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Section - “B”

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Paper - Discrete Structure

Q.1 a) Explain the concept of Biconditional statement.

(ANSWER)

Bioconditional statement:-

- The biconditional statement of p and q “p if, and only if, q” where p is hypothesis and q is a conclusion.
- Biconditional is denoted by by double head arrow(↔).
- A Biconditional statement is defined to be true whenever both parts have the same truth value and false if p and q have opposite truth values.
- The "if and only if" connective is represented by this symbol: ↔
- ↔ is the biconditinal operator.

TRUTH TABLE FOR THE BICONDITIONAL STATEMENT:-

P	Q	$P \leftrightarrow Q$
T	T	T
T	F	F
F	T	F
F	F	T

Example:-

Atlanta isn't in Georgia if and only if 1 + 1 = 2.

This statement has the form "p if and only if q," where p (Atlanta isn't in Georgia) is a false statement while q ("1 + 1 = 2") is a true statement. Since the two components of this biconditional statement have opposite truth values, the statement is FALSE.

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 statement.

i. **Sam had pizza last night if and only if Chris finished her homework.**
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 watch the news this morning, it is necessary and sufficient that Sam had pizza last night and Chris finished her homework**

(ANSWER)

(a) Sam had pizza last night and Chris finished her homework.
(b) Chris did not finish her homework and Pat watched the news this morning.
(c) Sam did not have pizza last night or Chris did not finish her homework.
(d) Either Chris finished her homework or Pat watched the news this morning, but not both.

Q.2 a) Lets 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 Bicondtional statement represented by the following formulas:

i. $q \leftrightarrow p$
ii. $p \leftrightarrow (q \wedge r)$
iii. $p \leftrightarrow (q \vee r)$
iv. $r \leftrightarrow (p \vee q)$

(ANSWER)

1)it is sunny and hot today. Since both the statement are true the biconditional $q \leftrightarrow p$ is true.

2) it is hot today but it is sunny and raining. Since the both the statement are opposite $p \leftrightarrow (q \wedge r)$ is false.

3) it is hot today but it is sunny or raining since both the statement can be same or opposite $p \leftrightarrow (q \vee r)$ can be true or false.

4)It is raining but it is sunny and hot today both the statement are opposite $r \leftrightarrow (p \vee q)$ so it is false

Q.3 a) Explain Argument with proper examples. Differentiate Valid and Invalid argument through proper examples, also construct a truth table showing valid and invalid arguments. (Note: Examples and truth table should not belongs to your book or slides).

(ANSWER)

Argument:-

Argument is a list of statements (premises or assumptions or hypotheses) followed by the statement (conclusion).

In logic and philosophy, an argument is a series of statements (in a natural language), called the premises or premisses (both spellings are acceptable), intended to determine the degree of truth of another statement, the conclusion.

To explain an argument is to see to it that your reader fully understands the argument you have just presented. The best and most clear way to explain an argument is to do two things for each premise of the argument:

(i) **define any technical terms that appear in the premise.**
(ii) **give the rationale for the premise.**

Example:-

No, you can't go to a concert on a school night.
But all my friends are going!
And if all your friends jumped off a bridge would you do that too?

Valid Arguments:-

A deductive argument is said to be valid if and only if it takes a form that makes it impossible for the premises to be true and the conclusion nevertheless to be false. ... In effect an argument is valid if the truth of the premises logically guarantees the truth of the conclusion.

Argument is valid if the conclusion is true when all the premises are true or if conjunction of its premises imply conclusion.
$(P1 \land P2 \land P3 \land \ldots \land Pn) \rightarrow C$ is a tautology.

Example:-

If there is an earthquake, the detector will send a message.
No message has been send.

So there was no earthquake.

Truth table for valid argument:-

S	G	S–>G	S	G
T	T	T	T	T
T	F	F	T	F
F	T	T	F	T
F	F	T	F	F

Invalid Argument:-

An invalid argument is a argument in which the premises do not provide conclusive reasons for the conclusion.

Argument is invalid if the conclusion is false when all the premises are true or if conjunction of its premises does not imply conclusion.
$(P1 \wedge P2 \wedge P3 \wedge \ldots \wedge Pn) \rightarrow C$ is a Contradiction.

Example:-

Whenever Anil is here, kumar is also here.
Anil is not here.
So kumar is not here.

Truth table for invalid argument:-

S	G	S–>G	G	S
T	T	T	T	T
T	F	F	F	T
F	T	T	T	F
F	F	T	F	F

Q.4 a) Explain the concept of Union, also explain membership table for union by giving proper example of truth table.

(ANSWER)

Union:-

union is an organization formed by workers who join together and use their strength to have a voice in their workplace. Through their union, workers have the ability to negotiate from a position of strength with employers over wages, benefits, workplace health and safety, job training and other work-related issues. Unions also serve an important role making sure that management acts fairly and treats its workers with respect.

Unions are democratic organizations and its leaders are elected by the membership.

