.(1)) 因为

$$\begin{matrix} & ! \\ 1 & -1 \\ 1 & 1 \end{matrix}$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{1} & 1 & 0 & 0 & 0 & 1 & -1 & 0 & 0 \\ \textcircled{2} & 0 & 1 & 0 & 0 & -1 & 2 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 & 0 & 0 & 3 & -5 \\ & & & & & & & & \textcircled{A} \end{array}.$$

$$\begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{1} & 0 & 0 & 1 & 0 & 0 & -1 & 2 & \\ & & & & & & & & \textcircled{1} \\ \textcircled{2} & 2 & 1 & 0 & 0 & & 1 & -1 & 0 & 0 \\ \textcircled{3} & 1 & 1 & 0 & 0 & & -1 & 2 & 0 & 0 \\ @ & 0 & 0 & 2 & 5 & & 0 & 0 & 3 & -5 \\ & & & & & & & & \textcircled{A} \end{array} = \begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{1} & 1 & -1 & 0 & 0 & & & & \\ \textcircled{2} & -1 & 2 & 0 & 0 & & & & \\ @ & 0 & 0 & 3 & -5 & & & & \\ & & & & & & & & \textcircled{A} \end{array}.$$

$$\begin{array}{cccc} 0 & 0 & 1 & 3 \\ & & & & 0 & 0 & -1 & 2 \end{array}$$

5.(1)) 因为

! 第1行乘(-1)加到第2行

$1 \quad -1$  第2行乘 $\frac{1}{2}$

$1 \quad 1$   $\rightarrow$

第2行加到第1行

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{1} & 1 & 0 & 0 & 0 & 1 & -1 & 0 & 0 \\ \textcircled{2} & 0 & 1 & 0 & 0 & -1 & 2 & 0 & 0 \\ @ & 0 & 0 & 1 & 0 & 0 & 0 & 3 & -5 \\ & & & & & & & & \textcircled{A} \end{array}.$$

$$\begin{array}{ccccccccc} & & & & & & & & 1 \\ \textcircled{1} & 0 & 0 & 0 & 1 & 0 & -1 & 2 & \\ & & & & & 1 & -1 & & \\ \textcircled{2} & 2 & 1 & 0 & 0 & & 1 & -1 & 0 & 0 \\ \textcircled{3} & 1 & 1 & 0 & 0 & = & -1 & 2 & 0 & 0 \\ @ & 0 & 0 & 2 & 5 & & 0 & 0 & 3 & -5 \\ & & & & & & & & \textcircled{A} \\ & 0 & 0 & 1 & 3 & & 0 & 0 & -1 & 2 \end{array}$$

5.(1)) 因为

$$\begin{array}{ccc} ! & \text{第1行乘}(-1) \text{加到第2行} & ! \\ 1 & -1 & \text{第2行乘} \frac{1}{2} \\ 1 & 1 & \longrightarrow \\ & & 1 & 0 \\ & & 0 & 1 \end{array}$$

第2行加到第1行

习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{vmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 1 & -1 \\ 0 & 1 & 0 & \frac{1}{2} & -1 & 1 & 1 & 1 \end{vmatrix} = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix},$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{vmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 1 & -1 \\ 0 & 1 & 0 & \frac{1}{2} & -1 & 1 & 1 & 1 \end{vmatrix} = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix},$$

$$\text{以 } \begin{vmatrix} 1 & -1 \\ 1 & 1 \end{vmatrix} = \begin{vmatrix} 1 & 0 & 1 & 0 & 1 & -1 \\ 1 & 1 & 0 & 2 & 0 & 1 \end{vmatrix}.$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{l} \text{以 } \begin{array}{ccccccccc|cc} & ! & & ! & & ! & & ! & \\ 1 & 1 & 1 & 0 & 1 & 0 & 1 & -1 & = & 1 & 0 \\ 0 & 1 & 0 & \frac{1}{2} & -1 & 1 & 1 & 1 & & 0 & 1 \end{array}, \\ \text{以 } \begin{array}{cc|ccccc} 1 & -1 & = & 1 & 0 & 1 & 0 & 1 & -1 \\ 1 & 1 & & 1 & 1 & 0 & 2 & 0 & 1 \end{array}. \end{array}$$

5.(2))

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc|cc} & ! & ! & ! & ! & ! & ! & ! & \\ \text{以} & 1 & 1 & 1 & 0 & 1 & 0 & 1 & -1 & = & 1 & 0 \\ & 0 & 1 & 0 & \frac{1}{2} & -1 & 1 & 1 & 1 & & 0 & 1 \end{array},$$

$$\begin{array}{cc|ccccc} \text{以} & 1 & -1 & = & 1 & 0 & 1 & 0 & 1 & -1 \\ & 1 & 1 & & 1 & 1 & 0 & 2 & 0 & 1 \end{array}.$$

5.(2)) 因为

$$\begin{matrix} O & & 1 \\ @ & 1 & 1 & 1 \\ B & @0 & 1 & 1 A \\ & 0 & 0 & 1 \end{matrix}$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc|cc} & ! & ! & ! & ! & ! & ! & ! & \\ \text{以} & 1 & 1 & 1 & 0 & 1 & 0 & 1 & -1 & = & 1 & 0 \\ & 0 & 1 & 0 & \frac{1}{2} & -1 & 1 & 1 & 1 & & 0 & 1 \end{array},$$

$$\begin{array}{cc|ccccc} \text{以} & 1 & -1 & = & 1 & 0 & 1 & 0 & 1 & -1 \\ & 1 & 1 & & 1 & 1 & 0 & 2 & 0 & 1 \end{array}.$$

5.(2)) 因为

$$\begin{array}{ccc|c} O & 1 & 1 & 1 \\ B & 1 & 1 & 1 \\ @ & 0 & 1 & 1 \\ A & & & \end{array} \xrightarrow{\substack{\text{第3行乘}(-1)\text{加到第2行} \\ \text{第3行乘}(-1)\text{加到第1行}}} \begin{array}{ccc|c} & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \end{array}$$

第2行乘(-1)加到第1行

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc|cc} & ! & ! & ! & ! & ! & ! & ! & \\ \text{以} & 1 & 1 & 1 & 0 & 1 & 0 & 1 & -1 & = & 1 & 0 \\ & 0 & 1 & 0 & \frac{1}{2} & -1 & 1 & 1 & 1 & & 0 & 1 \end{array},$$

$$\begin{array}{ccccc|ccccc} \text{以} & 1 & -1 & = & 1 & 0 & 1 & 0 & 1 & -1 \\ & 1 & 1 & & 1 & 1 & 0 & 2 & 0 & 1 \end{array}.$$

5.(2)) 因为

$$\begin{array}{ccc|c} O & 1 & 1 & 1 \\ B & 0 & 1 & 1 \\ @ & 0 & 1 & 1 \end{array} \xrightarrow{\substack{\text{第3行乘}(-1)\text{加到第2行} \\ \text{第3行乘}(-1)\text{加到第1行}}} \begin{array}{ccc|c} O & 1 & 0 & 1 \\ B & 0 & 1 & 0 \\ @ & 0 & 1 & 0 \end{array},$$

第2行乘(-1)加到第1行

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc|cc} & & & & & & & & \\ \text{以} & 1 & 1 & 1 & 0 & 1 & 0 & 1 & -1 & = & 1 & 0 \\ & 0 & 1 & 0 & \frac{1}{2} & -1 & 1 & 1 & 1 & & 0 & 1 \end{array},$$

$$\begin{array}{ccccc|ccccc} \text{以} & 1 & -1 & = & 1 & 0 & 1 & 0 & 1 & -1 \\ & 1 & 1 & & 1 & 1 & 0 & 2 & 0 & 1 \end{array}.$$

5.(2)) 因为

$$\begin{array}{ccc|c} \textcircled{O} & 1 & 1 & 1 \\ \textcircled{B} & 0 & 1 & 1 \\ @0 & & & \textcircled{C} \end{array} \xrightarrow{\substack{\text{第3行乘}(-1) \text{加到第2行} \\ \text{第3行乘}(-1) \text{加到第1行}}} \begin{array}{ccc|c} \textcircled{O} & 1 & 0 & 1 \\ \textcircled{B} & 0 & 1 & 0 \\ @0 & & & \textcircled{C} \end{array}, \quad \text{以}$$

$$\begin{array}{ccc|c} 0 & 0 & 1 & \\ & & & \xrightarrow{\substack{\text{第2行乘}(-1) \text{加到第1行}}} \\ 0 & 0 & 1 & \end{array}$$

$$\begin{array}{cccccc|cccccc|cccccc} \textcircled{O} & 1 & -1 & 0 & 1 & \textcircled{O} & 1 & 0 & -1 & 1 & \textcircled{O} & 1 & 0 & 1 & \textcircled{O} & 1 & 0 & 0 \\ \textcircled{B} & 0 & 1 & 0 & \textcircled{C} & \textcircled{B} & 0 & 1 & 0 & \textcircled{C} & \textcircled{B} & 0 & 1 & -1 & \textcircled{C} & \textcircled{B} & 0 & 1 \\ @0 & & & & @0 & & & & @0 & & & @0 & & & @0 & & & @0 \\ 0 & 0 & 1 & & 0 & 0 & 1 & & 0 & 0 & 1 & & 0 & 0 & 1 & & 0 & 0 & 1 \end{array} = \begin{array}{cccccc|cccccc|cccccc} \textcircled{B} & 1 & 0 & 0 & 1 & \textcircled{C} & 1 & 1 & 1 & 1 & \textcircled{A} & 1 & 0 & 0 & 1 \\ @0 & 1 & 0 & 0 & 1 & @0 & 1 & 1 & 1 & 1 & @0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & & 0 & 0 & 1 & & 0 & 0 & 1 & & 0 & 0 & 1 & & 0 & 0 & 1 \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} O \\ @ \\ B \\ @ \\ 0 \end{matrix} = \begin{matrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{matrix} \text{ 为 } \begin{matrix} O \\ @ \\ C \\ @ \\ 0 \end{matrix} = \begin{matrix} 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \end{matrix}.$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} O \\ B \\ @ \\ 0 \end{matrix} = \begin{matrix} O \\ B \\ @ \\ 0 \end{matrix} \text{ 为 } \begin{matrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{matrix} \text{ 的逆矩阵.}$$

$$\begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix} \quad \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix} \quad \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

6.)

