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FINAL TERM Paper

Course : Discrete Structure
Program : B.S (SE) (SecA)
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Q1#(a) Explain the Concept of Bio-con-
-ditional Statement.

Ans: A Bio-conditional Statement is a Statement that contains the phrase "if and only if" writing bio conditional Statement is equivalent to writing a conditional Statement and its converse.

A bio-conditional state-ment can be either true or false. To be True, both the conditional State-ment and its converse must be true. This means that a true bio-condition-al Statement is true both "forward and backward". All definations can be written as true biconditional Statements.

Let p and q be propositions. The biconditional statement $p \leftrightarrow q$ is the proposition "p if and only if q" which is true when p and q have the same truth values, and is false otherwise.

$p \leftrightarrow q$ has the same truth value as $(p \rightarrow q) \wedge (q \rightarrow p)$:

- Example:- Let p be the statement "Shape is a triangle" and let q be the statement "It has exactly three sides."

  $p \leftrightarrow q$:

  "Shape is a triangle if and only if it has exactly three sides."

  $(p \rightarrow q) \wedge (q \rightarrow p)$

- The Truth Table for the Bio-conditional $p \leftrightarrow q$:

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

"p is necessary and sufficient for q"
"If p then q and conversely".

- How to Write A Bio-conditional Statement:

The general form (For goats, geometry or lunch) is;

- Hypothesis if and only if conclusion.

Because statement is bio-conditional (conditional in both directions), we can also write it this way, which is the converse statement

- Conclusion if and only if hypothesis.

We can create two biconditional statements. If conditional statements are one way streets, biconditional statements are the two way streets of logic

Conditional:

If any I have a triangle, then my polygon has only three sides (true).

Conditional:

If I have a triangle, then my polygon has only three sides (true).

Converse:
If my polygon has only three sides, then I have a triangle (true).

Since both statements are true, we can write two bio-conditional statements.

I have a triangle if and only if my polygon has only three sides (true)

My polygon has only three sides if and only if i have a triangle. (True).

You can do this if only if both conditional and converse statements have the same truth value. They could both be fake and you could still write a true bio-conditional statement ("My pet goats draws polygons if and only if my pets goat buys and supplies online.

Conditional:
If I have a pet goat, then my homework will be eaten (true).

Converse :
If my homework is eaten, then I have a pet goat. (False)

We can attempt, but fail to write, logical bioconditional Statements, but they will not make Sense
I have a pet goat if and only if my homework is eaten)
(not true)

My homework will be eaten if and only if i have a pet goat. (not true).

• Bioconditional Statement symbols :
you may recall that logic Symbols can replace words in statements. So the conditional Statement. If I have a pet goat, then my home work gets eaten! can be replaced with a p for the hypothesis, a q for the conclusion, and a → for the connector $p \rightarrow q$.

for bio-conditional Statements, we use a double arrow, ⟺, Since the truth works in both.

- Bioconditional Statement Examples:

We still have several conditional geometry statements and their converses from above.

- Conditional: If the polygon has only four sides, then the polygon is a quadrilateral. (true).
- Converse: if the polygon is a quadrilateral, then the polygon has only four sides (true).
- Conditional: If the quadrilateral has four congruent sides and angles, then the quadrilateral is a square (True).
- Converse: If the quadrilateral is a square, then the quadrilateral has four congruent sides and angles (true).

The bio-conditional statements for these two sets would be.

- The polygon has only four sides if and only if the polygon is a quadrilateral.

- The polygon is a quadrilateral if and only if the polygon has only four sides.
- The quadrilateral has four congruent sides and angle if and only if the quadrilateral is a Square.
- The quadrilateral is a Square if and only if the quadrilateral has four congruent sides and angle.

Q# 1
part 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 home work.
ii- Pat watched the news this morning iff Sam did not have pizza last night.
iii- Pat watched the news this morning if and only if Chris finished her homework and Sam did not have pizza last night.
iv- In order for Pat to watched the news this morning, it is necessary and Sufficient that Sam had pizza last night and Chris finished her home-work.

