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Class : Monday
Timing

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Subject : Discrete
Structure

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Q1; Part (A)

Let p be the statement "DATAENDFLAG is off", q is the statement "Error equals 0", and r the statement "SUM is less than 1,000". Express the following sentence in symbolic notation.

Ans:

P : DATAENDFLAG is off

q : Error equals 0

r : SUM is less than 1,000

(a) DATAENDFLAG is off, ERROR equals 0, and SUM is less than 1,000.

$P \wedge q \wedge r$

(b) DATAENDFLAG is off but Error is not equal to 0

$P \wedge \neg q$

(c) DATAENDFLAG is OFF; however, Error is not 0 or SUM is greater than or equal to 1,000.

$P \wedge \neg q \vee \neg r$

d) DATAENDFLAG is on and Error equals 0 but SUM is greater than or equal To 1000

P19V~x

e) Either DATAENDFLAG is on or it is the case that both ERROR equals 0 but and SUM is less than 1,000.

PV (9,12)

1
Q) Part B

Show that $P \vee q \rightarrow r = (P \rightarrow r) \wedge (q \rightarrow r)$

Taking left hand side
" $P \vee q \rightarrow r$ "

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

Pg # 4

right hand side

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

P	Q	R	$P \rightarrow R$	$Q \rightarrow R$	$(P \rightarrow R) \wedge (Q \rightarrow R)$
T	T	T	T	T	T
T	T	F	F	F	F
T	F	T	T	T	T
T	F	F	F	T	F
F	T	T	T	T	T
F	T	F	T	F	F
F	F	T	T	T	T
F	F	F	T	T	T

Hence it's Proved

Q2; Part (A)

Write the Converse, Inverse, Contrapositive of the following.

Ans;

(a) If Howard can swim across the lake, then Howard can swim to the island.

Converse :

When Howard can swim to the island then Howard can swim across the lake.

Inverse :

If Howard cannot swim across the lake, then Howard cannot swim to the island.

Contrapositive :

When Howard cannot swim to the island then Howard cannot swim across the lake.

b) If Today is Easter, then Tomorrow
is Monday.

Converse :

When Tomorrow is Monday then
Today is Easter

Inverse :

If Today is not Easter then

Contrapositive

When Tomorrow is not
Monday then Today is
not Easter.

Q2; Part (B)

Use truth table to determine whether the argument's forms are valid. Indicate which columns represents the premises and which represent the conclusions.

(a)

$$\begin{array}{l}
 P \\
 P \rightarrow q \\
 \sim q \vee r \\
 \therefore r
 \end{array}$$

Truth Table

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

$P \rightarrow q, \sim q \vee r$ are hypothesis
and r is conclusion.

it is invalid.

Q2 Part (B)

$$(b) \quad \begin{aligned} P \wedge q &\rightarrow \neg r \\ P \vee \neg q & \\ \neg q &\rightarrow P \\ \neg r & \end{aligned}$$

P	q	r	$\neg r$	$\neg q$	$P \wedge q$	$P \wedge q \rightarrow \neg r$	$P \vee \neg q$	$\neg q \rightarrow P$	$\neg r$
"	"	"	"	"	"	$\neg r$	"	P	"
T	T	T	F	F	T	F	T	T	F
T	T	F	T	F	T	T	T	T	T
T	F	T	F	T	F	T	T	T	F
T	F	F	T	T	F	T	T	T	T
F	T	T	F	F	F	T	F	T	F
F	T	F	T	F	F	T	F	T	T
F	F	T	F	T	F	F	T	F	F
F	F	F	T	T	F	T	T	F	T

$$P \vee q \rightarrow r \quad \& \quad P \vee \neg q \quad \& \quad \neg q \rightarrow P$$

are hypothesis

$\neg r$ is conclusion

it is Invalid

Q3 In the back of an Old Cupboard you discover a not signed by a Pirate famous for his bizarre sense of humor and love of logical Puzzles. In the note he wrote that he had hidden treasure somewhere on the Property. He listed five true statements (a-e below) and challenged the reader to use them to figure out the location of the treasure.

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

Solution

- P : This house is next to a lake
 Q : The treasure is in the kitchen
 R : The tree in the front yard is an elm
 S : The treasure is buried under the flagpole
 T : The tree in back yard is an oak
 U : The treasure is in the garage

According to Question

- (1) $P \rightarrow \neg Q$
 (2) $R \rightarrow Q$
 (3) P
 (4) $R \vee S$
 (5) $T \rightarrow U$

	Steps	Reasons
1)	$P \rightarrow \neg Q$	Premise
2)	$R \rightarrow Q$	Premise
3)	P	Premise
4)	$R \vee S$	Premise
5)	$T \rightarrow U$	Premise
6)	$\neg Q$	Modus ponens (1) & (3)
7)	$\neg R$	Modus tollens (2) & (6)
8)	S	Elimination (1) & (7)

Answer : The treasure is in buried under flagpole.