King Saud University | MATH 151 (Discrete Mathematics)

Department of Mathematics | 1st Midterm Exam

1st Semester 1437-1438 H | Duration: 90 Minutes

Name:

Sequence Number:

Teacher's Name:

Section:

Question	Mark
Question I	
Question II	
Question III	
Question IV	
Total	

Question Number	1	2	3	4	5	6	Total
Answer							

Question I:

Choose the correct answer, then fill in the table above:

(1) The truth value of "$5+1=4\ if\ and\ only\ if\ 5+1=6$" is

(a) True (b) False (c) None of the previous

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(2) Let $Q(x,y)$ be the statement "$x=y+5$" then

(a) $Q(5,0)$ is true (b) $Q(0,5)$ is true (c) $Q(3,2)$ is true (d) None of the previous

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(3) If $P(x)$ is the statement "$2x=x,\ x\in\mathbb{Z}$", then the truth value of $\exists x\ P(x)$ is

(a)True (b) False (c) None of the previous

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(4) The inverse of the statement "$if\ x^2<x\ then\ 0<x<1$" is

(a) $if\ x^2>x\ then\ x\leq 0\ \wedge x\geq 1$ (b) $if\ 0<x<1\ then\ x^2<x$

(c) $if\ x^2\geq x\ then\ x\leq 0\vee x\geq 1$ (d) None of the previous

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(5) $\neg[\forall x\ (x<y\ \wedge x\ is\ rational)]$ is equivalent to

(a) $\forall x\ (x\geq y\ \wedge x\ is\ irrational)$ (b) $\exists x\ (x\geq y\ \vee x\ is\ irrational)$

(c) $\exists x\ (x\geq y\ \wedge x\ is\ irrational)$ (d) None of the previous

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(6) The power set of the set $\{\emptyset\}$ is

(a) $\mathcal{P}(\{\emptyset\})=\{\emptyset\}$ (b) $\mathcal{P}(\{\emptyset\})=\{\emptyset,\{\emptyset\}\}$ (c) $\mathcal{P}(\{\emptyset\})=\emptyset$ (d) None of the previous

Question II:

A. **Without using truth tables** prove the following:

$$\neg p \rightarrow (\neg p \wedge q) \equiv \neg p \rightarrow q.$$

B. Is the following argument valid or invalid? Justify your answer:

$$\begin{array}{c} p \rightarrow (\neg q \wedge p) \\ \neg[s \leftrightarrow (r \vee \neg q)] \\ q \leftrightarrow r \\ \hline \therefore s \vee q \end{array}$$

Question III:

A. If n is an integer, prove that "$7n + 4\ is\ even\ if\ and\ only\ if\ n\ is\ even$".

B. Prove that the statement "$for\ every\ x, y \in \mathbb{R},\ (x + y)^2 = x^2 + y^2$" is **false**.

Question IV:

A. Prove **by cases** that "$2n^2 + 3\ is\ odd$", for every integer number n.

B. If the universal set $U = \{1,2,3,4,5\}$ and $A = \{1,4\}, B = \{2,4\}\ and\ C = \{5\}$, then answer the following:

(1) Find the sets $\overline{B \cup C}$ and $A - B$.

(2) Find $A \times B$.

(3) $|\mathcal{P}(A \cup C)|$

(4) Is the set $D = \{4\}$ a subset of $A \cap B$?

Good Luck☺