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CLASS ID :- 15889
SUBJECT :- DISCRETE STRUCTURE
PROGRAM: BS(SE) 2ND SEMESTER

## Question No 4:-

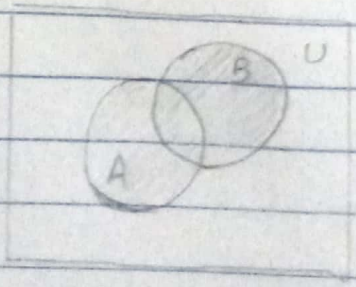
Q4 a) Explain the concept of Union, also explain also explain membership table for union by giving proper example of truth table.

### UNION:-

In set theory, the union denoted by $\cup$ of a collection of sets is the set of all elements in the collection. It is one of the fundamental operations through which sets can be combined and related to each other

Let A and B are two sets
A and B are subsets of universal set U
The union of A and B is the set of all elements in U that belong to A or to B or both
It is denoted by $A \cup B$
$A \cup B = \{x \in U \mid x \in A \text{ or } x \in B\}$
Union is commutative: $A \cup B = B \cup A$
$A \subseteq A \cup B$ and $B \subseteq A \cup B$

**EXAMPLE** : Let $U = \{1, 2, 3, 4, 5, 6, 7\}$
$A = \{1, 4, 6, 7\}$, $B = \{2, 3, 5\}$
$A \cup B = \{1, 2, 3, 4, 5, 6, 7\}$




$A \cup B$ is shaded

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## MEMBER SHIP TABLE FOR UNION

Member ship truth table for disjunction of two statements P and Q

Member ship table for union of sets X and Y is

Union replace 1 by True and 0 by False

| X | Y | X∪Y |
|---|---|---|
| 1 | 1 | 1 |
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 0 | 0 | 0 |

| P | Q | P∨Q |
|---|---|---|
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | F |

Q4 b Explain the concept of intersection also explain membership table for intersection by using proper example of truth table.

## INTERSECTION:-

The intersection of two sets A and B denoted by $A \cap B$ is the set containing all elements of A that also belong to B or all elements of B that also belong to A.

Intersection is written using the sign "$\cap$"

$A \cap B = \{x \in U \mid x \in A \text{ and } x \in B\}$

Intersection is commutative $A \cap B = B \cap B$

$A \cap B \subseteq A$ and $A \cap B \subseteq B$

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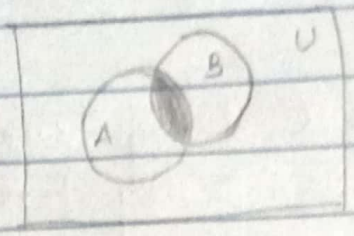
**EXAMPLE:-** Let $U = \{1, 2, 3, 4, 5, 6, 7\}$

$A = \{1, 3, 5, 6\}$, $B = \{2, 3, 5, 6, 7\}$

$A \cap B = \{3, 5, 6\}$.




$A \cap B$ is shaded.

## MEMBER SHIP TABLE FOR INTERSECTION

The truth table for conjunction of two statements P and Q is

Membership table for intersection of set X and Y is

Membership table of Intersection

1 is True

0 is False

| X | Y | $X \cap Y$ |
|---|---|---|
| 1 | 1 | 1 |
| 1 | 0 | 0 |
| 0 | 1 | 0 |
| 0 | 0 | 0 |

| P | Q | $P \wedge Q$ |
|---|---|---|
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | F |

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## Question No 1:-

Q1 a) Explain the concept of Biconditional statement?

## BICONDITIONAL STATEMENT:-

A biconditional statement is defined to be true whenever both parts have the same truth value. The biconditional operator is denoted by a double headed arrow $\leftrightarrow$. The biconditional $p \leftrightarrow q$ represents "p if and only if q." where p is a hypothesis and q is a conclusion. The truth table of biconditional $p \leftrightarrow q$

| p | q | $p \leftrightarrow q$ |
|---|---|---|
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | T |

In truth table $p \leftrightarrow q$ is true when p and q have the same truth values when either both are true or both are false.

Q1 b let p, q and r represent the following statements

p: Sam had pizza last night.
q: Chris finished her homework.
r: Pat watched the news this morning.
Give a formula (using appropriate symbols) for each of these statements

i Sam had pizza last night if and only if Chris finished her homework $p \leftrightarrow q$.

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b) Pat watched the news this morning if Sam did not have pizza last night. $r \leftrightarrow \neg p$.

c) Pat watched the news this morning if and only if Chris finished her homework and Sam did not have pizza last night.

$(r \leftrightarrow q \wedge \neg p)$

d) In order for Pat to watch the news this morning it is necessary and sufficient that Sam had pizza last night and Chris finished her homework. $r \leftrightarrow (p \wedge q)$

## Question No 3:-

Q3 Explain Argument with proper examples. Differentiate valid and Invalid argument through proper examples. also construct a truth table showing valid and Invalid arguments?

### ARGUMENT:-

An argument is a sequence of propositions called premises followed by a propositions called conclusion.

$P_1$ Premise
$P_2$ Premise
---
$P_n$ Premise
$\therefore$ c Conclusion

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## EXAMPLE

"If it rains, I drive to school."
"It rains."
∴ "I drive to school."

