1. If $A=\{2x/x\in N \text{ and } x<3\}, B=\{x/x^2-4x+3=0 \text{ and } x>1\}$, then $A\times B=$

1) $\{(4,3),(2,3)\}$ 2) $\{(2,4),(2,3)(4,3)\}$

3) $\{(1,4),(2,3),(2,2)\}$ 4) $\{(1,2),(1,3)(2,3)\}$

2. If $A=\{1,2,3\}, B=\{x\}$, then $(A\times B)\cup(B\times A)=$

1) $\{(1,x),(2,x),(3,x)\}$ 2) $\{(x,1),(x,2),(x,3)\}$

3) $\{(1,x),(2,x),(3,x),(x,1),(x,2),(x,3)\}$ 4) None

3. If $n(A\times B)=15, n(A)=3$, then $n(B)=$

1) 12 2) 5 3) 45 4) 3

4. If $n(A)=n$ then $n\{(x,y,z); x,y,z\in A, x\neq y, y\neq z, z\neq x\}=$

1) n^3 2) $n(n-1)^2$ 3) $n^2(n-2)$ 4) n^3-3n^2+2n

5. Let $X=\{1,2,3,4,5\}$. Then the number of different ordered pairs (Y, Z) that can be formed such that $Y\subseteq X, Z\subseteq X$ and $Y\cap Z$ is empty is

1) 2^5 2) 5^3 3) 5^2 4) 3^5

6. Range of $\{(1,x),(1,y),(2,x),(2,y),(3,z)\}$ is

1) $\{1,2,3\}$ 2) $\{x,y,z\}$ 3) $\{1,x\}$ 4) $\{1,2,3,x,y,z\}$

7. Let $R=\{(1,3),(4,2),(2,4),(2,3),(3,1)\}$ be a relation on the set $A=\{1,2,3,4\}$. The relation R is

1) a function 2) reflexive 3) not symmetric 4) transitive

8. Let $R=\{(3,3),(6,6),(9,9),(12,12),(6,12),(3,9),(3,12),(3,6),\}$ be a relation on the set $A=\{3,6,9,12\}$ The relation is

1) reflexive and transitive only 2) reflexive only

3) an equivalence relation 4) reflexive and symmetric only

9. For, $n,m\in N, n\mid m$ means that n is a factor of m, the relation $\mid$ is

1) reflexive and symmetric 2) transitive and symmetric

3) reflexive, transitive and symmetric 4) reflexive, transitive and not symmetric

10. Let $x,y,\in Z$ and suppose that a relation R on Z is defined by xRy if and only if $x\leq y$ then

1) R is partial order

2) R is an equivalence relation

3) R is reflexive and symmetric

4) R is symmetric and transitive

11. A and B are two sets having 3 and 4 elements respectively and having 2 elements in common The number of relations which can be defined from A to B is

1) 2^5 2) $2^{10}-1$ 3) $2^{12}-1$ 4) none of these

12. Let $R=\{(x,y):x,y\in A, x+y=5\}$ are where $A=\{1,2,3,4,5\}$ then

1) R is not reflexive, symmetric and not transitive
2) R is an equivalence relation
3) R is reflexive, symmetric but not transitive
4) R is not reflexive, not symmetric but transitive

13. For $x,y,\in R,$ define a relation R by $x \quad R\, y$ if and only if $x-y+\sqrt{2}$ is an irrational number. Then R is

1) an equivalence relation 2) R is symmetric
3) R is transitive 4) none of these

14. If R and S are two symmetric relations then

1) RoS is a symmetric relation 2) SoR is a symmetric relation
3) RoS^{-1} is symmetric relation 4) RoS is a symmetric relation if and only if $RoS = SoR$

15. f is a relation on the set R of real numbers defined as $(a,b)\in f \Rightarrow 1+ab>0.$ Then f is

1) transitive, reflexive but not symmetric
2) reflexive, symmetric but not transitive
3) reflexive, symmetric, transitive
4) not reflexive, not symmetric, not transitive

16. If $A=\{1,2,3\}$, the number of symmetric relation in A is

1) 3 2) 8 3) 328 4) 63

17. Let N denote the set of all natural numbers and R be the relation on $N\times N$ defined by $(a,b)R(c,d)$ if $ad(b+c)=bc(a+d),$ then R is

1) symmetric only 2) reflexive only 3) transitive only 4) an equivalence relation

18. Let $P=\{(x,y)/x^2+y^2=1, x,y\in r\}$ Then P is

1) reflexive 2) symmetric 3) transitive 4) anti-symmetric

19. Let R ne an equivalence relation on a finite set A having n elements Then the number of ordered pairs in R is

1) Less than n 2) greater than or equal to n
3) less than or equal to n 4) None of these

