## Code No: 841AA

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

Time: 2 Hours

Max.Marks:75

## Answer any five questions <br> 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.
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 $(p \rightarrow r) \leftrightarrow(\neg r \rightarrow \neg p)$.
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?
6.a) Determine the values of $n$ and $r$ in the following expressions.
i) $n P_{2}=56$
ii) $11 C_{r}=3 \times 11 C_{r-1}$
b) Obtain the coefficient of $x^{99} y^{60} z^{14}$ in $\left(2 x^{3}+y-z^{2}\right)^{100}$ using multinomial theorem. [7+8]
7. Use generating functions to solve the following recurrence relation:

$$
\begin{equation*}
a_{n}=5 a_{n-1}-6 a_{n-2} \text { for } n \geq 2, a_{0}=0 \text { and } a_{1}=3 . \tag{15}
\end{equation*}
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8.a) Determine whether the graphs shown in the following figure are isomorphic.

b) Find the chromatic number of the given graph.

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