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Class BS Software Engineering Section (B)

Subject Descrite Structure

Samester 2nd

Mid –Term Assignment

Submitted to Sir Muhammad Abrar Khan

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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) $a + b = 13$

Ans1

(a) is not a proposition. (It is a command, or imperative.)
(b) and
(c) are both propositions.
(d) is not a proposition; it's a question.
(e) strictly speaking is a propositional function, but many people would say it is a proposition.
(f) is not a proposition, because the result can be either true or false, it depends on the values of a & b.

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) $\neg p \wedge \neg q$

Ans2

(a) $x \geq 50$
(b) $x \leq 40$
(c) $40 < x < 50$
(d) $x < 50$ or $x > 40$. This is true for all values of x.
(e) $x \geq 50$ (Note that we don't need to say, in addition, that $x > 40$; this must be true whenever $x \geq 50$.)
(f) $x \geq 50$ and $x \leq 40$. This can never be true, whatever the value of x.

So (d) is a tautology – it's always true; and (f) is always false.

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"

Ans3

(a) (b)
(b) (a) and (c)
(c) (c)

Q.4

Construct truth tables for:

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

$(p \wedge q) \vee r$

Ans4

(a)

p	q	$\neg p$	$\vee$	$\neg q$
T	T	F	F	T
T	F	F	T	F
F	F	T	T	F
F	F	T	T	T
		(1)	(3) output	(2)

(b)

p	q	$q \wedge$	$\neg p$	$\vee q$
T	T	T	F	T
T	F	F	F	F
F	T	T	T	T
F	F	F	T	T
		(3) output	(1)	(2)

(c)

p	q	r	$p \wedge$	$(q \vee r)$
T	T	T	T	T
T	T	F	T	T
T	F	T	T	T
T	F	F	F	F
F	T	T	F	T
F	T	F	F	T
F	F	T	F	T
F	F	F	F	F
			(2) output	(1)

(d)

p	q	r	$(p \wedge q)$	$\vee\ r$
T	T	T	T	T
T	T	F	T	T
T	F	T	F	T
T	F	F	F	F
F	T	T	F	T
F	T	F	F	F
F	F	T	F	T
F	F	F	F	F
			(1)	(2) output

Q.5

Use truth tables to show that:

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

Ans5

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:

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

State carefully which law you are using at each stage.

Ans6

$(z \wedge w) \vee (\neg z \wedge w) \vee (z \wedge \neg w)$	$= (z \wedge w) \vee (z \wedge \neg w) \vee (\neg z \wedge w)$	*Commutative Law*
	$= (z \wedge (w \vee \neg w)) \vee (\neg z \wedge w)$	*Distributive Law*
	$= (z \wedge T) \vee (\neg z \wedge w)$	*Complement Law*
	$= z \vee (\neg z \wedge w)$	*Identity Law*
	$= (z \vee \neg z) \wedge (z \vee w)$	*Distributive Law*
	$= T \wedge (z \vee w)$	*Complement Law*
	$= (z \vee w) \wedge T$	*Commutative Law*
	$= z \vee w$	*Identity Law*