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1 Define Set: A set is an unordered collection of objects known as elements or number of the set.

2. Explain the roster nation and set builder notion of set with example.

Roster notion: list element of a set inside braces {}, separated by commas.

Ex. A = {1, 2, 3, 4, 5}.

Set builder notion: A set builder notion describes or defines the elements of a set instead of listing the elements.

Ex. A = {x / x is counting natural numbers less than 6}

3 Define null set and singleton set.

Null set: A set which contains no element at all is called Null set / Empty set / Void set.

Singleton set: A set which has only one element is called a singleton set.

4. What is Cardinality of a set?

If there are exactly n distinct elements in set A where n is a non-negative integer, we can say that A is finite set and that n is the cardinality of set A.

Size of the set A is known as cardinality number, denoted as |A|.

5 When are two sets said to be equal?
Two sets are equal when they have exactly the same elements, ~~and sets are equivalent~~.
Two sets A and B are said to be equal if every elements of A is an element of B.

6. What is a Powerset?
Powerset is the set of all possible subset of the given set. denotes as P(S).

7. Define the cartetion product of two set and give example.
The cartetion product of two set A and B is denoted as A x B, is the set of all possible ordered pairs where the elements of A are first and the element of B are second.
Example :- $A = \{1, 2\}$ $B = \{P, 9, \gamma\}$

$A \times B = \{(1,P), (1,9), (1,\gamma), (2,P), (2,9), (2,\gamma)\}$

8 Define the Complement and Relative Compliment of a set. Give example.
denoted by A^c and A' is the set of All the element except A.
A' is $U - A$

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Example:- A = {1, 2} B = {P, 9, r}

A x B = {(1, P), (1, 9), (1, r), (2, P), (2, 9), (2, r)}

8 Define the Complement and Relative Compliment of a set. Give example.
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Ex ⇒ $U = \{1, 3, 4, 6, 7, 9, 10\}$ $A = \{4, 6, 7\}$

A' or $A^c = \{1, 3, 9, 10\}$

Relative Complement : The relative complement of A with respects to a set B, also termed the set difference of B and A, written as $B \setminus A$.

Relative Complement $(B \setminus A)$ is the set of element in B but not in A.

Ex.

9 Define union and intersection of two set. give venn diagram representation.

union : The union of two set is a new set that contains all of the elements that are in at least one of the two sets.

intersection : The intersection of two set is a new set that contains all of the elements that are in both sets (common elements).

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A.10 Define the symmetric difference of two sets.

Difference between set B denoted as A-B. A-B is the set containing elements of A except the element of B.

Ex. $A = \{1, 3, 5, 6\}$

$B = \{0, 5, 6, 7\}$. Find $A \Delta B$

$A \setminus B = \{1, 3, 5, 6\} \setminus \{0, 5, 6, 7\}$

$= \{1, 3\}$

$B \setminus A = \{0, 5, 6, 7\} \setminus \{1, 3, 5, 6\}$

$= \{0, 7\}$.

Formula = $A \Delta B = (A \setminus B) \cup (B \setminus A)$

$= \{1 3\} \cup \{0, 7$

$\therefore A \Delta B = \{1, 3, 0, 7\}$

A-11 Given that $\mathcal{U} = \{1, 2, \ldots 10\}$, $A = \{1, 2, 3, 4, 5\}$,

$B = \{1, 2, 4, 8\}$ $C = \{1, 2, 3, 5, 7\}$, $D = \{2, 4, 6, 8\}$

Find each of the following.