20. Which one of the following relation on R is an equivalence relation

1) $aR_1b \Leftrightarrow |a|=|b|$ 2) $aR_2b \Leftrightarrow a\ge b$
3) $aR_3b \Leftrightarrow a\, divides\, b$ 4) $aR_4b \Leftrightarrow a<b$

21. let R be a relation on a set A such that $R=R^{-1}$ then R is

1) reflexive 2) symmetric 3) transitive 4) None of these

22. Let R be a relation on the set N be defined by $\{(x,y) \;|x,y,\in N, 2x+y=41\}$ then R is

1) reflexive 2) symmetric 3) transitive 4) None of these

23. The void relation an a set A is
1) reflexive 2) symmetric and transitive
3) reflexive and symmetric 4) reflexive and transitive

24. Let R be a relation on the set N of natural numbers denoted by $nRm \Leftrightarrow n$ is a factor of $m(i.e\ n/m)$ Then R is
1) reflexive and symmetric 2) transitive and symmetric
3) equivalence 4) reflexive, transitive but not symmetric

25. Which of the following is not correct for relation R on the set of real numbers
1) $(x, y) \in R \Leftrightarrow 0 < |x| - |y| \le 1$ is neither transitive not symmetric
2) $(x, y) \in R \Leftrightarrow 0 < |x - y| \le 1$ is symmetric and transitive
3) $(x, y) \in R \Leftrightarrow |x| - |y| \le 1$ is reflexive but not symmetric
4) $(x, y) \in R \Leftrightarrow |x - y| \le 1$ is reflexive and symmetric

26. Two points P and Q in a plane are related if OP = OQ where O is a fixed point this relation is
1) reflexive but not symmetric 2) symmetric but not transitive
3) an equivalence relation 4) None of these

27. The relation R defined in $A = \{1,2,3\}$ by aRb if $|a^2 - b^2| \le 5$ which of the following is false
1) $R = \{(1,1)(2,2)(3,3)(2,1)(1,2)(2,3)(3,2)$
2) $R^{-1} = R$
3) Domain of R={1,2,3}
4) Range of R = {5}

28. Let a relation R is the Set N of natural numbers be defined as $(x, y) \in R$ if and only if $x^2 - 4xy + 3y^2 = 0$ for all $x, y \in N$. The relation R is
1) Reflexive 2) Symmetric 3) transitive 4) An equivalence relation

29. Given the relation $R = \{(1,2)(2,3)\}$ on the set $A = \{1,2,3\}$. T he minimum number of ordered pairs which when added to R make it an equivalence relation is
1) 5 2) 6 3) 7 4) 8

30. Let X b e a family of sets and R be a relation on X defined by A is disjoint from B then R is
1) Reflexive 2) Symmetric 3) anti symmetric 4) Transitive

KEY SHEET-2

1	2	3	4	5	6	7	8	9	10
1	3	2	4	4	2	3	1	4	1
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
4	1	4	4	2	4	4	2	2	1
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
2	4	2	4	2	3	4	1	3	2

