

# 数学作业纸

(科目: 离散数学)

班级: 计 01

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1. (1)  $A \cap B = \{0, 2\}$

$$R = \{ \langle 0, 0 \rangle, \langle 0, 2 \rangle, \langle 2, 0 \rangle, \langle 2, 2 \rangle \}$$

(2)  $R = \{ \langle 4, 2 \rangle, \langle 1, 1 \rangle \}$

2.  $A \cup B = \{ \langle 1, 2 \rangle, \langle 1, 3 \rangle, \langle 2, 4 \rangle, \langle 3, 3 \rangle, \langle 4, 2 \rangle \}$

$$A \cap B = \{ \langle 2, 4 \rangle \}$$

$$\text{dom}(A) = \{1, 2, 3\}$$

$$\text{dom}(B) = \{1, 2, 4\}$$

$$\text{ran}(A) = \{2, 3, 4\}$$

$$\text{ran}(B) = \{2, 3, 4\}$$

$$\text{dom}(A \cup B) = \{1, 2, 3, 4\}$$

$$\text{ran}(A \cap B) = \{4\}$$

3. 对  $\forall x$ :  
 $x \in \text{dom}(R \cup S) \Leftrightarrow (\exists y) (\langle x, y \rangle \in R \cup S)$

$$\Leftrightarrow (\exists y) (\langle x, y \rangle \in R \vee \langle x, y \rangle \in S)$$

$$\Leftrightarrow (\exists y) (\langle x, y \rangle \in R) \vee (\exists y) (\langle x, y \rangle \in S)$$

$$\Leftrightarrow x \in \text{dom}(R) \vee x \in \text{dom}(S)$$

$$\Leftrightarrow x \in \text{dom}(R) \cup \text{dom}(S)$$

故  $\text{dom}(R \cup S) = \text{dom}(R) \cup \text{dom}(S)$

对  $\forall x$ :

$$x \in \text{dom}(R \cap S) \Leftrightarrow (\exists y) (\langle x, y \rangle \in R \cap S)$$

$$\Leftrightarrow (\exists y) (\langle x, y \rangle \in R \wedge \langle x, y \rangle \in S)$$

$$\Rightarrow (\exists y) (\langle x, y \rangle \in R) \wedge (\exists y) (\langle x, y \rangle \in S)$$

$$\Leftrightarrow x \in \text{dom}(R) \wedge x \in \text{dom}(S)$$

$$\Leftrightarrow x \in \text{dom}(R) \cap \text{dom}(S)$$

故  $\text{dom}(R \cap S) \subseteq \text{dom}(R) \cap \text{dom}(S)$

4.  $A = \{1, 2, 3\}$ , 有关系  $2^3 = 512$  种

$|A| = n$ , 有关系  $2^{n^2}$  种.

5.  $A \times B = \{ \langle a, d \rangle, \langle b, d \rangle, \langle c, d \rangle \}$

$$R_1 = \emptyset \quad R_2 = \{ \langle a, d \rangle \} \quad R_3 = \{ \langle b, d \rangle \} \quad R_4 = \{ \langle c, d \rangle \} \quad R_5 = \{ \langle a, d \rangle, \langle b, d \rangle \}$$

$$R_6 = \{ \langle a, d \rangle, \langle c, d \rangle \} \quad R_7 = \{ \langle b, d \rangle, \langle c, d \rangle \} \quad R_8 = \{ \langle a, d \rangle, \langle b, d \rangle, \langle c, d \rangle \}$$

6.  $\forall \langle x_1, x_2, x_3 \rangle = \langle \langle x_1, x_2 \rangle, x_3 \rangle$

$$\langle x_1, x_2, \dots, x_n \rangle = \langle \langle x_1, x_2, \dots, x_{n-1} \rangle, x_n \rangle$$

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(科目: 离散)

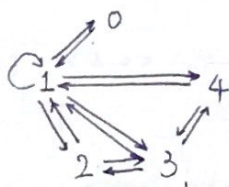
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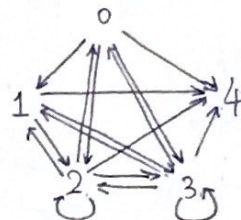
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7. (3) 
$$\begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$



(4) 
$$\begin{bmatrix} 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$



10. 对  $\forall \langle x, y \rangle$ ,  $\langle x, y \rangle \in R \circ (S \cup T)$

$$\Leftrightarrow (\exists z) (\langle x, z \rangle \in S \cup T \wedge \langle z, y \rangle \in R)$$

$$\Leftrightarrow (\exists z) ((\langle x, z \rangle \in S \vee \langle x, z \rangle \in T) \wedge \langle z, y \rangle \in R)$$

$$\Leftrightarrow (\exists z) ((\langle x, z \rangle \in S \wedge \langle z, y \rangle \in R) \vee (\langle x, z \rangle \in T \wedge \langle z, y \rangle \in R))$$

$$\Leftrightarrow (\exists z) (\langle x, y \rangle \in R \circ S \vee \langle x, y \rangle \in R \circ T)$$

$$\Leftrightarrow \langle x, y \rangle \in (R \circ S) \cup (R \circ T)$$

故  $R \circ (S \cup T) = (R \circ S) \cup (R \circ T)$