习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} & O \\ B & 1 & 1 & 1 \\ @ & 0 & 1 & 1 \end{matrix} C = \begin{matrix} & O \\ B & 1 & 0 & 0 \\ @ & 0 & 1 & 1 \end{matrix} C \begin{matrix} & O \\ B & 1 & 0 & 1 \\ @ & 0 & 1 & 0 \end{matrix} C \begin{matrix} & O \\ B & 1 & 1 & 0 \\ @ & 0 & 1 & 0 \end{matrix} C.$$

$$\begin{matrix} & 0 & 0 & 1 \\ & 0 & 0 & 1 \\ & 0 & 0 & 1 \end{matrix}$$

6.) 因为 !

$$\begin{matrix} 1 & 2 & 1 & 0 \\ 3 & 4 & 0 & 1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} O \\ B \\ \text{以} \\ @ \\ 0 \end{matrix} \begin{matrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \\ @ & 0 & 1 \\ 1 & 0 & 1 \end{matrix} = \begin{matrix} O \\ B \\ C \\ @ \\ 0 \end{matrix} \begin{matrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \\ @ & 0 & 1 \\ 0 & 1 & 0 \end{matrix} \begin{matrix} O \\ B \\ C \\ @ \\ 0 \end{matrix} \begin{matrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ @ & 0 & 1 \\ 0 & 1 & 0 \end{matrix}.$$

$$\begin{matrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

6.) 因为 !

$$\begin{matrix} 1 & 2 & 1 & 0 \\ 3 & 4 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}}$$





习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} O \\ B \\ \hline 1 & 1 & 1 \\ @0 & 1 & 1 \end{matrix} C = \begin{matrix} O \\ B \\ \hline 1 & 0 & 0 \\ @0 & 1 & 1 \end{matrix} C B = \begin{matrix} 1 & O \\ B \\ \hline 0 & 1 & 0 \\ @0 & 1 & 0 \end{matrix} C B = \begin{matrix} 1 & O \\ B \\ \hline 1 & 1 & 0 \\ @0 & 1 & 0 \end{matrix} C.$$

$$\begin{matrix} 0 & 0 & 1 \\ & 0 & 0 & 1 \\ & 0 & 0 & 1 \end{matrix}$$

6.) 因为 !

$$\begin{matrix} 1 & 2 & 1 & 0 \\ 3 & 4 & 0 & 1 \end{matrix} \xrightarrow{\substack{\text{初等行变换} \\ | \\ -1}} \begin{matrix} 1 & 0 & -2 & 1 \\ 0 & 1 & \frac{3}{2} & -\frac{1}{2} \end{matrix},$$

$$\text{以 } A^{-1} = \begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix}^{-1} = \begin{matrix} -2 & 1 \\ \frac{3}{2} & -\frac{1}{2} \end{matrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} & O \\ B & 1 & 1 & 1 \\ @ & 0 & 1 & 1 \end{matrix} \begin{matrix} & O \\ C & 1 & 0 & 0 \\ @ & 0 & 1 & 1 \end{matrix} = \begin{matrix} & O \\ B & 1 & 1 & 1 \\ @ & 0 & 1 & 1 \end{matrix} \begin{matrix} & O \\ C & 1 & 0 & 0 \\ @ & 0 & 1 & 0 \end{matrix} \begin{matrix} & O \\ B & 1 & 1 & 1 \\ @ & 0 & 1 & 0 \end{matrix}.$$

$$\begin{matrix} & 0 & 0 & 1 \\ & 0 & 0 & 1 \\ & 0 & 0 & 1 \end{matrix}$$

6.) 因为 !

$$\begin{matrix} 1 & 2 & 1 & 0 \\ 3 & 4 & 0 & 1 \end{matrix} \xrightarrow{\substack{\text{初等行变换} \\ | \\ -1}} \begin{matrix} 1 & 0 & -2 & 1 \\ 0 & 1 & \frac{3}{2} & -\frac{1}{2} \end{matrix},$$

$$\text{以 } A^{-1} = \begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix}^{-1} = \begin{matrix} -2 & 1 \\ \frac{3}{2} & -\frac{1}{2} \end{matrix};$$

$$\begin{matrix} 1 & 3 & 1 & 0 \end{matrix}$$

$$\begin{matrix} 2 & 4 & 0 & 1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} O \\ B \\ \hline 1 & 1 & 1 \\ @0 & 1 & 1 \end{matrix} C = \begin{matrix} O \\ B \\ \hline 1 & 0 & 0 \\ @0 & 1 & 1 \end{matrix} C B = \begin{matrix} 1 & O \\ B \\ \hline 0 & 1 & 0 \\ @0 & 1 & 0 \end{matrix} C B = \begin{matrix} 1 & O \\ B \\ \hline 1 & 1 & 0 \\ @0 & 1 & 0 \end{matrix} C.$$

$$\begin{matrix} 0 & 0 & 1 \\ & 0 & 0 & 1 \\ & 0 & 0 & 1 \end{matrix}$$

6.) 因为 !

$$\begin{matrix} 1 & 2 & 1 & 0 \\ 3 & 4 & 0 & 1 \end{matrix} \xrightarrow{\substack{\text{初等行变换} \\ | \\ -1}} \begin{matrix} 1 & 0 & -2 & 1 \\ 0 & 1 & \frac{3}{2} & -\frac{1}{2} \end{matrix},$$

$$\text{以 } A^{-1} = \begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix} = \begin{matrix} -2 & 1 \\ \frac{3}{2} & -\frac{1}{2} \end{matrix};$$

$$\begin{matrix} 1 & 3 & 1 & 0 \end{matrix} \xrightarrow{\text{初等行变换}}$$

$$\begin{matrix} 2 & 4 & 0 & 1 \end{matrix} \longrightarrow$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} & O & & 1 & & O & & 1 & O & & 1 & O & & 1 \\ B & 1 & 1 & 1 & B & 1 & 0 & 0 & B & 1 & 0 & 1 & B & 1 & 1 & 0 \\ @0 & 0 & 1 & 1 & @0 & 1 & 1 & 1 & @0 & 1 & 0 & 0 & @0 & 1 & 1 & 0 \end{matrix} A = \begin{matrix} & O & & 1 & & O & & 1 & O & & 1 & O & & 1 \\ B & 1 & 1 & 1 & B & 1 & 0 & 0 & B & 1 & 0 & 1 & B & 1 & 1 & 0 \\ @0 & 0 & 1 & 1 & @0 & 1 & 1 & 1 & @0 & 1 & 0 & 0 & @0 & 1 & 1 & 0 \end{matrix}.$$

$$\begin{matrix} 0 & 0 & 1 & & 0 & 0 & 1 & & 0 & 0 & 1 & & 0 & 0 & 1 \end{matrix}$$

6.) 因为 !

$$\begin{matrix} 1 & 2 & 1 & 0 & & 1 & 0 & -2 & 1 \\ 3 & 4 & 0 & 1 & \xrightarrow{\substack{! \\ -1}} & 0 & 1 & \frac{3}{2} & -\frac{1}{2} \end{matrix},$$

$$\text{以 } A^{-1} = \begin{matrix} 1 & 2 & & -2 & 1 \\ 3 & 4 & & \frac{3}{2} & -\frac{1}{2} \end{matrix};$$

$$\begin{matrix} 1 & 3 & 1 & 0 & & 1 & 0 & -2 & \frac{3}{2} \\ 2 & 4 & 0 & 1 & \xrightarrow{\substack{! \\ -1}} & 0 & 1 & 1 & -\frac{1}{2} \end{matrix},$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} O \\ B \\ \hline 1 & 1 & 1 \\ @0 & 1 & 1 \end{matrix} C = \begin{matrix} O \\ B \\ \hline 1 & 0 & 0 \\ @0 & 1 & 1 \end{matrix} C B = \begin{matrix} 1 & O \\ 0 & 1 \\ \hline 1 & 0 \\ @0 & 1 \end{matrix} C B = \begin{matrix} 1 & O \\ 1 & 1 \\ \hline 1 & 0 \\ @0 & 1 \end{matrix} C.$$

$$\begin{matrix} 0 & 0 & 1 \\ & 0 & 0 & 1 \\ & 0 & 0 & 1 \end{matrix}$$

6.) 因为 !

$$\begin{matrix} 1 & 2 & 1 & 0 \\ 3 & 4 & 0 & 1 \end{matrix} \xrightarrow{\substack{! \\ -1}} \begin{matrix} 1 & 0 & -2 & 1 \\ 0 & 1 & \frac{3}{2} & -\frac{1}{2} \end{matrix},$$

$$\text{以 } A^{-1} = \begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix} = \begin{matrix} -2 & 1 \\ \frac{3}{2} & -\frac{1}{2} \end{matrix};$$

$$\begin{matrix} 1 & 3 & 1 & 0 \\ 2 & 4 & 0 & 1 \end{matrix} \xrightarrow{\substack{! \\ -1}} \begin{matrix} 1 & 0 & -2 & \frac{3}{2} \\ 0 & 1 & 1 & -\frac{1}{2} \end{matrix},$$

$$\text{以 } B^{-1} = \begin{matrix} 1 & 3 \\ 2 & 4 \end{matrix} = \begin{matrix} -2 & \frac{3}{2} \\ 1 & -\frac{1}{2} \end{matrix};$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} O \\ B \\ \hline 1 & 1 & 1 \\ @0 & 1 & 1 \end{matrix} C = \begin{matrix} O \\ B \\ \hline 1 & 0 & 0 \\ @0 & 1 & 1 \end{matrix} C B = \begin{matrix} 1 & O \\ 0 & 1 \\ \hline 1 & 0 \\ @0 & 1 \end{matrix} C B = \begin{matrix} 1 & O \\ 1 & 1 \\ \hline 1 & 0 \\ @0 & 1 \end{matrix} C.$$

$$\begin{matrix} 0 & 0 & 1 \\ & 0 & 0 & 1 \\ & 0 & 0 & 1 \end{matrix}$$

6.) 因为 !

