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MATH212 : Discrete Mathematics — **Med.Term Exam Tu. 26/03/2024**

Time : 70 Minutes — الرقم الجامعي — اسم الطالب :

Question1: ***Answer with TRUE or FALSE, justify your answers:*** **(4 M)**

a) If 30 is divisible by 5 then 40 is divisible by 6. F

T → F

b) The proposition $\neg(\forall x P(x))$ is the same as $\neg \exists x$ such that (P(x)) F

c) If the logical proposition $P(x)$ is given by $(x^2 = 4) \rightarrow (x \leq 1)$. Then $P(3)$ is true. T

F F

a) If the domain consists of all integers, then $\forall n\ (n^2 \geq n)$ T

Question 2 : ***Given the following compound propositions:*** **(5+1 M)**

a) $P \vee (Q \wedge R)$ b) $P \rightarrow (\neg Q \vee R)$

1. **Construct a truth table for the compound propositions a and b.**
2. **Are the compound propositions a and b logically equivalent?**

P	Q	R	¬Q	Q∧R	P∨(Q∧R)	¬Q∨R	P→(¬Q∨R)
T	T	T	F	T	T	T	T
T	T	F	F	F	T	F	F
T	F	T	T	F	T	T	T
T	F	F	T	F	T	T	T
F	T	T	F	T	T	T	T
F	T	F	F	F	F	F	T
F	F	T	T	F	F	T	T
F	F	F	T	F	F	F	T

Question 3: **(3 M)**

Construct a combinatorial circuit using inverters, OR and AND gates that produces the output $(P \vee \neg R) \vee (P \vee \neg R) \wedge Q$ from the input bits P, Q and R.

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Question 4: (4 M)

Let P and Q be predicates defined as follows: P(x) : x is even number and Q(x) : x an odd number, Write each of the following predicates in symbolic form: (using Predicate quantifiers)

a) There is an even number. $\exists x\,(P(x)$

b) No number is either even or odd. $\forall x \neg (P(x) \vee Q(x))$

c) No number is both even and odd. $\forall x \neg (P(x) \wedge Q(x))$

d) The sum of two even numbers is odd.

Question 5: *If n and m are odd integers then (n + m) is even integer.* (4 M)

$n = 2k+1$

$m = 2r+1$

$2k+1+2r+1$

$2k+2r+2$

$2(k+r+2) \rightarrow m$

$2m$

Question 6: *Give a contrapositive proof of the:* (4 M)

If $x^2 - 6x + 5$ is even, then x is odd. $x \in Z$.

$\neg q \rightarrow \neg p$

x is even

x^2-6x+5 is odd

$(2k)^2 - 6(2k) + 5$

$4k^2 - 12k + 5$

$2(k^2 - 6k) + 5 \rightarrow r$

$2r + 5$

$2r$ ↓ even

5 ↓ odd

even + odd = odd

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