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* Discrete Mathematics (DM) - Assignment Number - 1

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Q-1. Among the integer 1 to 100:- a) How many of them are not divisible by 3 nor by 5 nor by 7.
b) How many are not divisible by 5 and 7 but divisible by 3.

→ a)→ Let A, B, C denote respectively the set of integer from 1 to 100 divisible by 3, by 5 and by 7.

$\therefore \bar{A} \cap \bar{B} \cap \bar{C}$ denote the set of integer not divisible by 3, nor by 5 and nor by 7.

By De Morgan's Law,
$$\bar{A} \cap \bar{B} \cap \bar{C} = (\overline{A \cup B \cup C}) \quad - \text{①}$$

$$\therefore |\bar{A} \cap \bar{B} \cap \bar{C}| = 100 - |A \cup B \cup C|$$

$$|A| = \left[\frac{100}{3}\right] = 33 \quad - \text{②} \qquad |C| = \left[\frac{100}{7}\right] = 14 \quad - \text{④}$$

$$|B| = \left[\frac{100}{5}\right] = 20 \quad - \text{③}$$

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$|A \cap B| = \left[\frac{100}{15}\right] = 6 \quad - (5)$ $\qquad |A \cap C| = \left[\frac{100}{21}\right] = 4. \quad - (6)$

