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**Subject: Discrete Structure**

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**Class: 2<sup>nd</sup> semester SE Section B**

**Q.1**

Which of the following are propositions?

- a) Buy Premium Bonds!
- b) The Apple Macintosh is a 16 bit computer.
- c) There is a largest even number.
- d) Why are we here?
- e)  $8 + 7 = 13$
- f)  $a + b = 13$

**Answer: b and c** are both prepositions.

**Q.2**

p is " $x < 50$ "; q is " $x > 40$ ".

Write as simply as you can:

- (a)  $\neg p$
- (b)  $\neg q$
- (c)  $p \wedge q$

- (d)  $p \vee q$
- (e)  $\neg p \wedge q$
- (f)  $\neg p \wedge \neg q$

**Answer:** (d)  $x < 50$  or  $x > 40$ . This is true for all values of  $x$ .

### Q.3

In each part of this question a proposition  $p$  is defined. Which of the statements that follow the definition correspond to the proposition  $\neg p$ ? (There may be more than one correct answer.)

(a)

$p$  is "Some people like Maths".

- (a) "Some people dislike Maths"
- (b) "Everybody dislikes Maths"
- (c) "Everybody likes Maths"

b)

$p$  is "The answer is either 2 or 3".

- (a) "Neither 2 nor 3 is the answer"
- (b) "The answer is not 2 or it is not 3"
- (c) "The answer is not 2 and it is not 3"

c)

$p$  is "All people in my class are tall and thin".

- (a) "Someone in my class is short and fat"
- (b) "No-one in my class is tall and thin"
- (c) "Someone in my class is short or fat"

**Answer:** In A part the definition correspond to the proposition  $\neg p$  is .

- a) "Everybody dislikes Maths"

In B part the definition correspond to the proposition  $\neg p$  is

- a) "Neither 2 nor 3 is the answer"

- b) "The answer is not 2 and it is not 3"

In C part the definition correspond to the proposition  $\neg p$  is

a) "Someone in my class is short or fat"

#### Q.4

Construct truth tables for:

- a)  $\neg p \vee \neg q$
- b)  $q \wedge (\neg p \vee q)$
- c)  $p \wedge (q \vee r)$
- d)  $(p \wedge q) \vee r$

**Answer:**

P	q	$\neg p$	v	$\neg q$
T	T	F	F	T
T	F	F	T	F
F	F	T	T	F
F	F	T	T	T

#### Q.5

Use truth tables to show that:

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

**Answer:** In each case, the result is F,F,F,F,T,T,F,F

#### Q.6

Use the laws of logical propositions to prove that:

$$(z \wedge w) \vee (\neg z \wedge w) \vee (z \wedge \neg w) \equiv z \vee w$$

State carefully which law you are using at each stage.

**Answer:**

$$\begin{aligned}
 (z \wedge w) \vee (\neg z \wedge w) \vee (z \wedge \neg w) &= (z \wedge w) \vee (z \wedge \neg w) \vee (\neg z \wedge w) && \text{Commutative Law} \\
 &= (z \wedge (w \vee \neg w)) \vee (\neg z \wedge w) && \text{Distributive Law} \\
 &= (z \wedge T) \vee (\neg z \wedge w) && \text{Complement Law} \\
 &= z \vee (\neg z \wedge w) && \text{Identity Law} \\
 &= (z \vee \neg z) \wedge (z \vee w) && \text{Distributive Law} \\
 &= T \wedge (z \vee w) && \text{Complement Law}
 \end{aligned}$$

$= (z \vee w)$       T      *Commutative Law*

$= z \vee w$       *Identity Law*