Addis Ababa University
Department of Mathematics
Mathematics for Natural Sciences (Math 1011): Test 1

Name: _____ Id. No: _____ Section: _____

Allocated mark: 10% Allocated time: 50min Target group: Section 5 & 7

Part 1: Multiple choice problems. (0.5pt. each)

1. Let $\mathcal{P}(A)$ denote the power set of A. If $\mathcal{P}(A) \subseteq B$ then
   A. $2^{|A|} \leq |B|$ B. $2^{|A|} \geq |B|$ C. $2|A| < |B|$ D. $|A| + 2 \leq |B|$ E. $2^{|A|} \geq 2^{|B|}$
2. Which of the following statements is FALSE?
   A. $\{2,3,4\} \subseteq A$ implies that $2 \in A$ and $\{3,4\} \subseteq A$
   B. $\{2,3,4\} \in A$ and $\{2,3\} \in B$ implies that $\{4\} \subseteq A - B$
   C. $A \cap B \supseteq \{2,3,4\}$ implies that $\{2,3,4\} \subseteq A$ and $\{2,3,4\} \subseteq B$
   D. $A - B \supseteq \{3,4\}$ and $\{1,2\} \subseteq B$ implies that $\{1,2,3,4\} \subseteq A \cup B$
   E. $\{2,3\} \subseteq A \cup B$ implies that if $\{2,3\} \cap A = \emptyset$ then $\{2,3\} \subseteq B$
3. Consider the following assertion: "The two statements (1) $\exists x \in D, (P(x) \wedge Q(x))$ and (2) $(\exists x \in D, P(x)) \wedge (\exists x \in D, Q(x))$ have the same truth value". Which of the following is correct? The assertion is:
   A. False. A counter example is $D = \mathbb{N}$, $P(x) =$ "x is divisible by 6", $Q(x) =$ "x is divisible by 3".
   B. True. The proof follows from the distributive law of $\wedge$.
   C. False. A counter example is $D = \mathbb{Z}$, $P(x) = "x < 0"$, $Q(x) = "x \geq 0"$.
   D. True. To see why, let $D = \mathbb{N}$, $P(x) =$ "x is divisible by 6," $Q(x) =$ "x is divisible by 3." If $x = 6$, then x is divisible by both 3 and 6 so both statements in the assertion have the same truth value for this x.
   E. False. A counter example is $D = \mathbb{N}$, $P(x) =$ "x is a square," $Q(x) =$ "x is odd."
4. The statement form $(p \Leftrightarrow r) \Rightarrow (q \Leftrightarrow r)$ is equivalent to
   A. $[(\neg p \vee r) \wedge (p \vee \neg r)] \vee \neg[(\neg q \vee r) \wedge (q \vee \neg r)]$
   B. $\neg[(\neg p \vee r) \wedge (p \vee \neg r)] \wedge [(\neg q \vee r) \wedge (q \vee \neg r)]$
   C. $[(\neg p \vee r) \wedge (p \vee \neg r)] \wedge [(\neg q \vee r) \wedge (q \vee \neg r)]$
   D. $[(\neg p \vee r) \wedge (p \vee \neg r)] \vee [(\neg q \vee r) \wedge (q \vee \neg r)]$
   E. $\neg[(\neg p \vee r) \wedge (p \vee \neg r)] \vee [(\neg q \vee r) \wedge (q \vee \neg r$

Which of the following statement is the contrapositive of the statement, "You win the game if you know the rules but are not overconfident"?

A. If you lose the game then you don't know the rules or you are overconfident.
B. If you don't know the rules or are overconfident you lose the game.
C. If you know the rules and are overconfident you win the game.
D. A sufficient condition that you win the game is that you know the rules or you are not overconfident.
E. A necessary condition that you know the rules or you are not overconfident is that yo the game.

Which of the following is irrational?

. $\sqrt{196}$ B. $0.14\overline{16}$ C. $0.\overline{1416}$ D. 0.1428514285 ... E. 0.40140014000