

Tutorial Sheets 11 (Representing Relations)

1. Let R be the relation on the set $\{1, 2, 3, 4, 5\}$ containing the ordered pairs $(1, 1), (1, 2), (1, 3), (2, 3), (2, 4), (3, 1), (3, 4), (3, 5), (4, 2), (4, 5), (5, 1), (5, 2),$ and $(5, 4)$. Find

a) R^2 . b) R^3 c) R^4 . d) R^5 .

2. Let R be the relation represented by the matrix

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

Find the matrix representing

- a) Complement R .
b) R^3 .

3. Let R_1 and R_2 be relations on a set A represented by the matrices

$$M_{R_1} = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{pmatrix} \quad \text{and} \quad M_{R_2} = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$$

Find the matrices that represent

- a) $R_1 \cup R_2$. b) $R_1 \cap R_2$. c) $R_1 \oplus R_2$.

4. Let $A = \{a, b, c, d\}$ be a set of students and $B = \{\text{AT\&T}, \text{3Com}, \text{HKT}, \text{IBM}, \text{Orange}\}$ be a set of companies that came to the Morrison Hill to interview students for jobs.

We have a binary relation R_1 from A to B describing the interviews the companies had with the students, and a binary relation R_2 from A to B describing the jobs of the companies offered to the students as shown in below.

	AT&T	3Com	HKT	IBM	Orange
a	✓	✓		✓	
b	✓	✓	✓	✓	✓
c				✓	✓
d	✓		✓	✓	

R_1

	AT&T	3Com	HKT	IBM	Orange
a					
b			✓	✓	
c		✓		✓	✓
d			✓	✓	✓

R_2

List the members and give the meanings of the binary relations

- a) $R_1 \cap R_2$ b) $R_1 \setminus R_2$ c) $R_2 \setminus R_1$