

National University of Computer and Emerging Sciences  
(Karachi Campus)

*Midterm Examination # 1*

<b>Course Code:</b> CS211	<b>Course Title:</b> Discrete Structures	<b>Date of Exam:</b> 21-02-2017
<b>Time Allowed:</b> 1 Hour	<b>Semester:</b> Spring 2017	<b>Maximum Marks:</b> 30
<b>Time of Exam:</b> 01- 02 PM	<b>Roll Number:</b>	<b>Group Number:</b>

**Instructions:**

1. You are supposed to attempt all questions.
2. All questions carry equal marks (2.5 marks each).

Q.1. What is the truth value of the negation of the following propositions?

- a. If  $2 + 1 = 3$ , then  $2 = 3 - 1$ .
- b.  $1 + 1 = 3$  if and only if  $2 + 2 = 3$

Q.2. Determine whether the following two propositions are logically equivalent:

$$p \rightarrow (\neg q \wedge r) \text{ and } \neg p \vee \neg(r \rightarrow q).$$

Q.3. Determine whether this proposition is a contingency, a contradiction or a tautology:

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

Q.4.  $P(m, n)$  means " $m = n$ ", where the universe of discourse for  $m$  and  $n$  is the set of nonnegative integers. What is the truth value of the statement?

- a.  $\exists n \forall m P(m, n)$ .
- b.  $\forall m \exists n P(m, n)$ .

Q.5. Assume that the universe for  $x$  is all people and the universe for  $y$  is the set of all movies. Write the English statement using the following predicates and any needed quantifiers:

$$S(x, y): x \text{ saw } y \quad A(y): y \text{ won an award} \quad C(y): y \text{ is a comedy.}$$

- a. Some people have seen every comedy.
- b. Ben has never seen a movie that won an award.

Q.6. Write the rule of inference in the form premises and conclusion used in the following:

- a. If I work all night on this homework, then I can answer all the exercises. If I answer all the exercises, I will understand the material. Therefore, if I work all night on this homework, then I will understand the material.
- b. If it snows today, the university will be closed. The university will not be closed today. Therefore, it did not snow today.

Q.7. Suppose the variable  $x$  represents students and  $y$  represents courses, and:

$$M(y): y \text{ is a math course} \quad F(x): x \text{ is a freshman} \quad B(x): x \text{ is a full-time student} \quad T(x, y): x \text{ is taking } y.$$

Write the statement in good English without using variables in your answers.

- a.  $\forall x \exists y T(x, y)$ .
- b.  $\forall x \exists y [(B(x) \wedge F(x)) \rightarrow (M(y) \wedge T(x, y))]$ .

Q.8. Find three subsets of  $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$  such that the intersection of any two has size (cardinality) 2 and the intersection of all three has size 1.

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Q.9. Determine whether the first is a subset of the second, the second is a subset of the first, or neither is a subset of the other.

- a. The set of people who were born in the Pakistan, the set of people who are Pakistani citizens.
- b. The set of animals living in the ocean, the set of fish.

Q.10. Out of 40 students, 14 are taking English Composition and 29 are taking Chemistry.

- a. If five students are in both classes, how many students are in either class?
- b. How many are in neither class?

Q.11. Draw Venn Diagrams of the following:

- a.  $A - (B \cup C)$
- b.  $A \cap B \cap C$

Q.12. Determine whether the following is one-to-one, onto, or a bijection:

$F: \mathbf{R} \rightarrow \mathbf{R}$  where  $F(x) = 1 / (x - 5)$

----- THE END -----

