

Date: _____



Name :- Muhammad Daniyal

Id NO:- 17011

Class timming:- wednesday (8:am to 11:-00am)

Subject:- Discrete mathematics

Program:- BS(CS)

1



Date: _____

Q1:- Let P be the Statement "DataEndFlage" is off" \vee the Statement "Error equals 0" and \wedge the Statement "Sum is less than thousand 1000". Express the following Sentence in Symbolic notation.

Solution:-

a:- $P \wedge q$

b:- $P \wedge \sim q$

c:- $P \wedge (\sim q \vee r)$

d:- $P \wedge (q \wedge r)$

e:- $P \vee (q \wedge r)$

Answer.

Date: _____

"Question no 1"

"Part B"

Show that

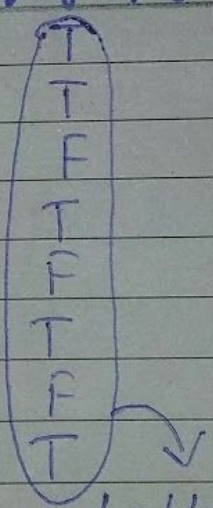
$$P \wedge Q \rightarrow R \equiv (P \rightarrow R) \wedge (Q \rightarrow R)$$

Solution:

First we take left hand side.

$$P \wedge Q \rightarrow R$$

P	Q	R	$P \vee Q \rightarrow R$
F	F	F	T
F	F	T	T
F	T	F	F
F	T	T	T
T	F	F	F
T	F	T	T
T	T	F	F
T	T	T	T



LoHoS

Date: _____

"Question no 1"
"Part B"

~~to~~ "R.H.S"

P	$\neg V$	$\neg X$	$P \rightarrow X$	$\neg V \rightarrow X$	$(P \rightarrow X) \wedge (\neg V \rightarrow X)$
F	F	F	T	T	T
F	F	T	T	T	T
F	T	F	T	F	F
F	T	T	T	T	T
T	F	F	F	T	F
T	F	T	T	T	T
T	T	F	F	F	F
T	T	T	T	T	T

R.H.S

So finally Hence proved
that

$$P \vee \neg V \rightarrow X \equiv (P \rightarrow X) \wedge (\neg V \rightarrow X)$$

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

Date: _____

"Question no 2"
"Part A"

write the Converse, inverse and
Contrapositive of the following

Solution:-

Converse:-

~~a:~~ a) If Howard Can swim across
the lake then howard can
swim to the island.

a: Howard Can swim across the
lake

b: Howard Can swim to the island
Take Converse of that:

b: Howard Can swim to the
island ~~if Howard~~

a:- If Howard Can swim across
the lake

Date: _____

5



In verse:-

a: Howard Can Swim across the lake.

b: Howard Can Swim to the Island

Take Inverse of that

$\Rightarrow (\neg a \rightarrow \neg b)$ Answer.

Contrapositive:-

a: Howard Can Swim across the lake

b: Howard Can Swim to the Island.

Take Contrapositive of that

$\Rightarrow (\neg b \rightarrow \neg a)$ Answer.



Date: _____

6

b: If today is Easter then
tomorrow is Friday.

Solution:-

Converse:-

a: Friday is easter

b: Tomorrow is Friday

Take Converse of that:

b: Tomorrow is Friday if

a: Friday is easter.

Inverse:-

a: Friday is easter

b: Tomorrow is Friday

Take Inverse of that:

$\neg a \rightarrow \neg b$

Answer.



7

Date: _____

Contrapositive:-

a: Friday is easter

b: Tommorrow is friday

Take Contrapositive of
that

$$\neg b \rightarrow \neg a$$

Answer:-

Date: _____

"Question no 2"

"Part B"

use truth table to determine whether the the arguments are valid.

a:- P

 $P \rightarrow q$ $\sim q \vee r$ $\therefore r$

P	q	$\sim q$	r	$P \rightarrow q$	$\sim q \vee r$
F	F	T	F	T	T
F	F	T	T	T	T
F	T	F	F	T	F
F	T	F	T	T	T
T	F	T	F	F	T
T	F	T	T	F	T
T	T	F	F	T	F
T	T	F	T	T	T

This arguments are Valid b/c
All the critical rows and columns

9



Date: _____

Conclusion is true.

So the first arguments are valid.

"Question no 2"
"Part B"

b:-

$$P \wedge q \rightarrow \sim r$$

$$P \vee \sim q$$

$$\sim q \rightarrow P$$

$$\therefore \sim r$$

Solution:-

P	q	r	$\sim q$	$\sim r$
F	F	F	T	T
F	F	T	T	F
F	T	F	F	T
F	T	T	F	F
T	F	F	T	T
T	F	T	T	F
T	T	F	F	T
T	T	T	F	F

Date: _____

$P \wedge Q$	$P \wedge Q \rightarrow \sim R$	$P \vee \sim Q$	$\sim Q \rightarrow \sim P$	$\sim R$
F	T	T	F	T
F	F	T	F	F
F	T	F	T	T
F	F	F	T	F
F	T	T	T	T
F	T	T	T	F
T	T	T	T	T
T	T	T	T	T

This arguments are not valid because 3rd last critical row conclusion is false.



11

Date: _____

"Question no 3"

In the back of an old cupboard you discover a note signed by a pirate famous for his bizarre sense of humor and love of logical puzzles.

- a) If this house is next to the lake then the treasure is not in the kitchen
- b) If the tree is in the front yard then the treasure is not in the kitchen
- c) This house is next to the lake.
- d) The tree in the front yard in the elm or the treasure is buried
- e) If the tree is in the back yard is an oak, the treasure is gone



12

Date: _____

Solution:

Negation: $\sim P$: not P

Disjunction: $P \vee Q$: P or Q

Conjunction: $P \wedge Q$: P and Q

Conditional Statement: $P \rightarrow Q$: If P then Q

Biconditional Statement: $P \leftrightarrow Q$: If and only if Q

Modus ponens:
$$\begin{array}{l} P \rightarrow Q \\ P \\ \hline \therefore Q \end{array}$$

Modus Tollens:
$$\begin{array}{l} P \rightarrow Q \\ \sim Q \\ \hline \therefore \sim P \end{array}$$



Date: _____

13

Let:

P = This house is next to a lake

Q = The treasure is in the kitchen

X = The tree in the front yard is
an elm

S = The treasure is buried under
the flag pole

T = The tree in the backyard is
an oak

U = The treasure is in the garage

we can then translate the four
given sentences as:

a) $P \rightarrow \sim Q$

b) $X \rightarrow Q$

c) P

d) $X \vee S$

e) $T \rightarrow U$

Now we will assume that the
previous four premises are true
and derive a conclusion
using a rule of inference.

Date: _____

Step:-

Reason:

1: $P \rightarrow \sim Q$

~~Premise~~ Premise

2: $X \rightarrow Q$

Premise

3: P

Premise

4: $X \vee S$

Premise

5: $t \rightarrow U$

Premise

6: $\sim Q$

Modus ponens of (1) and (3)

7: $\sim X$

Modus tollens of (2) and (6)

8: X

Elimination of (1)
and (7)

we have then derived in step (8) that "S" is true and thus the treasure is buried under the flag pole.

Result:-

The treasure is buried under the flag pole.