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**PAPER :** DISCRETE MATH

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Question No 1, part A, (A)

(a)

p = "Dataend<sup>flag</sup> is off"

q = "ERROR equals 0"

r = "Sum is less than 1000"

We can then rewrite the given sentence as;

"Dataendflag is off, and ERROR equals 0 and Sum is less than 1000."

Replacing the statements by p, q, and r and replacing "and" by  $\wedge$ , we then obtain

$$p \wedge (q \wedge r)$$

Note:- Brackets are unnecessary to place, because the associative law tells us that  $p \wedge (q \wedge r)$  is equivalent with  $(p \wedge q) \wedge r$  and thus the statement  $p \wedge q \wedge r$  is unambiguous.



Question No 1, part A, (B)

(b)

p = "Dataendflag is off"

q = "ERROR is not equal to 0"

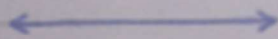
Note: we can use a word "but" in the given sentence actually implies "and" thus can then rewrite the given sentence as



"Dataendflag is OFF And ERROR is not equal to 0"

$$\{(P \wedge \neg q)\}$$

Brackets are unnecessary to place, because the associated law tell us that  $(p \wedge \neg q)$  is equivalent with  $p \wedge \neg q$  and thus the statement  $p \wedge \neg q$  is unambiguous.



Question No 1, part A, (C)

Answer: (C)

$P$  = "Dataendflag is OFF"

$q$  = "Error equals is 0"

$r$  = "Sum is less 1000"

we can then rewrite the given sentences;

"Dataendflag is OFF and ERROR is not equal 0 or Sum is not less than 1000."

Replacing the statements by  $p, q,$  and  $r$   
 Replacing "and" by " $\wedge$ " and replacing  
 "not" by  $\sim$ , we then obtain:

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

Note; Brackets are unnecessary to place because the associated law tell us that  $(p \wedge \neg q) \vee \neg r$  is equivalent with  $p \wedge (\neg q \vee \neg r)$  and thus the statement  $p \wedge \neg q \vee \neg r$  is unambiguous.





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Question No 1, (D)  
Part (A), D

d)

$p$  = "DataendFlag is off"

$q$  = "ERROR equals 0"

$r$  = "Sum is less than 1000"

Note: that the word "but" in the given sentence actually implies "and", thus can then rewrite the given sentence as:

"Dataendflag is not off and ERROR equals 0; and Sum is not less than 1000."

Replacing the statements by  $p$ ,  $q$ , and  $r$ , replacing "and" by  $\wedge$  and replacing "not" by  $\neg$ , we then obtain:

$$(\neg p \wedge q) \wedge \neg r$$

Note: Brackets are unnecessary to place, because the associated laws tell us that  $(\neg p \wedge q) \wedge \neg r$  is equivalent with  $\neg p \wedge (q \wedge \neg r)$  and thus the statement  $\neg p \wedge q \wedge \neg r$  is unambiguous.





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## Question 4 part A, (E)

e)

$P =$  "Dataendflag is off"

$q =$  "ERROR equals 0"

$r =$  "Sum is less than 1000"

We can then rewrite the given statement as

"Dataendflag is off or ERROR equals 0 and Sum is less than 1000"

Replacing the statements by  $p$ ,  $q$  and  $r$  and replacing and into " $\wedge$ " and or changed into " $\vee$ "

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

Note: Brackets are unnecessary to place, because the associated law tell us  $(\neg p \vee q) \wedge r$  is equivalent with  $\neg p \vee (q \wedge r)$  is unambiguous.



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Question no 1, part B  
 prove:  $(p \vee q) \rightarrow r \equiv (p \rightarrow r) \wedge (q \rightarrow r)$

Solution:

$$(P \vee q) \rightarrow r \equiv (P \rightarrow r) \wedge (q \rightarrow r)$$

Take R.H.S

 $\vee = \text{OR}$  $\wedge = \text{And}$  $\neg = \text{not}$ 

$$= (P \rightarrow r) \wedge (q \rightarrow r)$$

$$= (P \vee \neg r) \wedge (q \vee \neg r)$$

:-  $S = (P \vee q)$  :-

$$= \frac{(P \wedge q)}{S} \vee \neg r$$

$$= S \vee \neg r$$

$$= S \rightarrow r$$

$$= (P \vee q) \rightarrow r \quad \text{So L.H.S Proof.}$$





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## Question No 2 part A. a

Answer:

### Converse:

General:

a:  $p$  = "Howard can swim across the lake"  
 $q$  = "Howard can swim to the island"  
 $p \rightarrow q$

### Converse form:

$$q \rightarrow p$$

Converse: Howard can swim to the island  
 Howard can swim across the lake.

### Inverse:-

$$\neg p \rightarrow \neg q$$

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

### Contrapositive:

$\neg q \rightarrow \neg p \Rightarrow$  Howard cannot swim  
 across the lake  $\rightarrow$  Howard cannot swim to the island



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⇒ Question à part A-b

Answers:

 $p$  = "Today is Easter" $q$  = "Tomorrow is Monday"General: "If Today is Easter then Tomorrow is Monday"  $\Rightarrow p \rightarrow q$ : Converse:

$$q \rightarrow p$$

Tomorrow is Monday. Today is Easter.

: Inverse:

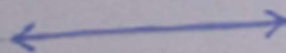
$$\neg p \rightarrow \neg q$$

Today isn't Easter. Tomorrow isn't Monday.

: Contrapositive:

$$\neg q \rightarrow \neg p$$

Tomorrow isn't Monday. Today isn't Easter.







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Question no 2  
part b.(b)

Truth table;

Propositions

	P	Q	$\neg Q$	$\neg P$	$P \vee \neg Q$	$P \wedge Q \rightarrow \neg Q$	$P \vee \neg Q$	$\neg Q \rightarrow P$	$\delta$
1	T	T	F	F	T	T	T	F	T
2	T	T	F	F	T	T	T	F	F
3	T	F	T	T	T	T	T	T	T
4	T	F	T	T	T	F	T	T	F
5	F	T	F	F	F	T	F	T	T
6	F	T	F	F	F	T	F	T	F
7	F	F	T	T	T	T	T	T	T
8	F	F	T	T	T	T	T	T	F

Premises

Question No 2 part A 100

Truth table;

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

Premises



## Question No : 3

Solution:

let

 $p =$  "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 the back yard is an Oak" $u =$  "the treasure is in the garage"

we can then translate the five given sentences

as

(a)  $p \rightarrow \neg q$

(b)  $r \rightarrow q$

(c)  $p$

(d)  $r \vee s$

(e)  $t \rightarrow u$

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

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 of (1) and (3)
7 $\neg r$	Modus tollens of (2) and (6)
8 $s$	Elimination of (4) and (7)

We have then derived in Step (8) that 's' is true and thus treasure is buried under the flagpole.

← → {Finish}



**Finish**

**My**

**Paper**

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