Membership table for union:-

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

b) Explain the concept of Intersection, also explain membership table for Intersection by using proper example of truth table. (Note: Examples and truth table should not belongs to your book or slides).

Intersection:-

The **intersection** of 2 sets AA and BB is denoted by A \cap B$A \cap B$. This is the set of all distinct elements that are in both AA and BB. A useful way to remember the symbol is intersection. We define the intersection of a collection of sets, as the set of all distinct elements that are in all of these sets.

Membership table for intersection:-

A	B	C	B∩C	AU(B∩C)
1	1	1	1	1
1	1	0	0	1
1	0	1	0	1
1	0	0	0	1
0	1	1	1	1
0	1	0	0	0
0	0	1	0	0
0	0	0	0	0

Q5) a) Explain the concept of Venn diagram with examples.

(ANSWER)

Venn Diagrams:-

It is a graphical representation of sets by regions in the plane

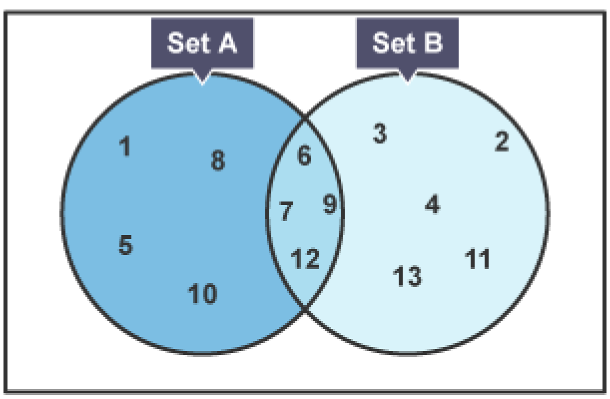
•The Universal Set is represented by the interior of a rectangle

•Other sets are represented by circles lying within the rectangle
•In Venn diagram above , sets A and B intersect each other
•In Venn diagram below, set A is totally contained in set B, so A ⊆ B

Example:-

The first Venn diagram example is in Mathematics. They are accessible when covering Sets Theory and Probability topics.

In the diagram below, there are two sets, A = {1, 5, 6, 7, 8, 9, 10, 12} and B = {2, 3, 4, 6, 7, 9, 11, 12, 13}. The section where the two sets overlap has the numbers contained in both Set A and B, referred to as the intersection of A and B. The two sets put together, gives their union which comprises of all the objects in A, B which are {1 2 3 4 5 6 7 8 9 10 11 12 13}.



b) 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.

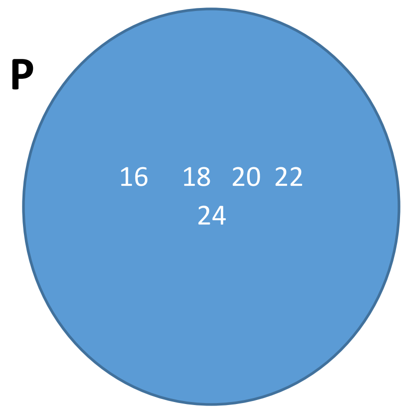
(ANSWER)

Solution:-

List 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.

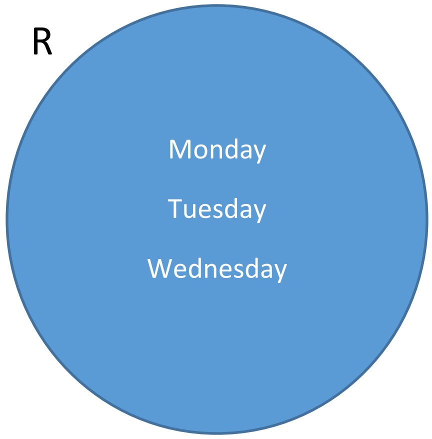


c) Draw and label a Venn diagram to represent the set R = {Monday, Tuesday, Wednesday}.

(ANSWER)

Solution:-

Draw a circle or oval. Label it R. put the element in R.



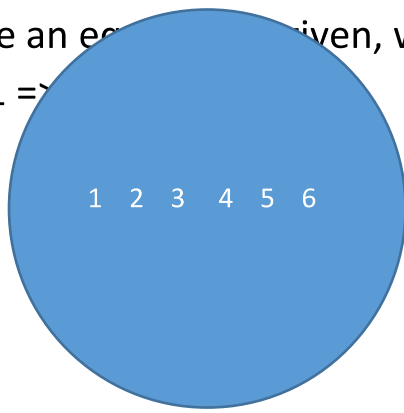
d) Given the set *Q* = {*x* : 2*x* – 3 < 11, *x* is a positive integer }. Draw and label a Venn diagram to represent the set *Q*.

(ANSWER)

Solution:-

Since an e… …iven, we need to first solve for x.

2x-3<11 =>…



So Q =(1,2,3,4,5,6)

Draw a circle or oval it. Label it Q.

Put the elements in Q.

(the end)