$$\begin{matrix} 1 & 2 & 1 & 0 \\ 3 & 4 & 0 & 1 \end{matrix} \xrightarrow{\substack{! \\ -1}} \begin{matrix} 1 & 0 & -2 & 1 \\ 0 & 1 & \frac{3}{2} & -\frac{1}{2} \end{matrix},$$

$$\text{以 } A^{-1} = \begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix} = \begin{matrix} -2 & 1 \\ \frac{3}{2} & -\frac{1}{2} \end{matrix};$$

$$\begin{matrix} 1 & 3 & 1 & 0 \\ 2 & 4 & 0 & 1 \end{matrix} \xrightarrow{\substack{! \\ -1}} \begin{matrix} 1 & 0 & -2 & \frac{3}{2} \\ 0 & 1 & 1 & -\frac{1}{2} \end{matrix},$$

$$\text{以 } B^{-1} = \begin{matrix} 1 & 3 \\ 2 & 4 \end{matrix} = \begin{matrix} -2 & \frac{3}{2} \\ 1 & -\frac{1}{2} \end{matrix};$$

$$A^T = B; B^{-1} = (A^{-1})^T;$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } \begin{matrix} O \\ B \\ \hline 1 & 1 & 1 \\ @0 & 1 & 1 \end{matrix} C = \begin{matrix} O \\ B \\ \hline 1 & 0 & 0 \\ @0 & 1 & 1 \end{matrix} C B = \begin{matrix} 1 & O \\ 0 & 1 \\ \hline 1 & 0 \\ @0 & 1 & 0 \end{matrix} C B = \begin{matrix} 1 & O \\ 1 & 1 \\ \hline 1 & 0 \\ @0 & 1 & 0 \end{matrix} C.$$

$$\begin{matrix} 0 & 0 & 1 \\ & 0 & 0 & 1 \\ & 0 & 0 & 1 \end{matrix}$$

6.) 因为 !

$$\begin{matrix} 1 & 2 & 1 & 0 \\ 3 & 4 & 0 & 1 \end{matrix} \xrightarrow{\substack{| \\ | \\ -1}} \begin{matrix} 1 & 0 & -2 & 1 \\ 0 & 1 & \frac{3}{2} & -\frac{1}{2} \end{matrix},$$

$$\text{以 } A^{-1} = \begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix} = \begin{matrix} -2 & 1 \\ \frac{3}{2} & -\frac{1}{2} \end{matrix};$$

$$\begin{matrix} 1 & 3 & 1 & 0 \\ 2 & 4 & 0 & 1 \end{matrix} \xrightarrow{\substack{| \\ | \\ -1}} \begin{matrix} 1 & 0 & -2 & \frac{3}{2} \\ 0 & 1 & 1 & -\frac{1}{2} \end{matrix},$$

$$\text{以 } B^{-1} = \begin{matrix} 1 & 3 \\ 2 & 4 \end{matrix} = \begin{matrix} -2 & \frac{3}{2} \\ 1 & -\frac{1}{2} \end{matrix};$$

$$A^T = B; B^{-1} = (A^{-1})^T; (A^T)^{-1} = (A^{-1})^T.$$

习题1.4( $P_{39} - P_{41}$ )

因为  $A + B = \begin{matrix} & ! \\ \begin{matrix} 2 & 5 \\ 5 & 8 \end{matrix} & , \end{matrix}$



习题1.4( $P_{39} - P_{41}$ )

因为  $A + B = \begin{matrix} & & ! \\ & 2 & 5 \\ 5 & & 8 \end{matrix}$ ,

$$\text{而 } \begin{matrix} 2 & 5 & 1 & 0 \\ 5 & 8 & 0 & 1 \end{matrix}$$

习题1.4( $P_{39} - P_{41}$ )

因为  $A + B = \begin{matrix} & & ! \\ 2 & 5 \\ 5 & 8 \end{matrix}$ ,

而  $\begin{matrix} 2 & 5 & 1 & 0 \\ 5 & 8 & 0 & 1 \end{matrix}$  初等行变换  $\longrightarrow$



习题1.4( $P_{39} - P_{41}$ )

因为  $A + B = \begin{matrix} & 2 & 5 \\ & 5 & 8 \end{matrix}$ ,

$$\text{而 } \begin{matrix} 2 & 5 & 1 & 0 \\ 5 & 8 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & -\frac{8}{9} & \frac{5}{9} \\ 0 & 1 & \frac{5}{9} & -\frac{2}{9} \end{matrix},$$



习题1.4( $P_{39} - P_{41}$ )

因为  $A + B = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix}$ ,

而  $\begin{matrix} 2 & 5 & 1 & 0 \\ 5 & 8 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & -\frac{8}{9} & \frac{5}{9} \\ 0 & 1 & \frac{5}{9} & -\frac{2}{9} \end{matrix}$ ,

以  $(A + B)^{-1} = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix}^{-1} = \begin{vmatrix} -\frac{8}{9} & \frac{5}{9} \\ \frac{5}{9} & -\frac{2}{9} \end{vmatrix}$ ;



习题1.4( $P_{39} - P_{41}$ )

因为  $A + B = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix}$ ,

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以  $(A + B)^{-1} = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix}^{-1} = \begin{pmatrix} -\frac{8}{9} & \frac{5}{9} \\ \frac{5}{9} & -\frac{2}{9} \end{pmatrix}$ ;

因为  $AB = \begin{vmatrix} 5 & 11 \\ 11 & 25 \end{vmatrix}$ ,

习题1.4( $P_{39} - P_{41}$ )

因为  $A + B = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix}$ ,

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因为  $AB = \begin{vmatrix} 5 & 11 \\ 11 & 25 \end{vmatrix}$ ,

而  $\begin{matrix} 5 & 11 & 1 & 0 \\ 11 & 25 & 0 & 1 \end{matrix}$

### 习题1.4( $P_{39} - P_{41}$ )

$$\text{因为 } A + B = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix},$$

$$\text{而 } \begin{matrix} 2 & 5 & 1 & 0 \\ 5 & 8 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & -\frac{8}{9} & \frac{5}{9} \\ 0 & 1 & \frac{5}{9} & -\frac{2}{9} \end{matrix},$$

$$\text{以 } (A+B)^{-1} = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix}^{-1} = \begin{vmatrix} -\frac{8}{9} & \frac{5}{9} \\ \frac{5}{9} & -\frac{2}{9} \end{vmatrix};$$

$$\text{因为 } AB = \begin{matrix} 5 & 11 \\ 11 & 25 \end{matrix},$$

$$\text{而} \quad \begin{matrix} 5 & 11 & 1 & 0 \\ 11 & 25 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}}$$



习题1.4( $P_{39} - P_{41}$ )

因为  $A + B = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix}$ ,

而  $\begin{matrix} 2 & 5 & 1 & 0 \\ 5 & 8 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & -\frac{8}{9} & \frac{5}{9} \\ 0 & 1 & \frac{5}{9} & -\frac{2}{9} \end{matrix}$ ,

$$\text{以 } (A + B)^{-1} = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix}^{-1} = \begin{pmatrix} -\frac{8}{9} & \frac{5}{9} \\ \frac{5}{9} & -\frac{2}{9} \end{pmatrix};$$

因为  $AB = \begin{vmatrix} 5 & 11 \\ 11 & 25 \end{vmatrix}$ ,

而  $\begin{matrix} 5 & 11 & 1 & 0 \\ 11 & 25 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & \frac{25}{4} & -\frac{11}{4} \\ 0 & 1 & -\frac{11}{4} & \frac{5}{4} \end{matrix}$ ,

### 习题1.4( $P_{39} - P_{41}$ )

$$\text{因为 } A + B = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix},$$

$$\text{而 } \begin{matrix} 2 & 5 & 1 & 0 \\ 5 & 8 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & -\frac{8}{9} & \frac{5}{9} \\ 0 & 1 & \frac{5}{9} & -\frac{2}{9} \end{matrix},$$

$$\text{以 } (A+B)^{-1} = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix}^{-1} = \begin{vmatrix} -\frac{8}{9} & \frac{5}{9} \\ \frac{5}{9} & -\frac{2}{9} \end{vmatrix};$$

$$\text{因为 } AB = \begin{pmatrix} 5 & 11 \\ 11 & 25 \end{pmatrix},$$

$$\text{而 } \begin{matrix} 5 & 11 & 1 & 0 \\ 11 & 25 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & \frac{25}{4} & -\frac{11}{4} \\ 0 & 1 & -\frac{11}{4} & \frac{5}{4} \end{matrix},$$

$$\text{以 } (AB)^{-1} = \begin{vmatrix} 5 & 11 \\ 11 & 25 \end{vmatrix}^{-1} = \frac{1}{25-121} \begin{pmatrix} 25 & -11 \\ -11 & 5 \end{pmatrix}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$\text{因为 } A + B = \begin{pmatrix} 2 & 5 \\ 5 & 8 \end{pmatrix},$$

$$\text{而 } \begin{matrix} 2 & 5 & 1 & 0 \\ 5 & 8 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & -\frac{8}{9} & \frac{5}{9} \\ 0 & 1 & \frac{5}{9} & -\frac{2}{9} \end{matrix},$$

$$\text{以 } (A+B)^{-1} = \begin{vmatrix} 2 & 5 \\ 5 & 8 \end{vmatrix}^{-1} = \begin{vmatrix} -\frac{8}{9} & \frac{5}{9} \\ \frac{5}{9} & -\frac{2}{9} \end{vmatrix};$$

$$\text{因为 } AB = \begin{pmatrix} 5 & 11 \\ 11 & 25 \end{pmatrix},$$

$$\text{而 } \begin{matrix} 5 & 11 & 1 & 0 \\ 11 & 25 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & \frac{25}{4} & -\frac{11}{4} \\ 0 & 1 & -\frac{11}{4} & \frac{5}{4} \end{matrix},$$

$$\text{以 } (AB)^{-1} = \begin{vmatrix} 5 & 11 \\ 11 & 25 \end{vmatrix}^{-1} = \begin{vmatrix} \frac{25}{4} & -\frac{11}{4} \\ -\frac{11}{4} & \frac{5}{4} \end{vmatrix} = B^{-1}A^{-1}.$$