Answer:

i- $q \leftrightarrow r$

ii - $p \leftrightarrow (q \wedge r)$

iii. $(\neg p) \leftrightarrow (q \vee r)$

iv - $r \leftrightarrow (p \vee q)$

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

Ans: **Arguments:**

A Logical argument is a claim that a set of premises support a conclusion. There are two general types of Arguments: inductive and deductive arguments

- **Argument Types:**

An Inductive argument uses a collection of specific examples as its premises and uses them to propose a general conclusion.

- A Deductive argument uses a collection of general statements as its premises and uses them to propose a specific situation as the conclusion.

- Valid:

An Argument is valid if and only if it is necessary that if all of the premises are true, then the conclusion is true; if all the premises are true, then the conclusion must be true, it is impossible that all the premises are true and the conclusion is false.

- Example:

Valid, but false argument.

- All humans are immortal.
- Steve is a human.
- Steve is immortal.

- Invalid:

An Argument that is not valid. We can test for invality by assuming that all the premises are true and seeing whether it is still possible for the conclusion to be false. If this is possible, the argument is invalid.

- Example:

Invalid Argument

- If you are a criminal, you go in jail
- You are not criminal
- therefore you are not in jail.

- Example valid Argument.
  Consider the argument:
  - Premise:
    If you bought bread, then you went to the store.
  - Premise:
    You bought bread.
  - Conclusion:
    You went to the store.

While this Example is hopefully fairly obviously a valid argument, we can analyze it using a truth table by representing each of the premises symbolically. We can then look at the implication that the premises together imply the conclusion if the truth table is a tautology (always true), then the argument is valid.

We'll get B represent

"you bought bread" and S represent "you went to the store" the the argument becomes:

Premise $B \rightarrow S$
Premise B
Conclusion S

To test the validity, we look at whether the combination of both premises implies the conclusion; is it true that $[(B \rightarrow S) \wedge B] \rightarrow S$?

B	S	$B \rightarrow S$	$(B \rightarrow S) \wedge B$	$[(B \rightarrow S) \wedge B] \rightarrow S$
T	T	T	T	T
T	F	F	F	T
F	T	T	F	T
F	F	T	F	T

Since, the truth table for $[(B \rightarrow S) \wedge B] \rightarrow S$ is always true; this is a valid argument.

Valid Argument.

- Example Invalid Argument Q

Finally, we find the value of A and ~(B V C)

A	B	C	B V C	~(B V C)	A ∧ ~(B V C)
T	T	T	T	F	F
T	T	F	T	F	F
T	F	T	T	F	F
T	F	F	F	T	T
F	T	T	T	F	F
F	T	F	T	F	F
F	F	T	T	F	F
F	F	F	F	T	F

Its turns out that this complex expression is only true in one case. If A is true, B is false, and C is false.

Q#4
part a

Explain the concept of union, also Explain membership table for union by giving a proper Example of truth table:

Ans: UNION:

In set theory, the union (denoted by U) 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. for Explanation of the symbols used in this article, refer to the table of mathematical symbols.

Membership table:

A	B	AUB
1.	1	1
1	0	1
0	1	1
0	0	0

We combine set in much the same way that we combined

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prepositions. Asking if an element x is in the resulting set is like asking if a proposition is true.. Note that x could be in any of the originals sets.

Q.21 Part b Explain the concept of Intersection, also Explain membership table for Intersection by using proper Example truth table.

Ans: **Intersection:**

Intersection of two given sets is the largest set which contains all the elements that are common to both the sets.

To find the Intersection of two given sets A and B which consists of all the elements which are common to both A and B.

- **Membership Table:**

We combine sets in much the same way that we combined propositions. Asking if an element x is in the resulting set is like asking if a proposition is true. Note that x could be in any of the originals sets.

A	B	A ∩ B
1	1	1
0	1	0
1	0	0

Q#5

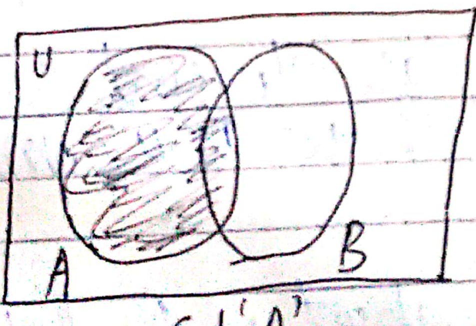
Part(a)

(a)- Explain the concept of venn diagram with Examples.