HINTS

1. $A=\{2x: x\in N, x<3\}=\{2,4\}, B=\{x: x^2-4x+2=0, x>1\}=\{3\}\ldots A\times B=\{(2,3),(4,3)\}$
2. $A\times B=\{(1,x),(2,x),(3,x), B\times A=\{(x,1),(x,2),(x,3)\}$
3. $n(A\times B)=n(A)n(B)\Rightarrow 15=3n(B)=5.$
4. There are n choice for the first coordinate, n-1 choices for second coordinate and n-2 choice for the third coordinate, hence $n(\{x,y,z\in A, x\neq y\neq z\})=n(n-1)(n-2)=n^3-3n^2+2n$
5. If $a\in X$ then one of the following 4 cases hold $a\notin Y, a\notin Z$
$Y\cap Z\phi\Rightarrow$ only 3 cases hold $\therefore$ The number of required pairs $=3^5$
6. Range = $\{x,y,z\}$
7. $(2,4),(2,3)\in R\Rightarrow 2$ has two image $\Rightarrow$ R is not a function
$(1,1)\notin R=R$ is not reflexive; $(2,3)\in R,(3,2)\notin R\Rightarrow R$ is not symmetric
8. $A=\{3,6,9,12\}$ and $(3,3),(6,6),(9,9),(12,12)\in R\Rightarrow R$ is reflexive
$(6,12)\in R$ but $(12,6)\ni R\Rightarrow R$
$(12,6)\ni R\Rightarrow R$ is not symmetric
$(3,6)\in R,(6,12)\in R\Rightarrow(3,12)\in R$ $\therefore R$ is transitive
9. Sinece n is a factor of n, so the relation is reflexive. If, however, n is a factor m, m is not necessarily a factor of n, so the relation is not symmetric. On the hand $n\,|$m and m $|\, l$ imply $n\,|l$, so the relation is transitive
10. Since $x\leq x$ for all $x\in Z$ so R is reflexive but is not symmetric as (1,2) $\in R$ and (2,1) $\notin R$. Also R is transitive as $x\leq y, y\leq z\Rightarrow x\leq z$.R is antisymmetric for if $x\leq y$ and $y\leq x$ then $x=y$ Hence R is partial order
11. Conceptional
12. $R=\{(1,4),(4,1),(2,3),(3,2)\}$, so R is not reflexive as (1,1) $\in R$. Also R is symmetric by definition and R is not transitive as (1,4) $\in R$,(4,1) $\in R$ but (1,1) $\notin R$
13. Since $x-x+\sqrt{2}=\sqrt{2}$ which is an irrational number so $x\ R\ x$ for all $x\in R$. Hence R is reflexive. R is not symmetric as $(\sqrt{2},1)\in R$ but $(1,\sqrt{2})\notin R$. Again R is not transitive since $(\sqrt{2},1)\in R$ and $(1,2\sqrt{2})\in R$ but $(\sqrt{2},2\sqrt{2})\notin R$
14. Since R and S are symmetric relation so $R^{-1}=R$ and $S^{-1}=S$
But $(R_oS)^{-1}$ $(R_oS)^{-1}=S^{-1}oR^{-1}=S_oR$ Thus R_oS is symmetric if and only if $R_oS=S_oR$
15. For $(a,b)\in f, 1+ab>0\Rightarrow 1+ba>0\Rightarrow(b,a)\in f\Rightarrow f$ is symmetric
16. The number of symmetric relation = $2^{3(3+1)/2}-1=2^6-1=63$
17.

: For $(a,b),(c,d)\in N\times N$; $(a,b)R(c,d)\Rightarrow ad(b+c)=bc(a+d)$
Reflexive : Since $ab(b+a)=ba(a+b)\ \forall\ ab\in N.$ $\therefore$ $(a,b)R(a,b).$ $\therefore$ R is reflexive.
Symmetric : For $(a,b),(c,d)\in N\times N$, let $(a,b)R(c,d)$.
$\therefore$ $ad(b+c)=bc(a+d)\Rightarrow bc(a+d)=ad(b+c)\Rightarrow cb(d+a)=da(c+b)\Rightarrow(c,d)R(a,b).$
$\therefore$ R is symmetric.
Transitive : For $(a,b),(c,d),(e,f)\in N\times N$, let $(a,b)R(c,d),(c,d)R(e,f)$
$\therefore$ $ad(b+c)=bc(a+d), cf(d+e)=de(c+f)$
$\Rightarrow adb+adc=bca+bcd\rightarrow(1)$ and $cfd+cfe=dec+def\rightarrow(2)$
$(1)\,ef+\ (2)\,ab\Rightarrow adbef+adcef+cfdab+cfeab=bcaef+bcdef+decab+defab$
$\Rightarrow adcf(b+e)=bcde(a+f)\Rightarrow af(b+e)=be(a+f)\Rightarrow(a,b)R(e,f).$
$\therefore$ R is transitive. Hence R is an equivalence relation.

18. $x^2 + y^2 = 1 \Rightarrow (x, y) \in R$

$y^2 + x^2 = 1 \Rightarrow (y, x) \in R$

$\therefore$ symmetric

19. $n(A) = n \Rightarrow (A \times A) = n^2$

$\Rightarrow n^2 \geq n$

20. $(a,b) \in R_1 \Rightarrow |a| = |a| \Rightarrow |a| = |b|$

$i) |a| = |a| \Rightarrow (a,a) \in R_1$ (Syme)

$ii) |a| = |b| \Rightarrow |b| = |a| \Rightarrow (b,a) \in R_1$ (Tr)

$iii) |a| = |b| \varepsilon |b| = |c| \Rightarrow |a| = |c| \Rightarrow (a,c) \in R_1$ (Tr)

21. $R = R^{-1} \Rightarrow RoR^{-1} = 1 \Rightarrow I$ is symmetric relation

22. $(x, y) \in R \Rightarrow 2x + y = 41$

$i) (x,x) \in R \Rightarrow 2x + x = 41 \Rightarrow x = \frac{41}{3} \notin N(x)$

