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(A) BS-CS/Semester

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Q1

P = DATAENDFLAG is off

Q = ERROR equals 0

R = SUM is less than 1000

a) P, Q, R

b) $P \wedge \neg Q$

c) $P \vee (\neg Q \vee \neg R)$

d) $\neg P \wedge (Q \wedge \neg R)$

e) $\neg P \vee (Q \wedge R)$

(B) Show that $P \vee Q \rightarrow R \equiv (P \rightarrow R) \wedge (Q \rightarrow R)$

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

Q2 (A)

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

Converse: If Howard can swim to the island then Howard can swim across the lake

Contrapositive: If Howard can not swim to the island then Howard cannot swim across the lake

Inverse: If Howard cannot swim ~~to the island~~ across the lake then Howard cannot swim to the island.

b) If today is Easter, then tomorrow is Monday.

Converse: If tomorrow is Monday then today is Easter.

Contrapositive: If tomorrow is not Monday then today is ^{not} Easter.

Inverse: If today is not Easter then tomorrow is not Monday.

(B) a)

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

From truth table "r" and " $r \wedge P \rightarrow q$ " hence the statement is true.

Q3: Let

P = The house is next to a lake

Q = Treasure is in the kitchen

r = Tree in front yard is an elm

S = Treasure is buried under the flagpole

t = Tree in the back yard is an oak

u = Treasure is in the garage

Then the statements become

a) $P \rightarrow \sim Q$

c) P

e) $t \rightarrow u$

b) $r \rightarrow Q$

d) $r \vee S$

Assuming these premises as true ~~and~~ ~~do~~ we can derive the conclusion using rules of inference

Step	Reason
i) $P \rightarrow \sim q$	Premise
ii) $r \rightarrow q$	Premise
iii) P	Premise
iv) $r \vee s$	Premise
v) $t \rightarrow u$	Premise
vi) $\sim q$	Modus Ponens of (1) & (3)
vii) $\sim r$	Modus Tollens of (2) & (6)
viii) s	Elimination of (4) & (7)

S is true, thus the treasure is buried under the flagpole.