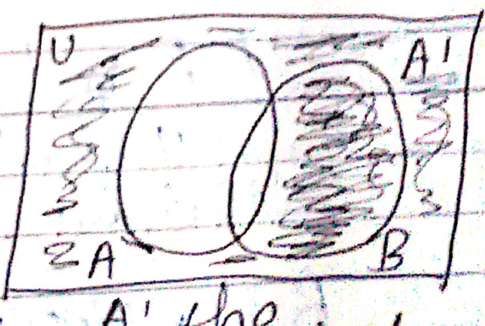
Ans:- A Venn Diagram is a pictorial representation of the relationships between Sets.

We can represent sets using venn diagrams. In a venn diagram, the sets are represented by shapes; usually Circles or ovals. The elements of a set are labeled with in the circle.

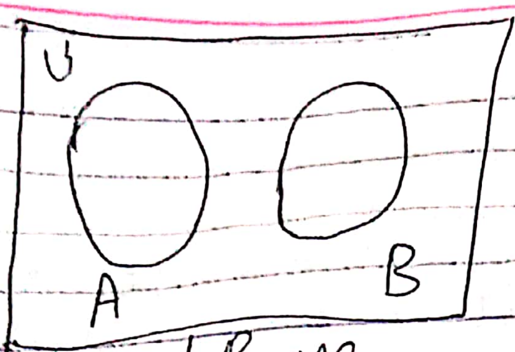
The following diagrams show the set operations and venn diagrams for complement of a set, Disjoint Sets, Sub-sets, Intersection and Union of Sets. Scroll down the page for more examples and Solutions.



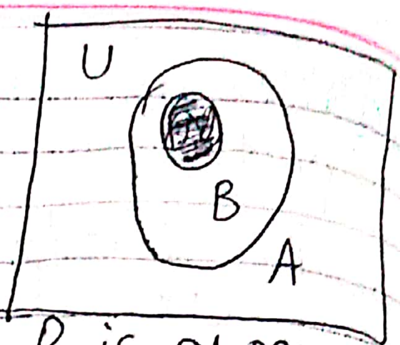
Set 'A'



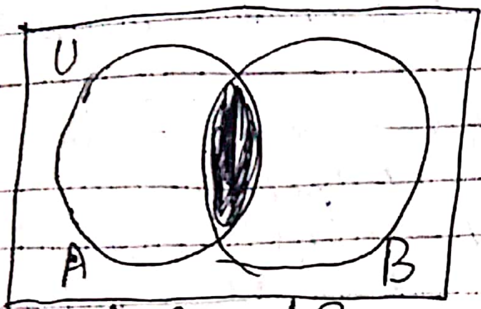
A' the Complement of A



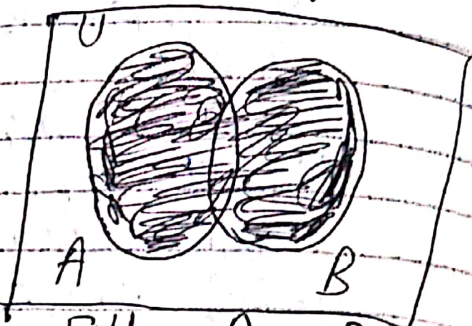
A and B are disjoint sets.



B is proper
$B \subset A$
Subset of 'A'.



Both A and B
$A \cap B$ A intersect B



Either A or B
A Union B $A \cup B$.

The Set of all elements being considered is called the Universal Set (U) and is represented by a rectangularLe.

The complement of A, A', is the set of element in U but not in A. $A' = \{x \mid x \in U \text{ and } x \notin A\}$.

Set A and B are disjoint sets if they do not share any common elements.

B is a proper Subset of A. This means B is a Subset of A, but $B \neq A$

The intersection of A and B is the set of elements in both set A and B. $A \cap B = \{x \mid x \in A \text{ and } x \in B\}$.

The Union of A and B is the set of elements in set A or set B.
$A \cup B = \{x \mid x \in A \text{ or } x \in B\}$

$A \cap \emptyset = \emptyset$.

A

$A \cap \emptyset = A$

1110 = A.