习题1.4( $P_{39} - P_{41}$ )

7.(1))



习题1.4( $P_{39} - P_{41}$ )

7.(1)) 构作 $\bar{Y}$ 阵  $A \quad B = \begin{matrix} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{matrix}^!$ ,





习题1.4( $P_{39} - P_{41}$ )

7.(1)) 构作 $\bar{Y}$ 阵  $A \quad B = \begin{matrix} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{matrix}^!$ , 对其? 行初等

行变换, 将其左侧化为单位 $\bar{Y}$ 阵, 其右侧即为 $A^{-1}B$ .

$$\begin{matrix} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{matrix}^!$$



习题1.4( $P_{39} - P_{41}$ )

7.(1)) 构作 $\bar{Y}$ 阵  $A \quad B = \begin{matrix} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{matrix}^!$ , 对其? 行初等

行变换, 将其左侧化为单位 $\bar{Y}$ 阵,  $\nwarrow$ 其右侧即为 $A^{-1}B$ .

$$\begin{matrix} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{matrix}^! \quad \text{初等行变换} \quad \begin{matrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 5 & -4 \end{matrix}^!$$



习题1.4( $P_{39} - P_{41}$ )

7.(1)) 构作 $\bar{Y}$ 阵  $A \quad B = \begin{array}{cccc|c} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{array}$ , 对其? 行初等

行变换, 将其左侧化为单位 $\bar{Y}$ 阵, 其右侧即为 $A^{-1}B$ .

$$\begin{array}{cccc|c} 4 & 1 & 5 & 4 & \text{初等行变换} \\ 6 & 1 & 5 & 8 & \longrightarrow \\ \hline & & & & 1 & 0 & 0 & 2 \\ & & & & 0 & 1 & 5 & -4 \end{array}$$

以 $X = A^{-1}B = \begin{array}{cc|c} 0 & 2 \\ 5 & -4 \end{array}$ .

习题1.4( $P_{39} - P_{41}$ )

7.(1)) 构作 $\bar{Y}$ 阵  $A \quad B = \begin{array}{cccc|c} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{array}$ , 对其? 行初等

行变换, 将其左侧化为单位 $\bar{Y}$ 阵, 其右侧即为 $A^{-1}B$ .

$$\begin{array}{cccc|c} 4 & 1 & 5 & 4 & \text{初等行变换} \\ 6 & 1 & 5 & 8 & \longrightarrow \\ \hline & & & & 1 & 0 & 0 & 2 \\ & & & & 0 & 1 & 5 & -4 \end{array}$$

$$\text{以 } X = A^{-1}B = \begin{array}{cc|c} 0 & 2 \\ 5 & -4 \end{array}.$$

7.(2))

习题1.4( $P_{39} - P_{41}$ )

7.(1)) 构作 $\bar{Y}$ 阵  $A \quad B = \begin{matrix} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{matrix}^!$ , 对其? 行初等

行变换, 将其左侧化为单位 $\bar{Y}$ 阵,  $\nwarrow$ 其右侧即为  $A^{-1}B$ .

$$\begin{matrix} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{matrix}^! \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 5 & -4 \end{matrix}^!$$

$$\text{以 } X = A^{-1}B = \begin{matrix} 0 & 2 \\ 5 & -4 \end{matrix}^!.$$

7.(2)) 构作 $\bar{Y}$ 阵  $A \quad B = \begin{matrix} 1 & 1 & -1 & 1 \\ 0 & 2 & -5 & 2 \\ 1 & 0 & 1 & 3 \end{matrix}^! \text{, }$

习题1.4( $P_{39} - P_{41}$ )

7.(1)) 构作 $\bar{Y}$ 阵  $A \quad B = \begin{matrix} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{matrix}^!$ , 对其? 行初等

行变换, 将其左侧化为单位 $\bar{Y}$ 阵,  $\leftarrow$ 其右侧即为 $A^{-1}B$ .

$$\begin{matrix} 4 & 1 & 5 & 4 \\ 6 & 1 & 5 & 8 \end{matrix}^! \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 5 & -4 \end{matrix}^!$$

$$\text{以 } X = A^{-1}B = \begin{matrix} 0 & 2 \\ 5 & -4 \end{matrix}^!.$$

7.(2)) 构作 $\bar{Y}$ 阵  $A \quad B = \begin{matrix} 1 & 1 & -1 & 1 \\ 0 & 2 & -5 & 2 \\ 1 & 0 & 1 & 3 \end{matrix}^! \text{, 对其? 行初}$

等行变换, 将其左侧化为单位 $\bar{Y}$ 阵,  $\leftarrow$ 其右侧即为 $A^{-1}B$ .

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccc|c} \textcircled{O} & 1 & 1 & -1 & 1 \\ \textcircled{B} & @0 & 2 & -5 & 2 \\ & 1 & 0 & 1 & 3 \end{array} \textcircled{A}$$



### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccc} \textcircled{O} & & 1 & & 1 \\ \textcircled{B} & 1 & 1 & -1 & 1 \\ @0 & 2 & -5 & 2 & C \\ \textcircled{A} & 0 & 1 & 1 & 3 \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{ccccc} \textcircled{O} & & 1 & & 1 \\ \textcircled{B} & 1 & 0 & 0 & 9 \\ @0 & 1 & 0 & -14 & C \\ \textcircled{A} & 0 & 0 & 1 & -6 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccc|c} \textcircled{O} & 1 & 1 & -1 & 1 \\ \textcircled{B} & @0 & 2 & -5 & 2 \\ \textcircled{C} & & & & A \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{cccc|c} \textcircled{O} & 1 & 0 & 0 & 1 \\ \textcircled{B} & @0 & 1 & 0 & -14 \\ \textcircled{C} & & & & A \end{array}$$

$$\begin{array}{cccc|c} 1 & 0 & 1 & 3 \\ & & & \end{array} \quad \begin{array}{cccc|c} 0 & 0 & 1 & -6 \\ & & & \end{array}$$

以  $X = A^{-1}$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccc|c} \textcircled{O} & 1 & 1 & -1 & 1 \\ \textcircled{B} & @0 & 2 & -5 & 2 \\ \textcircled{C} & & & & A \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{cccc|c} \textcircled{O} & 1 & 0 & 0 & 1 \\ \textcircled{B} & @0 & 1 & 0 & -14 \\ \textcircled{C} & & & & A \end{array}$$

$$\begin{array}{cccc|c} 1 & 0 & 1 & 3 \\ & & & \\ \textcircled{O} & & & 1 \\ & & & 9 \\ & & & -6 \end{array}$$

以  $X = A^{-1}B = \begin{matrix} \textcircled{B} \\ @-14 \\ \textcircled{C} \end{matrix}$ .

7.(3))

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccc|c} \textcircled{O} & 1 & 1 & -1 & 1 \\ \textcircled{B} & @0 & 2 & -5 & 2 \\ \textcircled{C} & & & & A \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{cccc|c} \textcircled{O} & 1 & 0 & 0 & 1 \\ \textcircled{B} & @0 & 1 & 0 & -14 \\ \textcircled{C} & & & & A \end{array}$$

$$\begin{array}{cccc|c} 1 & 0 & 1 & 3 & \\ \hline \textcircled{O} & 1 & & & \\ & 9 & & & \\ \textcircled{B} & @-14 & & & \\ \textcircled{C} & & & & A \end{array}$$

以  $X = A^{-1}B = \begin{array}{c} 1 \\ 9 \\ -14 \end{array}$

$$\begin{array}{c} \\ -6 \end{array}$$

7.(3)) 构作 $\check{Y}$ 阵

$$A \quad \textcolor{red}{B} = \begin{array}{ccccc|c} \textcircled{O} & 1 & -2 & 0 & -1 & 4 & 1 \\ \textcircled{B} & 4 & -2 & -1 & 2 & 5 & \\ \textcircled{C} & & & & & & A \end{array};$$

$$\begin{array}{ccccc} -3 & 1 & 2 & 1 & -3 \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccc|c} \textcircled{O} & 1 & 1 & -1 & 1 \\ \textcircled{B} & @0 & 2 & -5 & 2 \\ \textcircled{C} & & & & A \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{cccc|c} \textcircled{O} & 1 & 0 & 0 & 1 \\ \textcircled{B} & @0 & 1 & 0 & -14 \\ \textcircled{C} & & & & A \end{array}$$

$$\begin{array}{cccc|c} 1 & 0 & 1 & 3 & \\ \hline \textcircled{O} & 1 & & & \\ & 9 & & & \\ \hline \end{array}$$

以  $X = A^{-1}B = \begin{array}{c} \textcircled{B} \\ @-14 \\ \textcircled{A} \end{array}$ .

