University of Jordan
King Abdullah II School of Information Technology
Computer Science Department
Discrete Mathematics Midterm Exam (2006-2007)

اسم الطالب:	الرقم الجامعي:	رقم الشعبة:
رقم التسلسل في ورقة الحضور:	استاذ المادة:	الوقت:

Note: your answers should be filled in the following Table in capital letters

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer															

Q1. Given $f(x) = x^2 + 1$ " $Z^+ \rightarrow Z$" and $g(x) = x - 1$ " $Z^+ \rightarrow Z$" answer the following:

A. $f \circ g(x) =$ **(1 mark)**

B. Determine whether function f (x) is **one-to-one** or not? And why? **(2 marks)**

C. Determine whether function f (x) is **onto** or not? And why? **(2 marks)**

Q2: Show that $P \leftrightarrow Q$ and $(P \wedge Q) \vee (\neg P \wedge \neg Q)$ are logically equivalent. (Using Rules) (5 marks)

Q3. Translate the following English statements. Assuming the domain is: all people

T(x) : x is a CS teacher
S(x) : x is a student
C(x,y): x has taken a course with y
N(x): x is nice

A. All **CS** teachers are perfect and nice. **(2 marks)**

B. some student in IT has taken a course with every CS teacher. **(2 marks)**

Q4: multiple choices (15 marks)

1) $|\Phi \times \{a, b\}|$ is equivalent to

A. 0
B. 1
C. {a,b}
D. Φ

2) $p \rightarrow \neg q$ is equivalent to

A. $\neg p \rightarrow q$
B. $p \leftrightarrow \neg q$
C. $\neg(q \wedge p)$
D. None of the above

3) let U= {x | $1 \leq x \leq 12$ *and* $x \in Z$ }. Which of these sets are specified by "010111100000" bit string?

A. {1,3,5,7,9}
B. {2,4,5,6,7}
C. {2,4,6,8,10}
D. {1,3,8,9,10}

4) Which of the following is a true statement?

A. {Φ } has no elements
B. the cardinality of set X, is the umber of subsets of X
C. Φ is a singleton
D. The power set of set X, is the set of all subsets of X.

5) The precedence order of logical connectives, listed in the order of being carried out first to last is correct for which of the following?

A. $\neg \wedge \vee \leftrightarrow$
B. $\leftrightarrow \neg \wedge \vee$
C. $\wedge \neg \vee \rightarrow$
D. None of the above

6) Which of the following statement is **true**?

A. $\Phi \in \{\Phi\}$ **B.** $\{\Phi\} \in \{\Phi\}$ **C.** $\{\{\Phi\}\} \subset \{\{\Phi\}, \{\Phi\}\}$ **D.** None

7) Which of the following sets is a **power set**?

A. Φ **B.** $\{\Phi, \{a\}\}$ **C.** $\Phi, \{a\}, \{\Phi, a\}\}$ **D.** None

8). Let A and B be sets, $A \subseteq B$ if and only if:

A. $B \subseteq A$

B. $\overline{B} \subseteq \overline{A}$

C. $A \subseteq \overline{B}$

D. $\overline{A} \subseteq B$

9) Let A be subset of a universal set U, then:

A. $A \oplus U = A$

B. $A \oplus U = U$

C. $A \oplus U = \overline{A}$

D. $A \oplus U = \phi$

10) What do you say a bout the sets A and B if we know that A-B=B-A?

A. $A = \overline{B}$

B. $A \subseteq \overline{B}$

C. $\overline{A} \subseteq B$

D. $A = B$

11) Let $X = \lfloor -5.8 \rfloor + \lceil 4.8 \rceil$, then X given by following value?

A. 1

B. 0

C. -1

D. None of them

12) if A and B are sets such that A= { 1, 2, 3 ,4, 4}, B= {2, 3, 3 ,0} what is the **cardinality** of A $\cup$ B?

A. 9

B. 5

C. 6

D. None of the above

13) Let P(x) denote the sentence: x + y = 4. Which of the following is true in the domain of all integers?

A. $\forall x \forall y \ p(x, y)$

B. $\exists x \forall y \ p(x, y)$

C. $\exists y \forall x \ p(x, y)$

D. $\forall y \exists x \ p(x, y)$

14) The negation of $\exists x(p(x) \wedge Q(y))$ **is:**

A. $\forall x(\neg p(x) \wedge \neg Q(y))$

B. $\forall x(\neg p(x) \vee Q(y))$

C. $\forall x(p(x) \rightarrow \neg Q(y))$

D. None of the above

15) Two sets A and B are said to be disjoint if:

A. $A = B$

B. $A \subseteq B$ and $B \subseteq A$

C. $A \cap B = \Phi$

D. $A \cup B = \Phi$