

Roll No. _____

ARTS
B.Sc. Arts Science &
B.Sc. College
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B.I.D.A.R - 585 401

PGIS-N 1041 B-16
M.Sc. Ist Semester Degree Examination
Computer Science
(Mathematical Foundation For Computer Science)
Paper : HCT - 1.2

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

- 1) *Section - A is compulsory*
- 2) *Answer any five full questions from Section - B.*

Section - A

1. Answer the following questions : **(10×2=20)**
 - a) Define equivalence relation.
 - b) Let $A = \{1, 2, 3, 4\}$. Determine the nature of the relation $R = \{(1,1), (2,2), (3,3), (4,4), (2,3)\}$ on A.
 - c) State Pigeonhole principle
 - d) Construct the truth table for : $(p \vee \sim q) \wedge p$.
 - e) Represent the expression $(AB')A$ as switching circuit.
 - f) Define graph. Give an example of a graphs.
 - g) Define partial ordering set
 - h) State the properties of relations.
 - i) Define semi group. Is every semigroup is a group? Justify
 - j) Define phrase structure grammar and give an example.

Section - B

2. a) Define tautology and contradiction. Prove that the following proposition is tautology.
$$[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r) \quad (6)$$
- b) Prove the following by mathematical induction $1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2} \quad (6)$

3. a) If R and S are equivalence relations on a given set. Prove that. (6)
 R^{-1} and R ns equivalence relations.
- b) Let f and g be functions from \mathbb{N} to \mathbb{N} , where \mathbb{N} is the set of natural number sum that $f(n) = n+1$ and $g(n) = 2n$ Determine fof, fog, gof and gog (6)
4. a) Solve the recurrence relation $a_n = a_{n-1} + 2, n \geq 2$ subject to the initial condition $a_1 = 3$. (6)
b) State and prove De-Morgan's theorem for Boolean Algebra. (6)
5. a) Let (A, \leq) be a lattice with universal upper and lower bound's 0 and 1, then prove the following :
i) $a \vee 1 = a$ ii) $a \wedge 1 = a$
iii) $a \vee 0 = a$ iv) $a \wedge 0 = 0$ (6)
- b) Define Eulerian graph and Hamiltonian graph. Let G be a graph with $n \geq 3$ vertices. If $\deg(v) \geq \frac{n}{2}$ for all vertices v of G then show that G is Hamiltonean. (6)
6. a) For any graph G with six vertices, show that G and \bar{G} contains a triangle. (6)
b) Show that the set of all positive rational numbers forms an abelian group under the composition defined by $(a * b) = \frac{ab}{2}$. (6)
7. a) Give a grammar that satisfies the language : $L = [a^{2i}b^{2j}; i \geq 1, j \geq 1]$. (6)
b) Design finite state machine that adds two binary integers x and y. (6)
8. a) For an encoding function $E: \mathbb{Z}_2^4 \rightarrow \mathbb{Z}_2^6$, the parity check matrix is given by

$$H = \begin{bmatrix} 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 \end{bmatrix}$$

i) Find the associated generator matrix
ii) Decode the received words : 010101, 111010, 111110. (6)
- b) Define the minimum distance of an encoding function. Find the minimum distance of $e: B^2 \rightarrow B^5$ defined by $e(00)=00000$, $e(10)=00111$, $e(01)=01110$, $e(11)=11111$. (6)