$\begin{matrix} -6 \\ -6 \end{matrix}$

7.(3)) 构作 $\mathbf{\bar{Y}}$ 阵

$$A \quad \textcircled{B} = \begin{array}{ccccc|c} \textcircled{O} & 1 & -2 & 0 & -1 & 4 & 1 \\ \textcircled{B} & @4 & -2 & -1 & 2 & 5 & A \\ \textcircled{C} & & & & & & \end{array};$$

$$\begin{array}{ccccc} -3 & 1 & 2 & 1 & -3 \end{array}$$

初等行变换化其左侧为单位 $\mathbf{\bar{Y}}$ 阵，其右侧即为 $A^{-1}B$ .



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc} \textcircled{O} & 1 & -2 & 0 & -1 & 4 & 1 \\ \textcircled{B} & @ & 4 & -2 & -1 & 2 & 5 \\ @ & -3 & 1 & 2 & 1 & -3 & \textcircled{A} \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc}
 \textcircled{O} & 1 & -2 & 0 & -1 & 4 & 1 \\
 \textcircled{B} & @4 & -2 & -1 & 2 & 5 & \textcircled{C} \\
 @ & -3 & 1 & 2 & 1 & -3 & 
 \end{array}
 \xrightarrow{\text{初等行变换}}
 \begin{array}{cccccc}
 \textcircled{O} & 1 & 0 & 0 & \frac{13}{7} & \frac{54}{7} & 1 \\
 \textcircled{B} & @0 & 1 & 0 & \frac{10}{7} & \frac{13}{7} & \textcircled{C} \\
 @ & 0 & 0 & 1 & \frac{18}{7} & -\frac{1}{7} & 
 \end{array}
 ;$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{cccccc|c} \textcircled{O} & 1 & -2 & 0 & -1 & 4 & 1 \\ \textcircled{B} & @4 & -2 & -1 & 2 & 5 & \\ \textcircled{C} & @-3 & 1 & 2 & 1 & -3 & \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{cccccc|c} \textcircled{O} & 1 & 0 & 0 & \frac{13}{7} & \frac{54}{7} & 1 \\ \textcircled{B} & @0 & 1 & 0 & \frac{10}{7} & \frac{13}{7} & \\ \textcircled{C} & @0 & 0 & 1 & \frac{18}{7} & -\frac{1}{7} & \end{array};$$

$$\begin{array}{ccc|c} \textcircled{O} & \frac{13}{7} & \frac{54}{7} & 1 \\ \textcircled{B} & @\frac{10}{7} & \frac{13}{7} & \\ \textcircled{C} & @\frac{18}{7} & -\frac{1}{7} & \end{array}$$

以  $X = A^{-1}B =$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc}
\textcircled{O} & \begin{matrix} 1 & -2 & 0 & -1 & 4 & 1 \\ @4 & -2 & -1 & 2 & 5 & \end{matrix} & \textcircled{C} & \xrightarrow{\text{初等行变换}} & \textcircled{O} & \begin{matrix} 1 & 0 & 0 & \frac{13}{7} & \frac{54}{7} & 1 \\ @0 & 1 & 0 & \frac{10}{7} & \frac{13}{7} & \end{matrix} & \textcircled{C} \\
& \begin{matrix} -3 & 1 & 2 & 1 & -3 \end{matrix} & & \longrightarrow & & \begin{matrix} 0 & 0 & 1 & \frac{18}{7} & -\frac{1}{7} \end{matrix} & \\
\end{array}$$
  

$$\textcircled{O} \begin{matrix} \frac{13}{7} & \frac{54}{7} & 1 \\ @\frac{10}{7} & \frac{13}{7} & \end{matrix} \textcircled{C}$$

以  $X = A^{-1}B = \begin{matrix} \frac{13}{7} & \frac{54}{7} \\ @\frac{10}{7} & \frac{13}{7} \end{matrix} \textcircled{A}$  :

$$\begin{matrix} \frac{18}{7} & -\frac{1}{7} \end{matrix}$$

8.(1))

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc} \textcircled{O} & 1 & -2 & 0 & -1 & 4 & 1 \\ \textcircled{B} & @4 & -2 & -1 & 2 & 5 & \\ \textcircled{C} & @-3 & 1 & 2 & 1 & -3 & \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{ccccccccc} \textcircled{O} & 1 & 0 & 0 & \frac{13}{7} & \frac{54}{7} & 1 \\ \textcircled{B} & @0 & 1 & 0 & \frac{10}{7} & \frac{13}{7} & \\ \textcircled{C} & @0 & 0 & 1 & \frac{18}{7} & -\frac{1}{7} & \end{array};$$

$$\begin{array}{ccccccccc} \textcircled{O} & \frac{13}{7} & \frac{54}{7} & 1 \\ \textcircled{B} & @\frac{10}{7} & \frac{13}{7} & \\ \textcircled{C} & @\frac{18}{7} & -\frac{1}{7} & \end{array}$$

以  $X = A^{-1}B = \begin{array}{ccccccccc} \textcircled{O} & \frac{13}{7} & \frac{54}{7} & 1 \\ \textcircled{B} & @\frac{10}{7} & \frac{13}{7} & \\ \textcircled{C} & @\frac{18}{7} & -\frac{1}{7} & \end{array}$

8.(1)) 构作 $\bar{Y}$ 阵

$$A / = \begin{array}{ccccccccc} \textcircled{O} & 3 & -1 & 2 & 1 & 0 & 0 & 1 \\ \textcircled{B} & @1 & 0 & -1 & 0 & 1 & 0 & \\ \textcircled{C} & @-2 & 1 & 4 & 0 & 0 & 1 & \end{array};$$

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccccc} \textcircled{O} & 1 & -2 & 0 & -1 & 4 & 1 \\ \textcircled{B} & @4 & -2 & -1 & 2 & 5 & \\ \textcircled{C} & @-3 & 1 & 2 & 1 & -3 & \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{ccccccccc} \textcircled{O} & 1 & 0 & 0 & \frac{13}{7} & \frac{54}{7} & 1 \\ \textcircled{B} & @0 & 1 & 0 & \frac{10}{7} & \frac{13}{7} & \\ \textcircled{C} & @0 & 0 & 1 & \frac{18}{7} & -\frac{1}{7} & \end{array};$$

$$\textcircled{O} \quad \frac{13}{7} \quad \frac{54}{7} \\ \textcircled{B} \quad @\frac{10}{7} \quad \frac{13}{7} \\ \textcircled{C} \quad @\frac{18}{7} \quad -\frac{1}{7}$$

以  $X = A^{-1}B = \textcircled{B} \textcircled{C}$ :

8.(1)) 构作 $\bar{Y}$ 阵

$$A / = \begin{array}{ccccccccc} \textcircled{O} & 3 & -1 & 2 & 1 & 0 & 0 & 1 \\ \textcircled{B} & @1 & 0 & -1 & 0 & 1 & 0 & \\ \textcircled{C} & @-2 & 1 & 4 & 0 & 0 & 1 & \end{array};$$

初等行变换化左侧为单位 $\bar{Y}$ 阵，右侧为 $A^{-1}$ .





### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc} \textcircled{O} & 3 & -1 & 2 & 1 & 0 & 0 \\ \textcircled{B} & @ 1 & 0 & -1 & 0 & 1 & 0 \\ & -2 & 1 & 4 & 0 & 0 & 1 \end{array} \xrightarrow{\substack{\text{初等行变换}}} \textcircled{A}$$

$$\begin{array}{ccccccc} \textcircled{O} & 1 & 0 & 0 & \frac{1}{7} & \frac{6}{7} & \frac{1}{7} \\ \textcircled{B} @ 0 & 1 & 0 & -\frac{2}{7} & \frac{16}{7} & \frac{5}{7} \textcircled{C} ; \\ & 0 & 0 & 1 & \frac{1}{7} & -\frac{1}{7} & \frac{1}{7} \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc} \textcircled{O} & 3 & -1 & 2 & \textcolor{red}{1} & 0 & 0 \\ \textcircled{B} & @1 & 0 & -1 & \textcolor{red}{0} & 1 & 0 \\ & -2 & 1 & 4 & \textcolor{red}{0} & 0 & 1 \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{ccccccc} \textcircled{O} & 1 & 0 & 0 & \frac{1}{7} & \frac{6}{7} & \frac{1}{7} \\ \textcircled{B} & @0 & 1 & 0 & -\frac{2}{7} & 1 & \frac{16}{7} \\ & 0 & 0 & 1 & \frac{1}{7} & -\frac{1}{7} & \frac{1}{7} \end{array};$$

$$\textcircled{O} \quad \frac{1}{7} \textcolor{red}{0}$$

以  $A^{-1} = \textcircled{B}$

$$\begin{matrix} \textcolor{red}{B} \\ \textcolor{blue}{1} \end{matrix}$$

B

### 习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc} \textcircled{O} & 3 & -1 & 2 & 1 & 0 & 0 \\ \textcircled{B} & 1 & 0 & -1 & 0 & 1 & 0 \\ @ & 1 & 1 & 4 & 0 & 0 & 1 \end{array} \xrightarrow{\substack{\text{初等行变换}}} \begin{array}{ccccccc} & & & & & & 1 \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \end{array}$$

$$\begin{array}{cccccc} O & & & & & \\ \begin{matrix} 1 & 0 & 0 & \frac{1}{7} & \frac{6}{7} & \frac{1}{7} \end{matrix} \\ B @ 0 & 1 & 0 & -\frac{2}{7} & \frac{16}{7} & \frac{5}{7} \\ \begin{matrix} 0 & 0 & 1 & \frac{1}{7} & -\frac{1}{7} & \frac{1}{7} \end{matrix} \\ C \end{array}$$

$$\text{以 } A^{-1} = \begin{matrix} \textcircled{O} \\ \text{B} \\ \text{@} \end{matrix} \begin{matrix} \frac{1}{7} & \frac{6}{7} & \frac{1}{7} \\ -\frac{2}{7} & \frac{16}{7} & \frac{5}{7} \\ \frac{1}{7} & -\frac{1}{7} & \frac{1}{7} \end{matrix} \text{C,}$$

$$\text{以 } X = BA^{-1} = \begin{matrix} \frac{1}{7} & -\frac{8}{7} & \frac{57}{7} \\ -\frac{7}{7} & \frac{20}{7} & \frac{20}{7} \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc}
 \textcircled{O} & 3 & -1 & 2 & \textcolor{red}{1} & 0 & 0 \\
 \textcircled{B} & @ & 1 & 0 & -1 & \textcolor{red}{0} & \textcolor{red}{1} \\
 @ & & & & 0 & & 0 \\
 & -2 & 1 & 4 & \textcolor{red}{0} & 0 & 1
 \end{array}
 \xrightarrow{\text{初等行变换}}
 \begin{array}{cccccc}
 \textcircled{O} & 1 & 0 & 0 & & \textcolor{red}{1} \\
 \textcircled{B} & @ & & & & \\
 @ & & & & & \\
 & & & & & 
 \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