## DIFFERENCE BETWEEN VALID & INVALID ARGUMENT

### VALID ARGUMENT

A valid argument is one that, if all its premises are true, then the conclusion is true

If a valid arguments form consists

-premises : $P_1, P_2, \cdots P_k$

-conclusion : $q$

then $(P_1 \wedge P_2 \wedge \cdots \wedge P_k) \rightarrow q$ is a tautology

Eg. $((p \rightarrow q) \wedge p) \rightarrow q$ is a tautology

**EXAMPLE:-** Following argument form is valid

$\sim p \rightarrow$, where c is a contradiction

$\therefore p$

Truth table for the premise and the conclusion of this argument.

### INVALID ARGUMENT

Argument is invalid if the conclusion is false when all the premises are true or if conjunction of its premises does not imply conclusion

$(P_1 \wedge P_2 \wedge P_3 \wedge \cdots \wedge P_n) \rightarrow$ C is a Contradiction.

**EXAMPLE:-** Following argument form is invalid

$p \rightarrow q$

$q$

$\therefore p$

SOLUTION

| | | premises | | conclusion |
|---|---|---|---|---|
| p | q | p→q | q | p |
| T | T | T | T | T |
| T | F | F | F | T |
| F | T | T | T | F |
| F | F | T | F | F |

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| | | | premises | conclusion |
|---|---|---|---|---|
| p | ~p | c | ~p→c | p |
| T | F | F | T | T |
| F | T | F | F | |

There is only one critical row in which the premise is true and in this row the conclusion is also true Hence this argument is valid.

## TRUTH TABLE SHOWING VALID & INVALID ARGUMENTS

"If my computer crashes, I'll lose all my photos. I haven't lost all my photos. Therefore my computer hasn't crashed."

Premises

p→q: If my computer crashes, I'll lose all my photos

~q: I haven't lost all my photos

Conclusion

~p: My computer hasn't crashed

Argument:

$$[(p \rightarrow q) \wedge \sim q] \rightarrow \sim p$$

| p | q | ~p | ~q | p→q | (p→q)∧~q | [(p→q)∧~q]→~p |
|---|---|---|---|---|---|---|
| T | T | F | F | T | F | T |
| T | F | F | T | F | F | T |
| F | T | T | F | T | F | T |
| F | F | T | T | T | T | T |

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## Question No 5

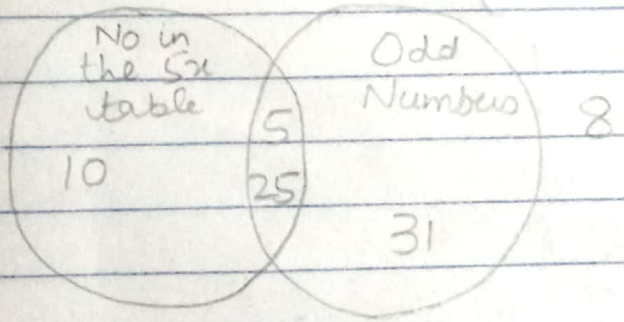
a) Explain the concept of Venn diagram with examples.

### VENN DIAGRAM:-

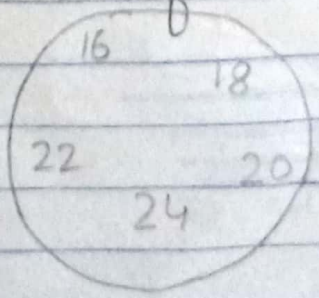
A venn diagram is an illustration of the relationships between and among sets, groups of objects that share something in common. The drawing is an example of a Venn diagram that show the relationship among three overlapping sets X, Y and Z. The intersection reldion is defined as the equivalent of the logic AND

### EXAMPLE

10 5 25 31 8




b) Given the set P is the set of even numbers between 15 and 25. Draw and label a Venn represent the set P and indicate all the elements of set P in the Venn diagram?



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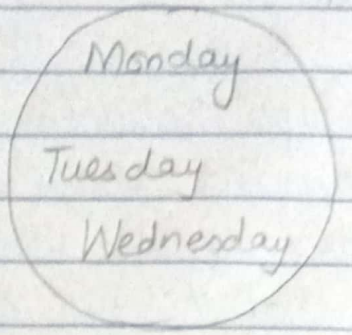
c) Draw and label a Venn diagram to represent the set

R = {Monday, Tuesday, Wednesday}




d) Given the set Q = {x: 2x - 3 < 11, x is a positive integer} Draw and label a Venn diagram to represent the set Q.

$2x - 3 < 11$

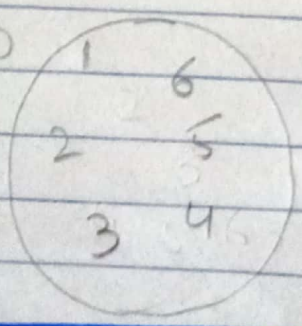
$2x < 11 + 3$

$2x < 14$

$x < \frac{14}{2}$

$x < 7$

Q = {1, 2, 3, 4, 5, 6}



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## Question No 2:-

a) let p, q, r represent the following statements

p: It is hot today

q: It is sunny

r: It is raining

Express in words the statements using Biconditional statement represented by the following formulas

① $q \Leftrightarrow p$

It is sunny if and only if it is hot today.

② $p \Leftrightarrow (q \wedge r)$

It is hot today if and only if it is sunny or it is raining

③ $p \Leftrightarrow (q \vee r)$

It is hot today if and only if it is sunny and raining

④ $r \Leftrightarrow (p \vee q)$

It is raining if and only if it is is sunny or hot today.