King Saud University
Department of Mathematics

151
First Midterm, November 2014

NAME:

Group Number:

ID:

Question	Grade
I	
II	
III	
Total	

Question	1	2	3	4	5	6	7	8	9	10
Answer										

I) Choose the correct answer (write it on the table above):

1) The statement $[\neg q \wedge (p \rightarrow q)] \rightarrow \neg p$ is a

(A) tautology	(B) contradiction	(C) None

2) The argument $\neg[p \vee (\neg p \wedge q)]$ is logically equivalent to

(A) $\neg p \wedge \neg q$	(B) $\neg(p \wedge q)$	(C) $p \vee \neg q$	(D) None

3) The argument

$p \rightarrow q$
$r \rightarrow \neg p$
$r \rightarrow q$
$- - - - -$
$\therefore q$
is

(A) valid	(B) invalid	(C) None

4) The Cartesian product of $A = \{a, b\}$ and $B = \{x, y, z\}$ is

(A) $\{a, b, x, y, z\}$	(B) $\{(a, x), (a, y), (a, z), (b, x), (b, y), (b, z)\}$	(C) $\{ax, ay, az, bx, by, bz\}$	(D) None

5) If the universal set is the set $\mathbb{Z}$ of integers, then the statement $\exists x(x^2 = 2)$ is

(A) true	(B) false

6) Given that propositions p and q are true and propositions r and s are false, the truth value of the expression $(p \leftrightarrow r) \wedge (\neg q \rightarrow s)$ is

(A) true	(B) false

7) If $A = \{1, 2, 4\}$ and $B = \{1, 3\}$, then $\mathcal{P}(A \cup B)$ has

(A) 8 elements	(B) 16 elements	(C) 12 elements	(D) Other answer

8) If A and B are any sets, then $A \cap (B \setminus A)$ equals

(A) A	(B) $B \setminus A$	(C) $\emptyset$	(D) Other answer

9) If the proposition p is false, then the conditional statement $p \to q$ is

(A) true	(B) false	(C) cannot be determined

10) The number $\sqrt{3}$ is

(A) integer	(B) rational	(C) irrational

II) A) Write the **contrapositive** of the statement:
"Your guarantee is valid only if you bought your CD player less than 90 *days ago".*

B) Find the negation of the statement:
"All students enrolled in Math 151 *are older than* 20 *years and taller than* 130 *cm".*

C) **Without** using a truth table, prove the equivalence

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

III) A) Prove the theorem:

"If n is an integer number, then n is odd if and only if $5n + 2$ is odd".

B) Prove that $2^n \leq n^2$, for all integers n, with $1 < n < 5$.