构成 $\bar{Y}$ 阵

$$\begin{matrix} & \begin{matrix} \textcircled{O} \\ 3 \\ 1 \\ -2 \\ @ \textcolor{red}{3} \end{matrix} & \begin{matrix} -1 \\ 0 \\ 1 \\ 0 \end{matrix} & \begin{matrix} 2 \\ -1 \\ 4 \\ -2 \end{matrix} & \begin{matrix} 1 \\ -1 \\ 4 \\ \textcolor{red}{1} \end{matrix} \\ \begin{matrix} A \\ B \end{matrix} & = & \begin{matrix} \textcircled{O} \\ 3 \\ 1 \\ -2 \\ @ \textcolor{red}{3} \end{matrix} & \begin{matrix} \textcircled{C} \\ 1 \\ 0 \\ 1 \\ \textcolor{red}{0} \end{matrix} & \begin{matrix} \textcircled{C} \\ -1 \\ 4 \\ -2 \\ \textcolor{red}{A} \end{matrix} \end{matrix}$$

习题1.4( $P_{39} - P_{41}$ )

$$\text{构成 } \bar{Y} \text{ 阵} \quad \begin{matrix} A \\ B \end{matrix} = \left[ \begin{array}{ccc|c} & 3 & -1 & 2 & 1 \\ & 1 & 0 & -1 & \\ \hline -2 & 1 & 4 & & \\ @ 3 & 0 & -2 & & \\ \hline & -1 & 4 & 1 & \end{array} \right]$$

初等列变换化上 为单位  $\bar{Y}$  阵, 下侧  $K$  为  $BA^{-1}$ .



习题1.4( $P_{39} - P_{41}$ )

$$\text{构成 } \bar{Y} \text{ 阵} \quad \begin{matrix} A \\ B \end{matrix} = \left[ \begin{array}{ccc|c} 3 & -1 & 2 & 1 \\ 1 & 0 & -1 & \\ -2 & 1 & 4 & \\ \hline 3 & 0 & -2 & \\ -1 & 4 & 1 & \end{array} \right]$$

初等列变换化上 为单位  $\bar{Y}$  阵, 下侧  $K$  为  $BA^{-1}$ .

$$\left[ \begin{array}{ccc|c} 3 & -1 & 2 & 1 \\ 1 & 0 & -1 & \\ -2 & 1 & 4 & \\ \hline 3 & 0 & -2 & \\ -1 & 4 & 1 & \end{array} \right]$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{构}\bar{\text{E}}\bar{\text{Y}}\text{阵 } \begin{matrix} A \\ B \end{matrix} = \begin{pmatrix} 3 & -1 & 2 & 1 \\ 1 & 0 & -1 & \\ -2 & 1 & 4 & \\ @ 3 & 0 & -2 & \end{pmatrix}$$

$$\begin{pmatrix} -1 & 4 & 1 \end{pmatrix}$$

初等列变换化上 为单位 $\bar{Y}$ 阵, 下侧 $K$ 为 $BA^{-1}$ .

$$\begin{pmatrix} 3 & -1 & 2 \\ 1 & 0 & -1 \\ -2 & 1 & 4 \\ @ 3 & 0 & -2 \end{pmatrix} \xrightarrow{\text{初等列变换}} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ @ \frac{1}{7} & \frac{20}{7} & \frac{1}{7} \end{pmatrix};$$

$$\begin{pmatrix} -1 & 4 & 1 \\ -\frac{8}{7} & \frac{57}{7} & \frac{20}{7} \end{pmatrix}$$



习题1.4( $P_{39} - P_{41}$ )

构成 $\bar{Y}$ 阵

$$\begin{array}{c} \text{!} \\ A \\ B \\ @ \end{array} = \left( \begin{array}{ccc} 3 & -1 & 2 \\ 1 & 0 & -1 \end{array} \right)$$

习题1.4( $P_{39} - P_{41}$ )

8.(2))



习题1.4( $P_{39} - P_{41}$ )

8.(2)) 先求 $A^{-1}$ 以及 $B^{-1}$ .



习题1.4( $P_{39} - P_{41}$ )

8.(2)) 先求 $A^{-1}$ 以及 $B^{-1}$ .

$$A \quad | \quad = \begin{array}{cccc} 1 & 3 & 1 & 0 \\ 2 & 5 & 0 & 1 \end{array} !$$

习题1.4( $P_{39} - P_{41}$ )

8.(2)) 先求 $A^{-1}$ 以及 $B^{-1}$ .

$$A \quad | \quad = \begin{array}{cccc|c} 1 & 3 & 1 & 0 \\ 2 & 5 & 0 & 1 \end{array} \quad \begin{matrix} \text{初等行变换} \\ \longrightarrow \end{matrix} \quad \begin{array}{cccc|c} 1 & 0 & -5 & 3 \\ 0 & 1 & 2 & -1 \end{array} \quad ;$$



习题1.4( $P_{39} - P_{41}$ )

8.(2)) 先求 $A^{-1}$ 以及 $B^{-1}$ .

$$A \begin{matrix} / \\ | \end{matrix} = \begin{array}{cccc|c} 1 & 3 & 1 & 0 \\ 2 & 5 & 0 & 1 \end{array} \quad \text{初等行变换} \quad \begin{array}{cccc|c} 1 & 0 & -5 & 3 \\ 0 & 1 & 2 & -1 \end{array} \quad ;$$

$$A^{-1} = \begin{matrix} / \\ | \end{matrix} \begin{array}{cc} -5 & 3 \\ 2 & -1 \end{array} .$$

习题1.4( $P_{39} - P_{41}$ )

8.(2)) 先求 $A^{-1}$



### 习题1.4( $P_{39} - P_{41}$ )

8.(2)) 先求 $A^{-1}$ 以及 $B^{-1}$ .

$$A \textcolor{red}{I} = \begin{matrix} 1 & 3 & 1 & 0 \\ 2 & 5 & 0 & 1 \end{matrix} \xrightarrow{\text{初等行变换}} \begin{matrix} 1 & 0 & -5 & 3 \\ 0 & 1 & 2 & -1 \end{matrix} \textcolor{red}{I}$$

$$A^{-1} = \begin{pmatrix} -5 & 3 \\ 2 & -1 \end{pmatrix}.$$

$$B \quad | \quad = \begin{array}{cccc|c} 1 & 0 & 1 & 0 \\ -1 & 1 & 0 & 1 \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{cccc|c} 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 \end{array} ;$$



习题1.4( $P_{39} - P_{41}$ )

8.(2)) 先求 $A^{-1}$ 以及 $B^{-1}$ .

$$A \begin{matrix} / \\ | \end{matrix} = \begin{array}{cccc|c} 1 & 3 & 1 & 0 \\ 2 & 5 & 0 & 1 \end{array} \quad \text{初等行变换} \quad \begin{array}{cccc|c} 1 & 0 & -5 & 3 \\ 0 & 1 & 2 & -1 \end{array} ;$$

$$A^{-1} = \begin{matrix} / \\ | \end{matrix} \begin{array}{cc|c} -5 & 3 \\ 2 & -1 \end{array} .$$

$$B \begin{matrix} / \\ | \end{matrix} = \begin{array}{cccc|c} 1 & 0 & 1 & 0 \\ -1 & 1 & 0 & 1 \end{array} \quad \text{初等行变换} \quad \begin{array}{cccc|c} 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 \end{array} ;$$

$$B^{-1} = \begin{matrix} / \\ | \end{matrix} \begin{array}{cc|c} 1 & 0 \\ 1 & 1 \end{array} .$$



习题1.4( $P_{39} - P_{41}$ )

以

$$X = A^{-1}CB^{-1} = \begin{vmatrix} -5 & 3 & 1 \\ 2 & -1 & 1 \end{vmatrix} \begin{vmatrix} 3 & 4 & 1 \\ 5 & 6 & 1 \end{vmatrix}^{-1} = \begin{vmatrix} -2 & -2 & 1 \\ 3 & 2 & \vdots \end{vmatrix}$$



习题1.4( $P_{39} - P_{41}$ )

以

$$X = A^{-1}CB^{-1} = \begin{vmatrix} -5 & 3 & 1 \\ 2 & -1 & 1 \\ 5 & 6 & 1 \end{vmatrix}^{-1} \begin{vmatrix} 3 & 4 & 1 \\ 5 & 6 & 1 \\ 1 & 1 & 1 \end{vmatrix}^{-1} = \begin{vmatrix} -2 & -2 & 1 \\ 3 & 2 & \vdots \end{vmatrix}$$

9.)



