

Motilal Nehru National Institute of Technology Allahabad

Department of Computer Science & Engineering

MCA First Semester

Mid Semester Examination 2016-17

Subject Code/Name: CA3104/Foundation of Logic

Duration: 90 Minutes

Max. Marks:20

NOTE:

- All questions are compulsory.
- Attempt the questions in sequential order.
- Answers should be justified & to the point.

1. Let the Set $A = \{0, 1, 2, 3, \dots\}$ and $R = \{(a, b) : a - b = 4m, m \text{ is any integer}\}$ is an equivalence relation defined on set A. Find out equivalence classes and rank of set A. (3)
2. Determine whether each of these compound propositions is satisfiable using Truth Table.
 - a. $(p \vee \neg q) \wedge (\neg p \vee q) \wedge (\neg p \vee \neg q)$
 - b. $(p \rightarrow q) \wedge (p \rightarrow \neg q) \wedge (\neg p \rightarrow q) \wedge (\neg p \rightarrow \neg q)$ (3)
3. Determine whether each of these functions from set $A = \{a, b, c, d\}$ to itself is one-to-one, onto or both.
 - a. $f(a) = b, f(b) = a, f(c) = c, f(d) = d$
 - b. $f(a) = b, f(b) = b, f(c) = d, f(d) = c$ (2)
4. Let $S(x)$ be the predicate of "x is a student" $F(x)$ be the predicate of "x is a faculty member" and $A(x, y)$ of the predicate "x has asked y a question" where the domain consist of all people associated with your school. Use Quantifier to express each of the statements
 - a. Every faculty member has either asked Professor Arun a question or been asked a question by Professor Arun.
 - b. Some student has not asked any faculty member a question. $\exists x(S(x) \rightarrow \neg \forall y(F(y) \wedge A(x, y))$ (2+2)
5. Translate the given nested quantification into an English statement that express a Mathematical fact, The domain of x, y and z are considered as positive integer.
$$P(x) = \neg(x=1) \wedge \forall y(\exists z(x=y*z) \rightarrow (y=x) \vee (y=1))$$
 (2)
6. Write a short note on of the followings :
 - a. Contrapositive with example.
 - b. Poset with example. (1.5+1.5)
7. Let S be the set of all strings of English Letter, Determine whether these relation are reflexive, irreflexive, symmetric or antisymmetric.
 - a. $R_1 = \{(a, b) : a \text{ and } b \text{ have no letters in common}\}$
 - b. $R_2 = \{(a, b) : a \text{ and } b \text{ are not the same length}\}$
 - c. $R_3 = \{(a, b) : a \text{ is longer than } b\}$ (3)