$ii) (x, y) \in R \Rightarrow 2x + y = 41; But\, 2x + x \neq 41 \Rightarrow (y,x) \notin R(x)$

$iii) (x, y) \in R \Rightarrow 2x + y = 41 \varepsilon (y,z) \in R 2y + z = 41 \Rightarrow 2x + z \neq 41(x)$

23. Void relation is Null set

As then is no elements if can't be reflexive

24. $(n,m) \in R \Rightarrow n$ is a factor of m

Z is a factor of $6 \Rightarrow (6,2) \notin R$ Not symmetric

25. $(x, y) \in R \Rightarrow o \leq |x - y| \leq 1$

$i) |x - x| = 0 \Rightarrow (x,x) \notin R$ not ref

$ii) (x, y) \in R \Rightarrow 0 \leq |x - y| \leq 1$

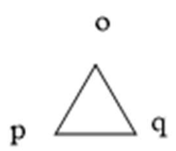
$0 \leq |y - x| \leq 1 \Rightarrow (y,x) \in R$ (symmetric)

$iii) (x, y) \in R \varepsilon (y,z) \in R \Rightarrow o < |x - y| \leq 1 \varepsilon o \leq |y - z| \leq 1$

$\Rightarrow |x - z| = |x - y + (y - z)|$

$|x - z| \leq |x - y| + |y - z|$

26. $(P,Q) \in R \Rightarrow OP = OQ$



$i) OP = OP \Rightarrow (P,P) \in R$

$ii) OP = OQ \Rightarrow OQ = OP \Rightarrow (Q,P) \in R$

$iii) (P,Q) \in R \varepsilon (Q,R) \in R \Rightarrow OP = OQ \varepsilon OQ = OR \Rightarrow (P,R) \in R$

27. $A = \{1,2,3\}\, and\, (a,b) \in R \Rightarrow |a^2 - b^2| \leq 5$

$a = 1 \varepsilon b = 1 \Rightarrow |a^2 - b^2| = 0$

$a = 1 \varepsilon b = 2 \Rightarrow |a^2 - b^2| = (1 - 4) = 3$ Lie thins Range

$= \{0,3,8,---\} \neq \{5\}$

$a = 1 \varepsilon b = 3 \Rightarrow |a^2 - b^2| = \pi |1 - 9| = 8$

28. $x^2 - 4xy + 3y^2 = 0 \Rightarrow x^2 - xy - 3xy + 3y^2 = 0$

$x(x - y) - 3y(x - y) = 0 \Rightarrow (x - y)(x - 3y) = 0$

$x = y\, or\, x = 3y$

i) Ref $(x,x)\in R \Rightarrow x^2-4x+x^2=0$

ii) Sym of $(x,y)\in R \Rightarrow (x-y)(x-3y)=0$

$\Rightarrow (y-x)(By-3x)$ need not be zero $\Rightarrow$ Not Sym

$(3,1)\in R$ but $(1,3)\notin R$

iii) Trans let $(x,y)\in R\eta(y,\eta\in R$

cleanly $(9,3)\in R\varepsilon(3,1)\in R$

$9^2-4(9)3+3(3)^2=0\varepsilon\, 3^2-4(3)1+3(1)^2=0$

But $(9,1)\notin R(\therefore 9^2-4(9)+3=81-36+3\neq 0)$

29. $A=\{1,2,3\}$

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

To male it reflexive odd (1,1) (2,2) (3,3)

Now to make it symmetric we must add (2,1) (3,2)

$\Rightarrow R=\{(1,2)(2,3)(1,1)(2,2)(3,3)\}$

$\Rightarrow R=\{(1,2)(2,3)(2,1)(3,2)(1,3)(3,1)(1,1)(2,2)(3,3)\}$

$\therefore$ minimum no of elements to be ass is 7

30 $(A,B)\in R \Rightarrow A\cap B=\phi$

i) $A\cap A\neq \phi(A,A)\notin R \Rightarrow$ not Ref

ii) $A\cap B\neq \phi \Rightarrow B\cap A=\phi \Rightarrow$ symmetric

iii) $A\cap B=\phi\varepsilon B\cap C=\phi \Rightarrow A\cap C$ need not be empty

Ex: $=\{1,2,3\}\ B=\{4,5,6\}\ \varepsilon C=\{1,3,7\}$

But $A\cap C=\{1,3\}\neq\phi$

$A\cap B=\phi$ $\quad$ $B\cap C=\phi$