习题1.4( $P_{39} - P_{41}$ )

以

$$X = A^{-1}CB^{-1} = \begin{vmatrix} -5 & 3 & 1 \\ 2 & -1 & 5 \end{vmatrix} \begin{vmatrix} 3 & 4 & 1 \\ 6 & 1 & 1 \end{vmatrix}^{-1} = \begin{vmatrix} -2 & -2 & 1 \\ 3 & 2 & \vdots \end{vmatrix}$$

9.) 由 $AB = A + 2B$ , 得 $(A - 2I)B = A$ ,



习题1.4( $P_{39} - P_{41}$ )

以

$$X = A^{-1}CB^{-1} = \begin{vmatrix} -5 & 3 & 1 \\ 2 & -1 & 1 \end{vmatrix} \begin{vmatrix} 3 & 4 & 1 \\ 5 & 6 & 1 \end{vmatrix}^{-1} = \begin{vmatrix} -2 & -2 & 1 \\ 3 & 2 & \vdots \end{vmatrix}$$

9.) 由 $AB = A + 2B$ , 得 $(A - 2I)B = A$ , 若 $(A - 2I)$ 可逆,  $B = (A - 2I)^{-1}A$ .



习题1.4( $P_{39} - P_{41}$ )

以

$$X = A^{-1}CB^{-1} = \begin{vmatrix} -5 & 3 & 1 \\ 2 & -1 & 1 \end{vmatrix} \begin{vmatrix} 3 & 4 & 1 \\ 5 & 6 & 1 \end{vmatrix}^{-1} \begin{vmatrix} 1 & 0 & 1 \\ 1 & 1 & 1 \end{vmatrix}^{-1} = \begin{vmatrix} -2 & -2 & 1 \\ 3 & 2 & : \end{vmatrix}$$

9.) 由 $AB = A + 2B$ , 得 $(A - 2I)B = A$ , 若 $(A - 2I)$ 可逆,  $B = (A - 2I)^{-1}A$ .

构造Y阵

$$A - 2I \quad \textcolor{red}{A} = \begin{matrix} \textcircled{O} \\ \textcircled{B} \\ \textcircled{C} \end{matrix} \begin{matrix} 1 & 0 & 1 & 3 & 0 & 1 \\ 1 & -1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 2 & 0 & 1 & 4 \end{matrix};$$

习题1.4( $P_{39} - P_{41}$ )

以

$$X = A^{-1}CB^{-1} = \begin{vmatrix} -5 & 3 & 1 \\ 2 & -1 & 1 \end{vmatrix} \begin{vmatrix} 3 & 4 & 1 \\ 5 & 6 & 1 \end{vmatrix}^{-1} \begin{vmatrix} 1 & 0 & 1 \\ 1 & 1 & 1 \end{vmatrix}^{-1} = \begin{vmatrix} -2 & -2 & 1 \\ 3 & 2 & : \end{vmatrix}$$

9.) 由 $AB = A + 2B$ , 得 $(A - 2I)B = A$ , 若 $(A - 2I)$ 可逆,  $B = (A - 2I)^{-1}A$ .

构造Y阵

$$A - 2I \quad \textcolor{red}{A} = \begin{matrix} \textcircled{O} \\ \text{B} \\ \text{C} \end{matrix} @ \begin{matrix} 1 & 0 & 1 & \textcolor{red}{3} & 0 & 1 \\ 1 & -1 & 0 & \textcolor{red}{1} & 1 & 0 \\ 0 & 1 & 2 & \textcolor{red}{0} & 1 & 4 \end{matrix};$$

初等行变换化左侧为单位Y阵, 右侧即为 $(A - 2I)^{-1}A$ .

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc} \textcircled{O} & & & & & & 1 \\ \textcircled{B} & 1 & 0 & 1 & 3 & 0 & \textcolor{red}{1} \\ @1 & & & & & & \\ \textcircled{A} & -1 & 0 & 1 & 1 & 0 & \textcircled{C} \\ 0 & 1 & 2 & 0 & \textcolor{red}{1} & 4 & \end{array}$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc}
 \textcircled{O} & 1 & 0 & 1 & 3 & 0 & 1 & 1 \\
 \textcircled{B} & @1 & -1 & 0 & 1 & 1 & 0 & \textcircled{A} \\
 \textcircled{C} & 0 & 1 & 2 & 0 & 1 & 4
 \end{array}
 \xrightarrow{\text{初等行变换}}
 \begin{array}{ccccccc}
 \textcircled{O} & 1 & 0 & 0 & 5 & -2 & -2 & 1 \\
 \textcircled{B} & @0 & 1 & 0 & 4 & -3 & -2 & \textcircled{A} \\
 \textcircled{C} & 0 & 0 & 1 & -2 & 2 & 3
 \end{array};$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc|c} \textcircled{O} & 1 & 0 & 1 & 3 & 0 & 1 & 1 \\ \textcircled{B} & @1 & -1 & 0 & 1 & 1 & 0 & \textcircled{A} \\ \hline 0 & 1 & 2 & 0 & 1 & 4 & & \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{ccccccc|c} \textcircled{O} & 1 & 0 & 0 & 5 & -2 & -2 & 1 \\ \textcircled{B} & @0 & 1 & 0 & 4 & -3 & -2 & \textcircled{A} \\ \hline 0 & 0 & 1 & -2 & 2 & 3 & & \end{array};$$

$$\text{以 } B = (A - 2I)^{-1}A = \begin{array}{ccc|c} \textcircled{O} & 5 & -2 & -2 & 1 \\ \textcircled{B} & @4 & -3 & -2 & \textcircled{A} \\ \hline -2 & 2 & 3 & & \end{array}:$$



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc|c} \textcircled{O} & 1 & 0 & 1 & 3 & 0 & 1 & 1 \\ \textcircled{B} & @1 & -1 & 0 & 1 & 1 & 0 & \textcircled{A} \\ \hline 0 & 1 & 2 & 0 & 1 & 4 & & \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{ccccccc|c} \textcircled{O} & 1 & 0 & 0 & 5 & -2 & -2 & 1 \\ \textcircled{B} & @0 & 1 & 0 & 4 & -3 & -2 & \textcircled{A} \\ \hline 0 & 0 & 1 & -2 & 2 & 3 & & \end{array};$$

$$\text{以 } B = (A - 2I)^{-1}A = \begin{array}{ccc|c} \textcircled{O} & 5 & -2 & -2 & 1 \\ \textcircled{B} & @4 & -3 & -2 & \textcircled{A} \\ \hline -2 & 2 & 3 & & \end{array}:$$

10.)

习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc|c} \textcircled{O} & 1 & 0 & 1 & 3 & 0 & 1 & 1 \\ \textcircled{B} & @1 & -1 & 0 & 1 & 1 & 0 & \textcircled{A} \\ \hline 0 & 1 & 2 & 0 & 1 & 4 & & \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{ccccccc|c} \textcircled{O} & 1 & 0 & 0 & 5 & -2 & -2 & 1 \\ \textcircled{B} & @0 & 1 & 0 & 4 & -3 & -2 & \textcircled{A} \\ \hline 0 & 0 & 1 & -2 & 2 & 3 & & \end{array};$$

$$\text{以 } B = (A - 2I)^{-1}A = \begin{array}{ccc|c} \textcircled{O} & 5 & -2 & -2 & 1 \\ \textcircled{B} & @4 & -3 & -2 & \textcircled{A} \\ \hline -2 & 2 & 3 & & \end{array}:$$

10.) 由  $2A^{-1}B = B - 4I$ , 得  $A(B - 4I) = 2B$ ,

以  $A = 2B(B - 4I)^{-1}$ .



习题1.4( $P_{39} - P_{41}$ )

$$\begin{array}{ccccccc|c} \textcircled{O} & 1 & 0 & 1 & 3 & 0 & 1 & 1 \\ \textcircled{B} & @1 & -1 & 0 & 1 & 1 & 0 & \textcircled{A} \\ \hline 0 & 1 & 2 & 0 & 1 & 4 & & \end{array} \xrightarrow{\text{初等行变换}} \begin{array}{ccccccc|c} \textcircled{O} & 1 & 0 & 0 & 5 & -2 & -2 & 1 \\ \textcircled{B} & @0 & 1 & 0 & 4 & -3 & -2 & \textcircled{A} \\ \hline 0 & 0 & 1 & -2 & 2 & 3 & & \end{array};$$

$$\text{以 } B = (A - 2I)^{-1}A = \begin{array}{ccc|c} \textcircled{O} & 5 & -2 & -2 & 1 \\ \textcircled{B} & @4 & -3 & -2 & \textcircled{A} \\ \hline -2 & 2 & 3 & & \end{array}:$$

10.) 由  $2A^{-1}B = B - 4I$ , 得  $A(B - 4I) = 2B$ ,

以  $A = 2B(B - 4I)^{-1}$ .

$$\text{用行初等变换, 求 } (B - 4I)^{-1} = \begin{array}{ccc|c} \textcircled{O} & -\frac{1}{4} & \frac{1}{4} & 0 & 1 \\ \textcircled{B} & @-\frac{1}{8} & -\frac{3}{8} & 0 & \textcircled{A} \\ \hline 0 & 0 & -\frac{1}{2} & & \end{array}.$$

习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } A = 2B(B - 4I)^{-1} = \begin{matrix} \textcircled{O} & 0 & 2 & 0 & 1 \\ \textcircled{B} & @-1 & -1 & 0 & \textcircled{C} \\ 0 & 0 & -2 \end{matrix}.$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } A = 2B(B - 4I)^{-1} = \begin{matrix} \textcircled{O} & 0 & 2 & 0 & 1 \\ \textcircled{B} & @-1 & -1 & 0 & \textcircled{C} \\ 0 & 0 & -2 \end{matrix}.$$

11.)