$|B \cap C| = \left[\frac{100}{35}\right] = 2 \quad - (7)$

$|A \cap B \cap C| = \left[\frac{100}{105}\right] = 0 \quad - (8)$

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

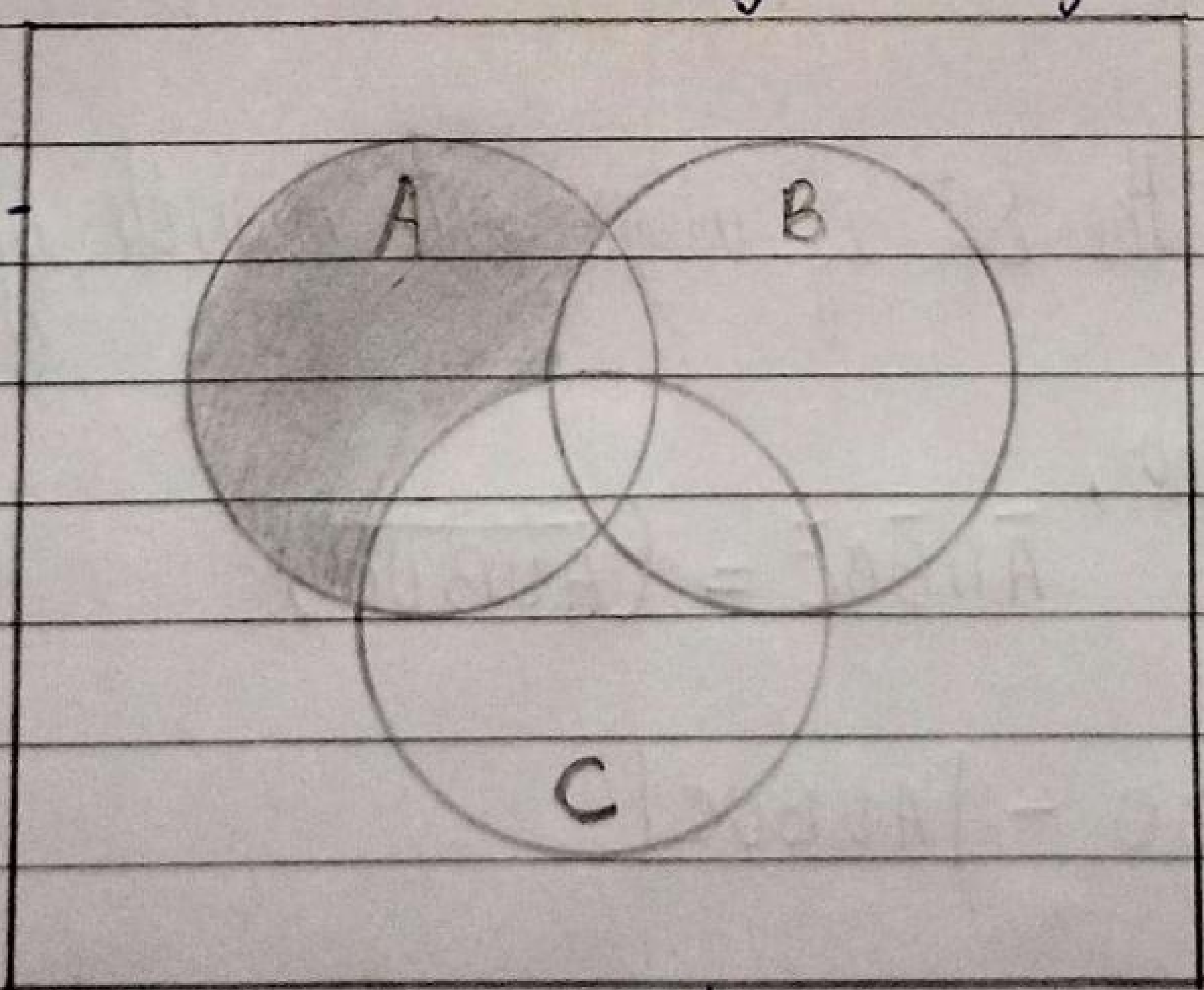
$= 33 + 20 + 14 - 6 - 4 - 2 + 0$

$|A \cup B \cup C| = 55. \quad - (9).$

$\therefore\ |\bar{A} \cap \bar{B} \cap \bar{C}| = 100 - 55 = \underline{\underline{45.}} \quad - (10).$

Hence 45 integers are not divisible by 3, nor by 5, nor by 7.

b) Consider the Venn Diagram:-



The of set of integer not divisible by 5 and 7 but divisible by 3 is

$A \cap \bar{B} \cap \bar{C} = A \cap (\overline{B \cup C}) = A - (B \cup C)$. (The shaded region).

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$\therefore |A \cup B \cup C| - |B \cup C|$ = Is no. of integer not divisible by 5 and 7 by divisible by 3 in range 1 to 100.

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$|B \cup C| = |B| + |C| - |B \cap C|$ — 12

$= 20 + 14 - 2$ .... [from 3, 4 and 7]

$|B \cup C| = 32$ — 13

$\therefore |A \cup B \cup C| - |B \cup C| = 55 - 32$ ... [from 9 and 13]

$= \underline{23}$

Hence 23 integer are not divisible by 5 and 7 but divisible by 3 in range 1 to 100.

Q-2. Define the following with proper set notation and examples:-

a) Proper Subset

b) Power Set

c) Cardinality of Sets

d) Empty Sets.

→ a) Proper Subset:-

Set A is considered to be a proper subset of set B contains at least one element that is not present in Set A

A proper subset is denoted by ⊂ and is read as 'is a proper subset of'.

Example:- If set A has element as {12, 24} and set B as {12, 24, 36}, then set A is the proper subset of B because 36 is not present in the set A.

$\boxed{A \subset B}$

b) Power Set:-
The power set of a set A is defined as the set of all subsets of the set A including the set itself and the null or empty set.

It is denoted by P(A).

Example:- Let Set $A = \{2, 9, 3, 7\}$
$\therefore$ Number of element $= 4$.
$\therefore$ Subsets of A are $\{\}$, $\{2\}$, $\{3\}$ $\{7\}$, $\{9\}$, $\{2,3\}$, $\{2,7\}$ $\{2,9\}$, $\{3,7\}$, $\{3,9\}$, $\{7,9\}$, $\{2,3,7\}$, $\{3,7,9\}$, $\{2,7,9\}$, $\{2,3,9\}$, $\{2,3,7,9\}$.

$\therefore P(A) = \{\{\}, \{2\}, \{3\}, \{7\}, \{9\}, \{2,3\}, \{2,7\}, \{2,9\}, \{3,7\}, \{3,9\}, \{7,9\}, \{2,3,7\}, \{2,7,9\}, \{2,3,9\}, \{3,7,9\}, \{2,3,7,9\}\}$.

The Power Set of A will have $2^4 = 16$ elements.

The number of element in set A is written as $|A|$, if A have n element then
$|P(A)| = 2^n$.

c) Cardinality of Set:-
The cardinality of set is a measure of a set's size meaning the number of element in a set.

The cardinality of set is denoted by $|A|$ where A is finite set.

Example:- $A = \{1, 2, 3, 4\}$.
$|A| = 4$.
$B = \{a, b, c, d, e, f, g, h, i, j, k\}$
$|B| = 11$.

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d) Empty Set:-

A set containing no element is called the empty set or the null set and is denoted by the symbol ϕ or $\{\}$ or void set.

Example:- $A = \{x : x \in N, 1 < x < 2\}$

$A = \phi$