Tutorial – 1.

Sets and Relations.

Q1. If $A = \{1, 2, 3, 4\}$ $B = \{3, 4, 5, 6\}$ $C = \{4, 5, 6, 7, 8\}$
and $X = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$.

(i) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$.

$\therefore$ LHS.

$B \cap C = \{4, 5, 6\}$.

$A \cup (B \cup C) = \{1, 2, 3, 4, 5, 6\}$.

$\therefore$ RHS.

$A \cup B = \{1, 2, 3, 4, 5, 6\}$.

$(A \cup C) = \{1, 2, 3, 4, 5, 6, 7, 8\}$.

$(A \cup B) \cap (A \cup C) = \{1, 2, 3, 4, 5, 6\}$.

$\therefore$ RHS = LHS hence condition is verified.

(ii). $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

LHS.

$(B \cup C) = \{3, 4, 5, 6, 7, 8\}$.

$A \cap (B \cup C) = \{3, 4\}$.

RHS

$A \cap B = \{3, 4\}$.

$(A \cap C) = \{4\}$.

$(A \cap B) \cup (A \cap C) = \{3, 4\}$.

as, RHS = LHS hence verified.

(iii) $(A \cup B)' = A' \cap B'$

LHS.

$A \cup B = \{1,2,3,4,5,6\}$. $(A \cup B)' = \{7,8,9,10\}$.

RHS $A' = \{5,6,7,8,9,10\}$. $B' = \{1,2,7,8,9,10\}$.

$A' \cap B' = \{7,8,9,10.\}$.

RHS = LHS.

(iv) $(A \cap B)' = A' \cup B'$

LHS.

$A \cap B = \{3,4\}$. $(A \cap B)' = \{1,2,5,6,7,8,9,10\}$.

RHS.

$A' = \{5,6,7,8,9,10\}$ $B' = \{1,2,7,8,9,10\}$.

$A' \cup B' = \{1,2,5,6,7,8,9,10\}$.

$\therefore$ LHS = RHS.

(v) $A = (A \cap B) \cup (A \cap B')$.

RHS.

$A \cap B = \{3,4\}$.

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

$(A \cap B) \cup (A \cap B') = \{1,2,3,4\}$.

$= A$.

$\therefore$ RHS = LHS.

(iii) $(A \cup B)' = A' \cap B'$.

A	B	$A \cup B$	$(A \cup B)'$	A'	B'	$A' \cap B'$
0	0	0	1	1	1	1
0	1	1	0	1	0	0
1	0	1	0	0	1	0
1	1	1	0	0	0	0.

(iv). $(A \cap B)' = A' \cup B'$

A	B	$A \cap B$	$(A \cap B)'$	A'	B'	$A' \cup B'$
0	0	0	1	1	1	1
0	1	0	1	1	0	1
1	0	0	1	0	1	1
1	1	1	0	0	0	0

Q3. $A = \{a, b, c\}$ $B = \{d, e\}$ $C = \{a, d\}$.

(i) $A \times B = \{(a,d), (a,e), (b,d), (b,e), (c,d), (c,e)\}$.

(ii) $B \times A = \{(d,a), (d,b), (d,c), (e,a), (e,b), (e,c)\}$.

Q4. A → Failed in MHT-CET
B ⇒ Failed In AIEEE.
C → Failed in IIT

$U = 200$.
$n(A) = 35$. , $n(B) = 40$, $n(C) = 40$.
$n(A \cap B) = 20$, $n(B \cap C) = 17$, $n(A \cap C) = 15$.
$n(A \cap B \cap C) = 5$.

(i). Did not fail in any examination.

$n(A \cup B \cup C)' = U - n(A) - n(B) - n(C) + n(A \cap B) + n(A \cap C) + n(B \cap C) - n(A \cap B \cap C)$
$= 200 - 35 - 40 - 40 + 20 + 17 + 15 - 5$.
$= 132$.

(ii) Failed in AIEEE or IIT.

$n(B \cup C) = n(B) + n(C) - n(B \cap C)$
$= 40 + 40 - 17$.
$= 63$.

Q5. literate individuals (U) = 2000.

Marathi readers (A) $70\% = \frac{70}{100} \times 2000 = 1400.$

English readers (B) $= 50\% = \frac{50}{100} \times 2000 = 1000.$

$\therefore n(A \cap B) = 32.5\% = \frac{32.5}{100} \times 2000 = \cancel{600}\ 650.$

(i) at least one of the news paper.

