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Assignment :- 01.

Q1] $|U| = 25$ $|A| = 15$ $|R| = 12$ $|W| = 11$
$|A \cap W| = 5$ $|A \cap R| = 9$ $|R \cap W| = 4$
$|A \cap R \cap W| = 3$.

$\therefore |A \cap R \cap W| = |A| + |R| + |W| - |A \cap R| - |A \cap W| - |W \cap R| + |A \cap R \cap W|$

$= 15 + 12 + 11 - 5 - 9 - 4 + 3$

$= \underline{\underline{23}}$.

a) only one of the option :

$= |A| + |R| + |W| - 2(|A \cap W| + |A \cap R| + |R \cap W|) + 3(|A \cap R \cap W|)$

$= 25 + 12 + 11 - 2(5 + 9 + 4) + 3 \times 3$

$= \underline{\underline{11}}$

b) Atleast one of option :-

$= |A \cup R \cup W|$

$= \underline{\underline{23}}$

c) None of the option :-

$= |U| - |A \cup R \cup W|$

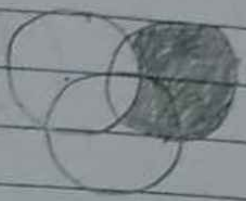
$= 25 - 23$

$= \underline{\underline{2}}$

Q2] a) $(B-A) \cup (C-A) = (B \cup C) - A$.

LHS :-

$(B-A)$ =



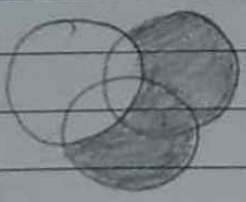
$(C-A)$ =

$(B-A) \cup (C-A)$ =

RHS :-

$(B \cup C)$ =

$(B \cup C) - A$ =



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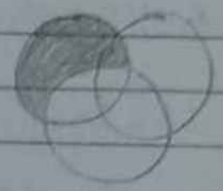
Since L.H.S = R.H.S

Hence proved.

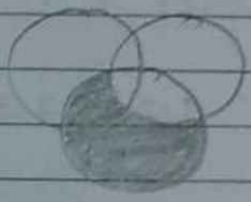
b) $(A-C) \cap (C-B) = \phi$.

LHS :-

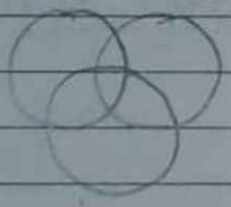
$(A-C)$ =



$(C-B)$ =

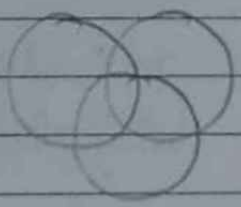


$(A-C) \cap (C-B)$ =



RHS :-

ϕ =



Since L.H.S = R.H.S

Hence proved.

Q3] **STEP 1:-** Check for all values n = 1.

L·H·S = $1 \times (1+1)$

= 2.

R·H·S = $\frac{1 \times 2 \times 3}{3}$

= 2. —— (1)

LHS = RHS.

STEP 2:- Assume it is true for P(k)

$1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + 4 \cdot 5 \ldots\ldots K(K+1)$

$= \frac{K(K+1)(K+2)}{3}$.

—— (2)

STEP 3: Induction step

$n = K+1$.

LHS = $\frac{K(K+1)(K+2)}{3} + (K+1)(K+2)$

— from eq (2).

$= \frac{K(K+1)(K+2) + 3(K+1)(K+2)}{3}$

$= \frac{(K+1)(K+2)(K+3)}{3}$ (RHS)

Putting $n = K+1$ from RHS:

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$= \frac{(k+1)(k+1+1)(k+1+2)}{3}$.

$= \frac{(k+1)(k+2)(k+3)}{3}$

$\Rightarrow$ L.H.S = RHS.

hence assumption was correct

Q4]

P	Q	$P \wedge Q$	$P \rightarrow Q$	$(P \wedge Q) \rightarrow (P \rightarrow Q)$
T	F	F	F	T
T	T	T	T	T
F	T	F	T	T
F	F	F	T	T

$\Rightarrow$ Tautology.

Q5] P : This system is good.
Q : This system is cheap.

a) This system is good and cheap
$= (P \wedge Q)$

b) This system is not good but cheap.
$= (\sim P \wedge Q)$

c) This system is neither good nor cheap.
$= (\sim P \wedge \sim Q)$

d) This system is good or cheap
$= (P \vee Q)$

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Q6] B : Bus T : Train A : Automobile

$|B| = 40$ $|B \cap T| = 20$

$|T| = 45$ $|B \cap A| = 15$ $|A \cap B \cap T| = 5$.

$|A| = 100$ $|T \cap A| = 20$

Total number of people = $|A \cup B \cup T|$

$\therefore |A \cup B \cup T| = |A| + |B| + |T| - |A \cap B| - |B \cap A| - |T \cap A| + |A \cap B \cap T|$

$= 100 + 40 + 45 - 15 - 20 - 20 + 5$

Total number of people = 135.

Q7] STEP 1 : Check for $n = 1$.

LHS :

$$\frac{1}{1 \cdot (1+1)} = \frac{1}{2}.$$

RHS :

$$\frac{1}{1+1} = \frac{1}{2}.$$

LHS = RHS $\Rightarrow$ It is true for $n = 1$.

STEP 2 : Assuming it is true for $n = k$ and $P(k)$ is true.

LHS : $\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} \cdots \frac{1}{k(k+1)}$ — (1)

RHS : $\frac{k}{(k+1)}$

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STEP 3: Induction step:

LHS for $n = k+1$.

$$\text{LHS} = \underbrace{\frac{1}{1\cdot2} + \frac{1}{2\cdot3} + \frac{1}{3\cdot4} \cdots \frac{1}{k(k+1)}}_{} + \frac{1}{(k+1)(k+2)}$$

$$\text{LHS} = = \frac{k}{(k+1)} + \frac{1}{(k+1)(k+2)} \quad \text{— from eq 0}$$

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

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

RHS: for $n = k+1$.

$$\text{RHS} = \frac{k+1}{k+2}$$

Multiplying the fraction by $k+1$ on whole.

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

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

Hence LHS = RHS

∴ Assumption is true.

Q8 ① UNIVERSAL QUANTIFIER:-

There are many mathematical statements asserts that is true for all values

such statements are expressed as universal quantification.

P(x) : is true for all values of x in domain

DEF^n :-

" P(x) is true for all values of x in it's domain"

It is denoted by $\forall P(x)$.

e.g:- P(x): Every apple is red.

② EXISTENTIAL ~~EXIST~~ QUANTIFIER:

Many mathematical statement asserts that is there is an element with a certain property such statement is expressed using Existential Quantifier.

DEF^n :-

" There exists an element x in the domain such that P(x) is true for some values of x"

It is denoted by $\exists P(x)$

e.g:- P(x): some birds are blue in color