* $(A \cup B) \cap C = \{\{1, 2, 3, 4, 5\} \cup \{1, 2, 4, 8\} \cap \{1, 2, 3, 5, 7\}$

$= \{1, 2, 3, 4, 5, 8\} \cap \{1, 2, 3, 5, 7\}$

$= \{1, 2, 3, 5\}$

* $(A \cup (B \cap C) = \{1, 2, 3, 4, 5\} \cup [\{1, 2, 4, 8\} \cap \{1, 2, 3, 5, 7\}$

$= \{1, 2, 3, 4, 5\} \cup \{1, 2\}$

$= \{1, 2, 3, 4, 5\}$

* $C' \cup D' = \{4, 6, 8, 9, 10\} \cup \{1, 3, 5, 7, 9, 10\}$

$= \{1, 3, 4, 5, 6, 7, 8, 9, 10\}$

* $(C \cup D)' = (C \cup D)^c$

$= \{1,2,3,4,5,6,7,8\}'$

$= \{9,10\}$

* $(A \cup B) - C = \{1,2,3,4,5,8\} - \{1,2,3,5,7\}$

$= \{4,8\}$

* $A \cup (B - C) = \{1,2,3,4,5\} \cup \{4,8\}$

$= \{1,2,3,4,5,8\}$

* $(B - C) - D = \{4,8\} - \{2,4,6,8\}$

$= \{\}$

$= \phi$

* $B - (C - D) = \{1,2,4,8\} - \{1,3,5,7\}$

$= \{2,4,8\}$

* $(A \cup B) - (C \cap D) = \{1,2,3,4,5,8\}$

$(C \cap D) = \{2\}$

$(A \cup B) - (C \cap D) = \{1,2,3,4,5,8\} - \{2\}$

$= \{1,3,4,8,5\}$.

12 which of these sets is finite?

a. $\{x \mid x \text{ is even}\}$ infinite
b. $\{x \mid x < 5\}$ infinite
c. $\{1, 2, 3, \ldots\}$ infinite
d. $\{1, 2, 3 \ldots 999, 1000\}$ finite

Hence, $\{1, 2, 3, \ldots 999, 1000\}$, {d} is finite set.

13 which of these set is not null set.

$A = \{x \mid 6x = 24 \text{ and } 3x = 1\}$
$B = \{x \mid x + 1 = 10\}$.
$C = \{x \mid x \text{ is a man older than 200 years}\}$
$D = \{x \mid x < x\}$.

=) $A = \{x \mid 6x = 24 \text{ and } 3x = 1\}$

$6x = 24$

$x = \frac{24^4}{6}$ $\quad x = \frac{1}{3}$

$\therefore A = \{4, 1/3\}$.

=) $B = \{x \mid x + 1 = 10\}$.

$\therefore B = \{9\}$.

=) $C = \{x \mid x \text{ is a man older than 200 years}\}$.

possible that there is some person have age 200.

So it is not null set.

=) $D = \{x \mid x < x\}$.

x is not less than itself.

So, here A, B and C are not a null set / empty set / void set.

14. let consider $U = \{1, 2, 3 \ldots 8, 9\}$, $A = \{1, 3, 5, 7\}$ then find A', $(A')'$, $A' \cap (A') \cup A')$.

$A' = U - A = \{2, 4, 6, 8\}$.

$(A')' = A = \{1, 3, 5, 7\}$.

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

$= A' \cap A'$

$= A'$

$= \{2, 4, 6, 8\}$.

15. If $U = \{1, 2, \ldots \ldots 15\}$, $A = \{1, 2, 3, \ldots 8, 9\}$ and $B = \{3, 5, 7, 9\}$ then find $A \cup B$, $A \cap B$, A', B', $(A \cup B)'$, $(A \cap B)'$, $A' \cup B'$ $A' \cap B'$, $A - B$, $A' - B$, $A \Delta B$, $A \cup B \cap A'$, $(A \Delta B)'$

$A \cup B = A = \{1, 2, 3, 4, \ldots \ldots 9\}$.

$A \cap B = B = \{3, 5, 7, 9\}$.

$A' = \{10, 11, 12, 13, 14, 15\}$

$B' = \{1, 2, 4, 6, 8, 10, \ldots 15\}$

$(A \cup B)' = (A)' = \{10, 11, 12, 13, 14, 15\}$

$(\because A \cup B = A)$

$(A \cap B)' = (B)' = \{1, 2, 4, 6 \ldots 15\}$

$(\because A \cap B = B)$.

