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**R15** 

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD MCA I Semester Examinations, October/ November - 2020 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

**Time: 2 Hours** 

Max.Marks:75

[7+8]

[7+8]

[7+8]

Answer any five questions All questions carry equal marks

- 1.a) Give the formal definition of a well-formed formula in predicate calculus with examples of formulae that are well-formed and not-well-formed.
  - b) Show that *B* is tautologically implied by  $(\neg(A \lor B) \rightarrow C) \land \neg A \land \neg C$  using automatic theorem proving. [7+8]
- 2.a) Show that  $(a \lor \neg b) \land (\neg a \lor \neg c \lor b) \land (a \lor \neg a)$  is not a tautology.
  - b) Find a CNF for  $(p \rightarrow r) \leftrightarrow (\neg r \rightarrow \neg p)$ .
- 3.a) Let *R* be the following equivalence relation on the set  $A = \{1,2,3,4,5,6\}$ .  $R = \{(1,1), (1,5), (2,2), (2,3), (2,6), (3,2), (3,3), (3,6), (4,4), (5,1), (5,5), (6,2), (6,3), (6,6)\}$ . Find the partition of *A* induced by *R*.
  - b) Define the following properties of binary relations with examples.
    - i) Reflexive
    - ii) Symmetric
    - iii) Anti symmetric
    - iv) Transitive.
- 4.a) Find all group homomorphisms from  $Z_4$  into  $Z_{10}$ .
- b) Define the following terms with examples:
  - i) Semigroup
  - ii) Monoid
  - iii) Group
  - iv) Abelian group.

5.a) Using the digits 1,2,3 and 5, how many 4 digit numbers can be formed if

- i) The first digit must be 1 and repetition of the digits is allowed?
- ii) The first digit must be 1 and repetition of the digits is not allowed?
- iii) The number must be divisible by 2 and repetition is allowed?
- iv) The number must be divisible by 2 and repetition is not allowed?
- b) How many different arrangements of the word ELLIPSE are possible if
  - i) There are no restrictions?
  - ii) The arrangement starts with S?
  - iii) Both L's are together?

The letters are in alphabetical order?

[7+8]

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b)

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- 6.a) Determine the values of *n* and *r* in the following expressions. i)  $nP_2 = 56$ ii)  $11C_r = 3 \times 11C_{r-1}$ 
  - b) Obtain the coefficient of  $x^{99}y^{60}z^{14}$  in  $(2x^3 + y z^2)^{100}$  using multinomial theorem. [7+8]
- 7. Use generating functions to solve the following recurrence relation:  $a_n = 5a_{n-1} - 6a_{n-2}$  for  $n \ge 2$ ,  $a_0 = 0$  and  $a_1 = 3$ . [15]
- 8.a) Determine whether the graphs shown in the following figure are isomorphic.

