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INTERNAL ASSESSMENT EXAMINATIONS - I & II

ROLL NO. 241215	CPRN NO.	DATE 22 08 2025	
BRANCH : Comps		SEMESTER : 03	
SUBJECT : DSGT		SUPERVISOR'S SIGN. : 22.8.25	

Q. NO.	1	2	3	4	5	6	TOTAL MARKS	SIGN OF EXAMINER
MARKS OBTAINED	10	05	05	-	-	-	20	

START WRITING FROM HERE

Q1)

a) $p \rightarrow q$ (when ~~prede~~ premise implies to the result

Inverse :- ~~Inverse~~ Inverse is when the result implies to premise $[q \rightarrow p]$

01

Converse - Converse is when -ve premise implies to -ve result $\sim p \rightarrow \sim q$

Contrapositive - Contrapositive is when -ve result implies to -ve premise $\sim q \rightarrow \sim p$

b)

Universal Set	Empty set
i) Universal set is a set that covers all the elements of a particular scenario. denoted as U	i) Empty set is a set that has no elements in it. denoted as { }, ϕ
ii) It is a broader set that contains all the other sets	ii) Its value is null formula :
ex $U = \{1, 2, 3, \ldots 100\}$ set of Natural numbers till 100	ex if $n = 0$ $n(\{\}) = \{\phi\} = 1$ $(\because 2^0 = 1)$ ~~if n=1~~

02

iv)

c) $P(S)$ is power set of set S

$P(\phi) = \{\phi\}$

$\therefore n(P(\phi)) = 1$ ... $(\because 2^0 = 1)$

$P(\{\phi\}) = \{\phi, \{\phi\}\}$ ($\because$ every element is a subset of itself)

$\therefore n(P(\{\phi\})) = 2$ ... $(2^1 = 2)$

02

power set :- Power set is defined as sub set of all the elements of a set

d) $a R b$ iff $a \equiv b \pmod 4$

$\therefore a - b = 4m$ ... (It means $a-b$ is divisible by 4)

i.e $a R b$ iff $a-b$ is divisible by 4

~~for Z_1 ie $0 R 1 = 4m$ $0 R 15$~~

~~$0-1 = 4m$ $0 - k = 4$~~

~~$Z_4 =$~~

Z_4:

$[0] = \{\dots, -12, -8, -4, 0, 4, 8, 12, 16, \dots\}$

$[1] = \{\dots, -11, -7, -3, 1, 5, 9, 13, 17, \dots\}$

$[2] = \{-10, -6, -2, 2, 6, 10, 14, \dots\}$

02

$[3] = \{\dots, -9, -5, -1, 3, 7, 11, 15, \dots\}$

$[4] = \{\dots, -12, -8, -4, 0, 4, 8, 12, 16, \dots\}$ same as $[0]$

$\therefore Z_4 = \{[0], [1], [2], [3]\}$

e) Equivalence relation:-

If R is a relation on set A and if R is a ~~reflective~~ reflexive relation (aRa), symmetric relation (aRb → bRa) and as well as transitive relation (aRb & bRc → aRc). then R is an equivalence relation

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

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

Reflexive:-

since aRa $\forall a \in A$. it is reflexive relation

ex. (1,1),(2,2),(3,3)

Symmetric

Since aRb → bRa , it is symmetric relation

ex. (1,2)(2,1)

Transitive

since aRb & bRc → aRc it is transitive relation

ex (1,1)

∴ R is equivalence relation

Equivalence class:-

If R is a equivalence relation on set A, then equivalence class is the set of all the elements of A such for all the elements of a in R. ~~aR~~

i.e:-

$[a] = \{(x \in A) \mid (a, x \in R)\}$

Ex : $A = \{1,2,3,4\}$, Let Q be equivalence class

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

$[1] = \{2,3\}$

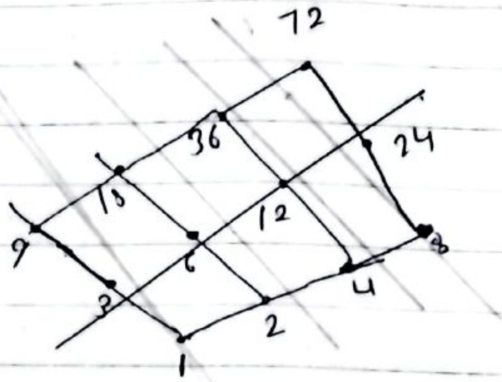
$[2] = \{3,4\}$

$[3] = \{3,4,1\}$

$[4] = \phi$

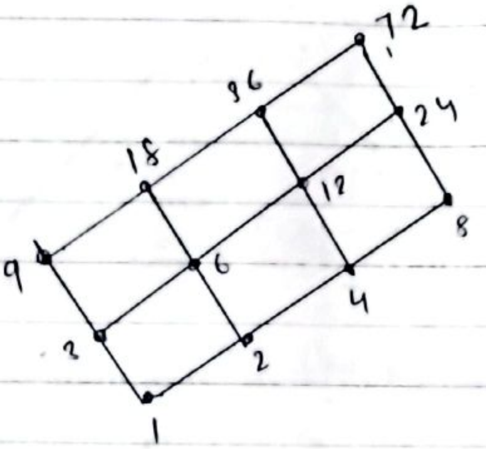
$\therefore Q = \{[1],[2],[3],[4]\}$

f) $D72 = \{1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72\}$



$D72 = \{1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72\}$

f) 1



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Hasse - D72
Diagoom

Q2)

b) $\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+\frac{1}{3\cdot 4}+\frac{1}{4\cdot 5}+\dots+\frac{1}{n(n+1)}=\frac{n}{n+1} \rightarrow p(n)$