$= n(A) + n(B) - n(A \cap B)$

$= 1400 + 1000 - 650$

$= \cancel{18}\ 1750$

(ii) neither Marathi nor English.

$= 2000 - $ (at least one newspaper)

$= 2000 - 1750$

$= 250.$

(iii) only one newspaper.

$= n(A) + n(B) - 2n(A \cap B).$

$= 1400 + 1000 - 2 \times 650$

$= 1100$

Q6) $U = 40$.
English $(A) = 14$.
chemistry $(B) = 29$.

$n(A \cap B) = 5$.

(a) how many students are in neither class.
$= U - (n(A) + n(B) - n(A \cap B))$
$= 40 - (14 + 29 - 5)$
$= 2$.

(b) How many are in either class.
$= n(A) + n(B) - n(A \cap B)$
$= 14 + 29 - 5$
$= 38$

Q7. class $(U) = 40$.
Cricket $(A) =$
Football $(B) =$

$\therefore n(A \cap B) = 15$. $n(A) = 20$.

no of people like to play football not cricket
$= (n(B) + n(B \cap A)) + U$.
$= U - (n(A) +$

Q8. $A = \{1, 3, 5\}$.

$\therefore$ all possible subsets of A are
$\{\}$, $\{1\}$, $\{3\}$, $\{5\}$, $\{1, 3\}$, $\{3, 5\}$, $\{1, 5\}$, $\{1, 3, 5\}$.

Q9. $P = \{11, 12, 13, 14, 15\}$.
$Q = \{10, 12, 14, 16, 18\}$.
$R = \{7, 9, 11, 14, 18, 20\}$.

(i) difference of sets P & Q.
$P - Q = \{11, 13, 15\}$.

(ii) $Q - R$.
$= \{10, 12, 16,\}$

(iii) $R - P$
$= \{7, 9, 18, 20\}$.

(iv) $Q - P$
$= \{10, 16, 18\}$.

Q 10. $X = \{1, 2, 3, 4, 5, 6\}$.

(i) $[\{1, 2, 3\}\{1, 4, 5, 6\}]$.
Not a partition of X due to Repetition of an element

(ii) $[\{1, 2\}, \{3, 5, 6\}]$.
Not a partition of X due to element missing.

(iii) $[\{1, 3, 5\}, \{2, 4\}, \{6\}]$.
~~Not~~ This a is a partition of X.

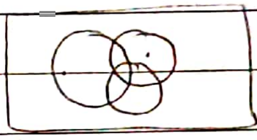
(iv) $[\{1, 3, 5\}\{4, 4, 6, 7\}]$
Not a partition of X due to Repetition of element.

Q 11. $U = 150$.

$n(A \cup B \cup C) = 109$.

$n(A) = 45$

$n(B) = 61$



$n(C) = 53$.

$n(A \cap B) = 18$. $n(A \cup B \cup C) = A + B + C - (A \cap B) - (B \cap C) - (C \cap A) + n(A \cap B \cap C)$

$n(B \cap C) = 53$

$n(A \cap C) = 23$.

(i) $n(A \cap B \cap C) = \cancel{n(A) + n(B) + n(C)}$

$= n(A \cup B \cup C) - n(A) - n(B) - n(C) + n(A \cap B) + n(B \cap C) + n(C \cap A)$

$= 109 - 45 - 61 - 53 + 18 + 53 + 23$.

$= 44$.

(ii). only B $= n(B) - n(A \cap B) - n(B \cap C) + n(A \cap B \cap C)$

$= 61 - 18 - 53 + 44$

$= 34$.

(iii) $n(A \cup B \cup C)' = 150 - 109$

$= 41$.

Tutorial-2.

Relations.

(1) (i) Relation.

Relation 'R from set A to B is a subset of $A \times B$ which can be defined as $aRb \leftrightarrow (a,b) \in R \leftarrow R(a,b)$.

(ii) Domain of Relation

The domain of a relation R is the set of all first elements of the ordered pair which belong to R, and the range is the set of second elements.

(iii) Range of Relation.

Range of Relation is the set of second elements of the ordered pair.

