"MID TERM"

Name :- Mirza Abdullah Baig
Roll no :- 04
Course :- Discrete Structure
Faculty :- Sir Mohsin
Field :- Data Science
Date :- 9 Sept, 2020

QUESTION :- 1

• DISCRETE MATHEMATICS :-

Discrete mathematics is the study of mathematical structures that are countable or otherwise distinct and separable.

for e.g.
combination, graphs and logical statements.

Scanned with CamScanner

Discrete	Continous
• Discrete mathematics is the mathematical structeres that are countable or separable.	Continous mathematics is the mathematical structures that are measurable and the change is continuous.
• Discrete data can only take certain values.	Continous data can take values any within a range.

EXAMPLES:-

• **Discrete Mathematics :-**

The results of rolling two dices only have given the certain values which are 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12.

• **Continuous Mathematics:-**

A person's height could be any value (within the range of human heights), not just certain fixed.

Scanned with CamScanner

• Define:-

1)- **Truth Table:-**

A truth table specifies the truth value of a compound proposition for all possible truth values of its constituent propositions.

2)- **Logic:-**

Logic is the study of principles of correct reasoning and foundation of a logical argument is its proposition. The proposition is either accurate (true) or not (false).

3)- **De-Morgan's Law:-**

The statements of De-Morgan's Law are following.

1)- "The negation of an AND statement is logically equivalent to the OR statement in which each component is negated.

$$\sim(p \wedge q) \equiv \sim p \vee \sim q$$

Scanned with CamScanner

3)- The negation of an OR statement is logically equivalent to the AND statement in which each component is negated.

$$\sim(p \vee q) \equiv \sim p \wedge \sim q$$

4)- Contradiction:-

A statement form that is always false, regardless of the truth values of the statements variables. A contradiction is ~~represt~~ represented by the symbol "c".

- Show that $s \to t$ and its contrapositive $\sim t \to \sim s$ are logically equivalent.

s	t	$\sim s$	$\sim t$	$\sim t \to \sim s$	$s \to t$
T	T	F	F	T	T
T	F	F	T	F	F
F	T	T	F	T	T
F	F	T	T	T	T

equal

So,

$$s \to t \equiv \sim t \sim s$$

proved.

Scanned with CamScanner

QUESTION :- 2

• Shows that proposition $q \to p$ and $\sim p \to \sim q$ is not equivalent to $p \to q$.

p	q	$\sim p$	$\sim q$	$q \to p$	$\sim p \to \sim q$
T	T	F	F	T	T
T	F	F	T	T	T
F	T	T	F	F	F
F	F	T	T	T	T

$(q \to p) \to (\sim p \to \sim q)$	$p \to q$
T	T
T	F
T	T
T	T

Not equal

So, the proposition $q \to p$ and $\sim p \to \sim q$ is not equivalent to $p \to q$.

Scanned with CamScanner

- Consider the following propositions
$\sim p \vee \sim q$ and $\sim (p \wedge q)$
are they equivalent?

p	q	$\sim p$	$\sim q$	$\sim p \vee \sim q$	$p \wedge q$	$\sim (p \wedge q)$
T	T	F	F	F	T	F
T	F	F	T	T	F	T
F	T	T	F	T	F	T
F	F	T	T	T	F	T

equal

Yes, $\sim p \vee \sim q \equiv \sim (p \wedge q)$

• Investigate whether the argument is valid or not.

If at least one of these two numbers is divisible by 6, then the product of these two numbers is divisible by 6. Neither of these two numbers is divisible by 6.

$\therefore$ The product of these two numbers is not divisible by 6.

Let,

n = at least one of these two numbers is divisible by 6.

p = product of these two numbers is divisible by 6.

Then,

$n \rightarrow p$

$\sim n$

$\therefore \sim p$

$n \rightarrow p$

Scanned with CamScanner

n	p	$n \to p$	$\sim n$	$\sim p$
T	T	T	F	F
T	F	F	F	F
F	T	T	T	T
F	F	T	T	F
		T	T	T

In the first critical row, the conclusion is false when the premises are true. Therefore, the argument is invalid.

QUESTION:- 3

- Investigate whether the argument is valid or not.

If I get a bonus, I'll buy a car
If I sell my pilot, I'll buy a car.
∴ If I get a bonus or I sell my pilot then I'll buy a car.

Let,

b = I get a bonus
c = I'll buy a car
p = I sell my pilot

Scanned with CamScanner

Then,

$b \rightarrow c$

$p \rightarrow c$

$\therefore b \vee p \rightarrow c$

b	c	p	$b \rightarrow c$	$p \rightarrow c$	$b \vee p$	$b \vee p \rightarrow c$
T	T	T	T	T	T	T
T	T	F	T	T	T	T
T	F	T	F	F	T	F
T	F	F	F	T	T	F
F	T	T	T	T	T	T
F	T	F	T	T	F	T
F	F	T	T	F	T	F
F	F	F	T	T	F	T

The conclusion of all five critical rows are true. Therefore, the statement is valid.

Scanned with CamScanner

• Investigate whether the argument is valid or not.

If you invest in stock market, then you will get rich.
If you get rich, then you will be happy.
∴ If you invest in stock market, then you will be happy.

Let,

i = invest in stock market.
r = you will get rich
h = you will be happy

Then,

$i \rightarrow r$
$r \rightarrow h$
$\therefore i \rightarrow h$

Scanned with CamScanner

i	r	h	i → r	r — h	i — h
T	T	T	T	T	T
T	T	F	T	F	F
T	F	T	F	T	T
T	F	F	F	T	F
F	T	T	T	T	T
F	T	F	T	F	T
F	F	T	T	T	T
F	F	F	T	T	T
				T	

The conclusion of all four critical rows are true. Therefore, the argument is valid.

- Investigate ($p \vee q$, $p \longrightarrow r$, $q \longrightarrow r$, $\therefore r$) is a valid argument.

p	q	r	$p \vee q$	$p \rightarrow r$	$q \rightarrow r$	r
T	T	T	T	T	T	T
T	T	F	T	F	F	F
T	F	T	T	T	T	T
T	F	F	T	F	T	F
F	T	T	T	T	T	T
F	T	F	T	T	F	F
F	F	T	F	T	T	T
F	F	F	F	T	T	F

The conclusion is true in all three critical rows. Therefore, the argument is valid.

Scanned with CamScanner

• Investigate ($p \to q$, $\therefore \sim p \to \sim q$) is a invalid argument.

p	q	$\sim p$	$\sim q$	$p \to q$	$\sim p \to \sim q$
T	T	F	F	$\boxed{T}$	$\boxed{T}$
T	F	F	T	F	T
F	T	T	F	$\boxed{T}$	$\boxed{F}$
F	F	T	T	$\boxed{T}$	$\boxed{T}$

The conclusion is false in second critical row
Therefore, the argument is invalid.

Scanned with CamScanner