Step 1:-

for $n=1$

$P(1)$: LHS $=\frac{1}{1(1+1)}=\frac{1}{2}$

$\therefore$ RHS $=\frac{1}{1+1}=\frac{1}{2}$

$\therefore$ $p(n)$ is true for $n=1$

Step 2:-

Assume that $p(n)$ is true for $n=k$

$p(k)=\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+\frac{1}{3\cdot 4}+\frac{1}{4\cdot 5}+\dots+\frac{1}{k(k+1)}=\frac{k}{k+1}$ —(1)

Step 3:-

for $n=k+1$

$p(k+1)=\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+\frac{1}{3\cdot 4}+\frac{1}{4\cdot 5}+\dots+\frac{1}{k(k+1)}+\frac{1}{(k+1)(k+2)}$

$=\frac{k+1}{(k+2)}$

LHS $=\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+\frac{1}{3\cdot 4}+\frac{1}{4\cdot 5}+\dots+\frac{1}{k(k+1)}+\frac{1}{(k+1)(k+2)}$

$=\frac{k}{k+1}+\frac{1}{(k+1)(k+2)}$ from (1)

$=\frac{1}{(k+1)}\left(k+\frac{1}{k+2}\right)$

$=\frac{1}{(k+1)}\left(\frac{k^2+2k+1}{k+2}\right)$

$= \frac{1}{(k+1)(k+2)} \left(k^2 + k + k + 1 \right)$

$= \frac{1}{(k+1)(k+2)} \left(k(k+1) + 1(k+1) \right)$

$= \frac{(k+1)(k+1)}{(k+1)(k+2)}$

$= \frac{(k+1)}{(k+2)}$

$= RHS$ | $\therefore LHS = RHS$

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$\therefore$ It is proved using Mathematical induction that $p(n)$ is true for all $n \geq 1$

Q2)

a) $n(U) = 100$

People eating fruits $n(F) = 37$ | People eating cheese - n(C)

People eating vegetable : $n(V) = 33$

$n(C \cap F) = 9$

$n(C \cap V) = 12$

$n(F \cap V) = 10$

$n(F \cap C \cap V) = 3$

Only cheese :- $n(C - F - V) = 12$

i) Only cheese $= n(C) - n(C \cap V) - n(C \cap F) + n(C \cap F \cap V)$

$12 = n(C) - 12 - 9 + 3$

$\boxed{\therefore n(C) = 30}$

$\therefore$ 30 people eats cheese

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ii) $n(C \cup F \cup V) = n(C) + n(F) + n(V) - (n(C \cap F) + n(C \cap V) + n(F \cap V)) + n(C \cap F \cap V)$

$= 30 + 37 + 33 - (9 + 12 + 10) + 3$

$n(C \cup F \cup V) = 72$

$\therefore n(C \cup F \cup V)^c = n(U) - n(C \cup F \cup C) = 100 - 72 = \boxed{28}$

$\therefore$ 28 people do not eat any offering

7

(Q1)

a) xRy iff $2x+5y$ is divisible by 7

(i) since $2x+5x=7x$ is divisible by 7 $(\forall x \in Z)$

$\therefore xRx$

$\therefore$ It is a reflexive relation.

ii) xRy i.e $2x+5y=7m$ .... (given) —(1)

$\therefore yRx \Rightarrow \cancel{5x+2y}\ 2y+5x$

Adding $\cancel{(5x+2y)}\ (2y+5x)$ on both side in (1)

$\therefore (2x+5y)+(5x+2y) = 7m + \cancel{(5x+2y)}\ (2y+5x)$

$\therefore 7x+7y = 7m + (2y+5x)$

$\therefore 7y+7x = 7m + (2y+5x)$

$\therefore 7(y+x) - 7m$

$\therefore 7(y+x-m) = 2y+5x$

as $(y+x-m)$ is constant / integer

$2y+5x$ is divisible by 7

$\therefore yRx$

As $xRy \longrightarrow yRx$

It is a symmetric relation

iii) xRy i.e $2x+5y = 7m_1$ .... (given) —(2)

yRz i.e $2y+5z = 7m_2$ .... (given) —(3)

Adding (2) & (3)

$2x+7y+5z = 7m_1+7m_2$

$2x+5z+7y = 7(m_1+m_2)$

$\therefore 2x+5z = 7(m_1+m_2-y)$

as (m_1+m_2-y) is constant / integer

$2x+5z$ is divisible by 7

$\therefore xRz$

As xRy & $yRz \longrightarrow xRz$

It is a transitive relation

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