R13

Code No: 811AA

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

Time: 2 Hours **Max.Marks:60**

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 $(\neg(A \vee B) \rightarrow C) \wedge \neg A \wedge \neg C$ using automatic theorem proving. [6+6]

2.a) Show that $(a \vee \neg b) \wedge (\neg a \vee \neg c \vee b) \wedge (a \vee \neg a)$ is not a tautology.
b) Find a CNF for $(p \rightarrow r) \leftrightarrow (\neg r \rightarrow \neg p)$. [6+6]

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. [6+6]

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. [6+6]

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? [6+6]

6.a) Determine the values of n and r in the following expressions.

i) $nP_2 = 56$

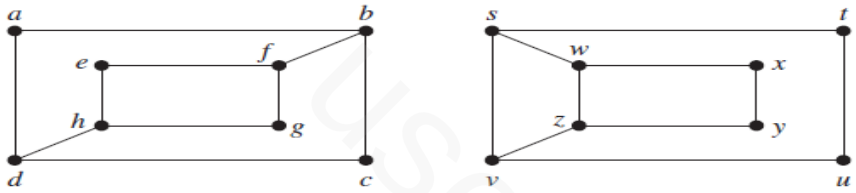
ii) $11C_r = 3 \times 11C_{r-1}$

b) Obtain the coefficient of $x^{99}y^{60}z^{14}$ in $(2x^3 + y - z^2)^{100}$ using multinomial theorem. [6+6]

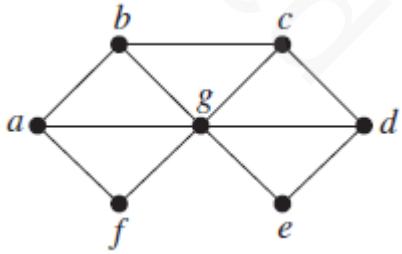
7. Use generating functions to solve the following recurrence relation:

$a_n = 5a_{n-1} - 6a_{n-2}$ for $n \geq 2$, $a_0 = 0$ and $a_1 = 3$. [12]

8.a) Determine whether the graphs shown in the following figure are isomorphic.



b) Find the chromatic number of the given graph. [6+6]



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