$A - B = \{1, 2, 4, 6, 8\}$

$A' - B = A' = \{10, 11, 12, 13, 14, 15\}$

$A \Delta B = (A \cup B) - (A \cap B)$

$= A - B$

$= \{1, 2, 4, 6, 8\}$

$A \cup B \cap A' = A \cap A'$

$= \phi$

$(A \Delta B)' = \{3, 5, 7, 9, 10, 11 \ldots\ldots 15\}$

16 Verify with example.

$U = \{1, 2, 3, \ldots\ldots 15\}$

$A = \{1, 2, 3, 4, 5\}$

$B = \{1, 2, 4, 8\}$

$C = \{1, 2, 3, 5, 7\}$

$D = \{2, 4, 6, 8\}$

* $(A \cup B)' = A' \cap B'$ (De' morgans law)

$LHS = (\{1, 2, 3, 4, 5\} \cup \{1, 2, 4, 8\})$

$= \{1, 2, 3, 4, 5, 8\}'$

$= \{6, 7, 9, 10\}$

$R.H.S = \{6, 7, 8, 9, 10\} \cap \{3, 5, 6, 7, 9, 10\}$

$= \{6, 7, 9, 10\}$

$\therefore$ L.H.S = R.H.S

* $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$

L.H.S $= (A \cup B) \cap C$
$= (\{1,2,3,4,5\} \cup \{1,2,4,8\}) \cap \{1,2,3,5,7\}$
$= \{1,2,3,4,5,8\} \cap \{1,2,3,5,7\}$
$= \{1,2,3,5\}$

R.H.S $= (A \cap C) \cup (B \cap C)$
$= (\{1,2,3,4,5\} \cap \{1,2,3,5,7\}) \cup (\{1,2,4,8,\} \cap \{1,2,3,5,7\})$
$= \{1,2,3,5\} \cup \{1,2\}$
$= \{1,2,3,5\}$

$\therefore$ L.H.S = R.H.S

* $(A')' = A$

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

* $A \cup \phi = A$
$= \{1,2,3,4,5\} \cup \{\}$
$= \{1,2,3,4,5\}$

* $A \cap \phi = \phi$
$= \{1,2,3,4,5\} \cap \{\}$
$= \phi$

* $A \cup U = U$ and $A \cap U = A$
$= \{1,2,3,4,5\} \cup \{1,2,\ldots 10\}$
$= \{1,2,3,4,\ldots,10\}$

$A \cap U = \{1,2,3,4,5\} \cap \{1,2,3,4,\ldots,10\}$

$= \{1,2,3,4,5\}$

* $A \cup A' = U$

L.H.S $= A \cup A'$

$= \{1,2,3,4,5\} \cup \{6,7,8,9,10\}$

$= \{1,2,3,4,5,6,7,8,9,10\}$

$= U$

$=$ R.H.S

* $A \cap A' = \phi$

L.H.S $= A \cap A'$

$= \{1,2,3,4,5\} \cap \{6,7,8,9,10\}$

$= \{\}$

$= \phi$

$=$ R.H.S

* $(A \cap B) \cup C = (A \cup C) \cap (B \cup C)$

L.H.S $= (A \cap B) \cup C$

$= (\{1,2,3,4,5\} \cap \{1,2,4,8\}) \cup \{1,2,3,5,7\}$

$= \{1,2,4\} \cup \{1,2,3,5,7\}$

$= \{1,2,3,4,5,7\}$

R.H.S $= (A \cup C) \cap (B \cup C)$

$= \{1,2,3,4,5\} \cup \{1,2,3,5,7\} \cap$

$\{1,2,4,8\} \cup \{1,2,3,5,7\}$

$= \{1,2,3,4,5,7\} \cap \{1,2,3,4,5,7,8\}$

$= \{1,2,3,4,5,7\}$

L.H.S $=$ R.H.S

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* $A \cup U' = U$

$= A \cup U'$

$= \{1,2,3,4,5\} \cup \{1,2,3\ldots,10\}'$

$= \{1,2,3,4,5,6,7,8,9,10\}$

* $A \cap \phi' = \phi$

$= A \cap \phi'$

$= A \cap U \quad (\because \phi' = U)$

$= \phi.$