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } A = 2B(B - 4I)^{-1} = \begin{matrix} O & 0 & 2 & 0 & 1 \\ B & @-1 & -1 & 0 & C \\ 0 & 0 & -2 & & \end{matrix}.$$

11.) 由  $AX + I = A^2 + X$ ,

得  $(A - I)X = A^2 - I = (A - I)(A + I)$ ,



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } A = 2B(B - 4I)^{-1} = \begin{matrix} \textcircled{O} & 0 & 2 & 0 \\ \textcircled{B} & @-1 & -1 & 0 \\ \textcircled{C} & 0 & 0 & -2 \end{matrix}.$$

11.) 由  $AX + I = A^2 + X$ ,

得  $(A - I)$

习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } A = 2B(B - 4I)^{-1} = \begin{matrix} \textcircled{O} & 0 & 2 & 0 \\ \textcircled{B} & @-1 & -1 & 0 \\ \textcircled{C} & 0 & 0 & -2 \end{matrix}.$$

11.) 由  $AX + I = A^2 + X$ ,

得  $(A - I)$

习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } A = 2B(B - 4I)^{-1} = \begin{matrix} \textcircled{O} & 0 & 2 & 0 \\ \textcircled{B} & @-1 & -1 & 0 \\ \textcircled{C} & 0 & 0 & -2 \end{matrix}.$$

11.) 由  $AX + I = A^2 + X$ ,

得  $(A - I)X = A^2 - I = (A - I)(A + I)$ , 若  $(A - I)$  可逆, 则  
两边同时左乘  $(A - I)^{-1}$ , 得  $X = A + I$ .

| 用矩阵的行初等变换, 可以验证  $A - I$  可逆,

$$\text{以 } X = A + I = \begin{matrix} \textcircled{O} & 2 & 0 & -1 \\ \textcircled{B} & @1 & 4 & 0 \\ \textcircled{C} & 0 & 2 & 2 \end{matrix}.$$



习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } A = 2B(B - 4I)^{-1} = \begin{matrix} \textcircled{O} & 0 & 2 & 0 \\ \textcircled{B} & @-1 & -1 & 0 \\ \textcircled{C} & 0 & 0 & -2 \end{matrix}.$$

11.) 由  $AX + I = A^2 + X$ ,

得  $(A - I)X = A^2 - I = (A - I)(A + I)$ ,

习题1.4( $P_{39} - P_{41}$ )

$$\text{以 } A = 2B(B - 4I)^{-1} = \begin{matrix} \textcircled{O} & 0 & 2 & 0 \\ \textcircled{B} & @-1 & -1 & 0 \\ \textcircled{C} & 0 & 0 & -2 \end{matrix}.$$

11.) 由  $AX + I = A^2 + X$ ,

得  $(A - I)X = A^2 - I = (A - I)(A + I)$ ,

习题1.4( $P_{39} - P_{41}$ )构造 $\text{Y}$ 阵

$$A \quad | \quad = \begin{array}{cccccc} \textcircled{a} & -1 & 1 & \textcolor{red}{1} & 0 & 0 & 1 \\ \textcircled{0} & 1 & 2 & 0 & 1 & 0 & \textcircled{A} \\ 1 & 0 & 3 & 0 & 0 & 1 \end{array}$$



习题1.4( $P_{39} - P_{41}$ )构造 $\text{Y}$ 阵

$$A \quad | \quad = \begin{matrix} \textcircled{O} \\ \text{B} \\ \text{@} \\ \text{C} \end{matrix} \begin{matrix} a & -1 & 1 & \textcolor{red}{1} & 0 & 0 & 1 \\ 0 & 1 & 2 & 0 & 1 & 0 \\ 1 & 0 & 3 & 0 & 0 & 1 \end{matrix} \begin{matrix} \\ \\ \text{A} \end{matrix}$$

对其? 行初等行变换, 从而可以得到 $A$ 可以化为单位 $\text{Y}$ 阵的条件以及 $A^{-1}$ .



习题1.4( $P_{39} - P_{41}$ )构造 $\text{Y}$ 阵

$$A \quad | \quad = \begin{matrix} \textcircled{O} \\ \textcircled{a} & -1 & 1 & \textcolor{red}{1} & 0 & 0 & 1 \\ \textcircled{B} @ 0 & 1 & 2 & 0 & 1 & 0 & \textcircled{C} \\ \textcircled{A} & 1 & 0 & 3 & 0 & 0 & 1 \end{matrix}$$

对其? 行初等行变换, 从而可以得到 $A$ 可以化为单位 $\text{Y}$ 阵的条件以及 $A^{-1}$ .

$$\begin{matrix} \textcircled{O} \\ \textcircled{a} & -1 & 1 & \textcolor{red}{1} & 0 & 0 & 1 \\ \textcircled{B} @ 0 & 1 & 2 & 0 & 1 & 0 & \textcircled{C} \\ \textcircled{A} & 1 & 0 & 3 & 0 & 0 & 1 \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )构造 $\text{Y}$ 阵

$$A \quad | \quad \begin{matrix} O \\ a & -1 & 1 & 1 & 0 & 0 & 1 \\ @0 & 1 & 2 & 0 & 1 & 0 & C \\ 1 & 0 & 3 & 0 & 0 & 1 \end{matrix}$$

对其?行初等行变换，从而可以得到 $A$ 可以化为单位 $\text{Y}$ 阵的条件以及 $A^{-1}$ .

$$\begin{matrix} O \\ a & -1 & 1 & 1 & 0 & 0 & 1 \\ @0 & 1 & 2 & 0 & 1 & 0 & C \\ 1 & 0 & 3 & 0 & 0 & 1 \end{matrix} \xrightarrow{\substack{\text{换第1、第3行} \\ \text{第1行乘}(-a)\text{加到第3行} \\ \text{第2行加到第3行}}} \begin{matrix} O \\ 1 & 0 & 3 & 0 & 0 & 1 \\ @0 & 1 & 2 & 0 & 1 & 0 & C \\ 0 & 0 & 3 - 3a & 1 & 1 & a \end{matrix}$$



习题1.4( $P_{39} - P_{41}$ )构造 $\text{Y}$ 阵

$$A \quad | \quad = \begin{array}{cccccc} \textcircled{O} & a & -1 & 1 & \textcolor{red}{1} & 0 & 0 \\ \textcircled{B} & @0 & 1 & 2 & 0 & 1 & 0 \\ \textcircled{C} & & & & & & \end{array} \begin{array}{c} 1 \\ \\ \end{array}$$

$$\begin{array}{cccccc} 1 & 0 & 3 & 0 & 0 & 1 \end{array}$$

对其? 行初等行变换, 从而可以得到 $A$ 可以化为单位 $\text{Y}$ 阵的条件以及 $A^{-1}$ .

$$\begin{array}{cccccc} \textcircled{O} & a & -1 & 1 & \textcolor{red}{1} & 0 & 1 \\ \textcircled{B} & @0 & 1 & 2 & 0 & 1 & 0 \\ \textcircled{C} & & & & & & \end{array} \xrightarrow{\substack{\text{换第1、第3行} \\ \text{第1行乘}(-a)\text{加到第3行} \\ \text{第2行加到第3行}}} \begin{array}{cccccc} \textcircled{O} & 1 & 0 & 3 & 0 & 0 & 1 \\ \textcircled{B} & @0 & 1 & 2 & 0 & 1 & 0 \\ \textcircled{C} & & & & & & \end{array}$$

$$\begin{array}{cccccc} 1 & 0 & 3 & 0 & 0 & 1 \end{array}$$

由初等变换的(果可以得,  $A^2$  过初等变换可以化为单位 $\text{Y}$ 阵的充要条件是 $3 - 3a \neq 0$ , 以 $A$ 可逆充要条件是 $a \neq 1$ .



习题1.4( $P_{39} - P_{41}$ )

$3a \neq 1$ 时， $\exists$ 对上述 $\text{Y}$ 阵？一步？行初等行变换：



习题1.4( $P_{39} - P_{41}$ )

$3a \neq 1$  时, 2对上述 $\text{Y}$ 阵? 一步? 行初等行变换:

第3行乘  $\frac{1}{3-3a}$

$$\begin{array}{ccccccc} \textcircled{O} & 1 & 0 & 0 & -\frac{3}{3-3a} & -\frac{3}{3-3a} & \frac{3-6a}{3-3a} \\ \textcircled{B} & @0 & 1 & 0 & -\frac{2}{3-3a} & \frac{1-3a}{3-3a} & -\frac{2a}{3-3a} \\ \xrightarrow{\longrightarrow} & 0 & 0 & 1 & \frac{1}{3-3a} & \frac{1}{3-3a} & \frac{a}{3-3a} \end{array} \textcircled{C} ;$$

第3行乘(-2)加到第2行

$\longrightarrow$

第3行乘(-3)加到第1行

$$\begin{array}{ccccccc} \textcircled{O} & -\frac{3}{3-3a} & -\frac{3}{3-3a} & \frac{3-6a}{3-3a} & 1 \\ \textcircled{B} & @-\frac{2}{3-3a} & \frac{1-3a}{3-3a} & -\frac{2a}{3-3a} & \textcircled{C} : \\ & \frac{1}{3-3a} & \frac{1}{3-3a} & \frac{a}{3-3a} & \end{array}$$

习题1.4( $P_{39} - P_{41}$ )

13.) 由于单位 $\hat{Y}$ 阵与任何可乘 $\hat{Y}$ 阵都可换, 而 $A^3 = 0$ ,  
以

习题1.4( $P_{39} - P_{41}$ )

13.) 由于单位 $\mathbf{Y}$ 阵与任何可乘 $\mathbf{Y}$ 阵都可换, 而 $A^3 = 0$ ,  
以

$$(I + A)(I - A + A^2) = (I - A + A^2)(I + A) = I + A^3;$$

$$(I - A)(I + A + A^2) = (I + A + A^2)(I - A) = I - A^3$$



*Thank you!*

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