(iv) Inverse Relation

Let R be any relation from a set A to a set B. The inverse of R, denoted by R^{-1}, is the relation from B to A which consists of those ordered pairs which, when reversed, belong to R.

$$R^{-1} = \{(b,a) \mid (a,b) \in R\}.$$

eg:-

$A = \{1,2,3\}$ $B = \{x, y, z\}$

$R = \{(1,y), (1,z), (3,y)\}$

$R^{-1} = \{(y,1), (z,1), (y,3)\}$.

Q2.

(i) $A = \{1, 2, 3\}$ $B = \{r, s\}$.

$R = \{(1, r), (2, s), (3, r)\}$.

Domain $= \{1, 2, 3\}$

range $= \{r, s\}$.

Matrix be

	r	s
1	1	0
2	0	1
3	1	0

$\therefore$

$$M_R = \begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array} \begin{array}{c} \begin{array}{cc} r & s \end{array} \\ \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 0 \end{bmatrix} \end{array}$$

(ii) $A = \{1, 2, 3, 4, 5\}$ and aRb if $a < b$

Q3. $A = \{1, 2, 3, 4\}$ $B = \{x, y, z\}$.

$R = \{(1,y), (1,z), (3,y), (4,x), (4,z)\}$.

(a) Domain be $\{1, 3, 4\}$.

Range be $\{y, z, x\}$.

(b)

$R^{-1} = \{(y,1), (z,1), (y,3), (x,4), (z,4)\}$.

(c) Matrix of R.

$$M_R = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array} \begin{array}{c} \begin{array}{ccc} x & y & z \end{array} \\ \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix} \end{array}$$

Q4. $A = \{1, 2, 3\}$ $B = \{a, b\}$.

$R = \{(1,a), (3,a), (2,b), (3,b)\}$.

$S = \{(1,b), (2,b)\}$.

(a) Composition relation $S \circ R$.

A

1

2

3

Q.5.

(i) $A = \{1, 2, 3\}$ $B = \{a, b\}$

$R = \{(1, a), (3, a), (2, b), (3, b)\}$.

$S = \{(1, b), (2, b)\}$.

(b) $R^{-1} = \{(a, 1), (a, 3), (b, 2), (b, 3)\}$.

(c) $R \cap S = \{(2, b)\}$.

(d). $S = \{(1, b), (2, b)\}$.

(e) $S^{-1} = \{(b, 1), (b, 2)\}$.

(ii) $A = \{1, 2, 3\}$, $B = \{a, b, c\}$ $C = \{x, y, z\}$.

(a) $ARB = \{(1, b), (2, a) (2, c)\}$.

(d) $BSC = \{(a, y), (b, x), (c, y), (c, z)\}$.

~~(a) R = ...~~

(b) $R^{-1} = \{(b, 1), (a, 2), (c, 2)\}$.

(c) $R \cap S =$

Q.6. A = {1, 2, 3, 4}

(i) R = {(1,1), (2,2), (2,3), (3,2), (4,2), (4,4)}

Not Reflexive → coz The pairs does not point back to themselves.
irreflexive → coz The pairs ~~no~~ does not point back to themselves
Not symmetric → there is no (2,4)
antisymmetric → coz there is (2,3) & (3,2) [No pairs should connect in both direction if they are grouped].
Transitive → Non transitive.

(ii) R = {(1,1), (1,3), (1,4) (3,3) (2,4) (4,4)}.
Not Reflexive, irreflexive, Not symmetric, Not antisymmetric
Non transitive.

Q7.

A = {1, 2, 3, 4}.

$$M_R = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array} \begin{array}{c} \begin{array}{cccc} 1 & 2 & 3 & 4 \end{array} \\ \begin{bmatrix} 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 \end{bmatrix} \end{array}$$

R = {(1,1), (1,2), (1,4), (2,1), (2,2), (2,3), (2,4), (3,2), (3,3) (4,1), (4,2), (4,4)}.
Reflexive, Not irreflexive, Symmetric, Antisymmetric, transitive.

Q8.

(i) Reflexive and symmetric, but not transitive.

$A = \{a, b, c, d\}$.
$R = \{(a, a)\ (b, b), (c, c), (d, d)\}$

(ii) Reflexive and transitive, but not symmetric.

$R = \{(a, a), (b, b), (c, c)\ (d, d), (a, b), (b, d)\}$.

(iii) Transitive, reflexive and symmetric.

$R = \{(a, a)\ (b, b)\ (c, c)\ (d, d), (a, b), (b, c), ($