Part B Example; → Part b Q no 5 (2)

Given the set P is the set of even numbers between 15 and 25. Draw and label a venn diagram to represent the set P and indicate all the elements of set P in the venn diagram.

Solution:

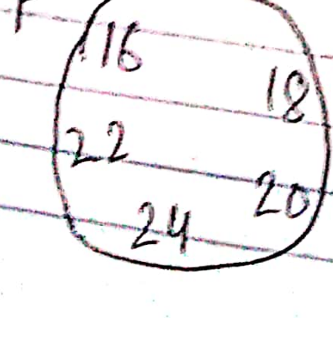
Listen out the elements of P.

P = {16, 18, 20, 22, 24} ← between

does not include 15 and 25.

Draw a circle or oval. Label it P

Put the element in P.



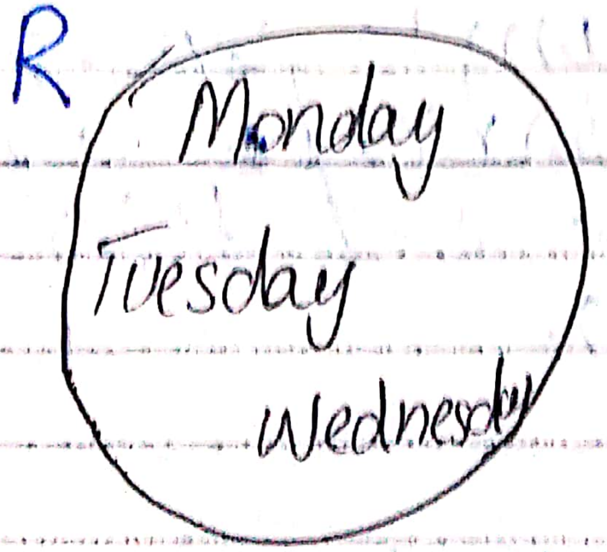
Part C

c: Draw and label a venn diagram to represent the Set

$R = \{$Monday, Tuesday, Wednesday$\}$.

Sol:

Draw a circle or oval. Label it R. Put the elements R.



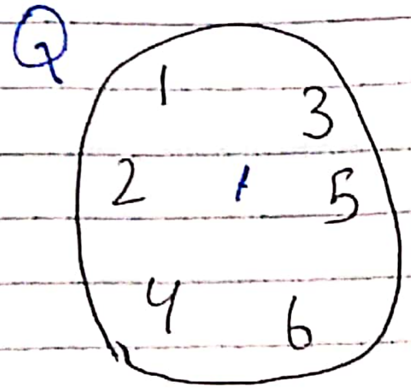
Part d

D). Given the Set $Q = \{x : 2x - 3 < 11, x \text{ is a positive integer}\}$. Draw and label a venn diagram to represent the Set Q.

Sol

Since an equation is given, we need to first solve for X.

$2x - 3 < 11 \Rightarrow 2x < 14 \Rightarrow X < 7$



So, $Q = \{1, 2, 3, 4, 5, 6\}$

Draw a circle a oval label it Q.
Put the Element in Q.

Q# 2

Ans

(i) $q \leftrightarrow p$

p	q	$q \leftrightarrow p$
T	T	T
T	F	F
F	T	F
F	F	T

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

p	q	r	$q \wedge r$	$p \leftrightarrow (q \wedge r)$
T	T	T	T	T
T	T	F	F	F
T	F	T	F	F
T	F	F	F	F
F	T	T	T	F
F	T	F	F	T
F	F	T	F	T
F	F	F	F	T

iii- $p \leftrightarrow (q \vee r)$

p	q	r	$q \vee r$	$(p \leftrightarrow (q \vee r))$
T	T	T	T	T
T	T	F	T	T
T	F	T	T	T
T	F	F	F	F
F	T	T	T	F
F	T	F	T	F
F	F	T	T	F
F	F	F	F	T

iv- $r \leftrightarrow (p \vee q)$.

p	q	r	$p \vee q$	$r \leftrightarrow (p \vee q)$
T	T	T	T	T
T	T	F	T	F
T	F	T	T	T
T	F	F	T	F
F	T	T	T	T
F	T	F	F	T
F	F	T	T	T
F	F	F	F	T