[15103]

M.C.A. DEGREE EXAMINATIONS

FIRST SEMESTER

Paper - III: DISCRETE MATHEMATICAL STRUCTURES

(2016-17, 2017-18, 2018-19 &2019-20 Admitted Batches)

Time : 3 Hours **Maximum Marks : 75**

SECTION-A

Answer ALL questions. Each question carries 15 marks. **(4×15=60)**

1. a) Prove that any propositions p, q, r, the compound proposition

$\{p \to (q \to r)\} \to \{(p \to q) \to (p \to r)\}$ is tautology.

b) Show that the premises "It is not sunny this afternoon and it is colder than yesterday,""We will go swimming only if it is sunny," "If we do not go swimming, then we will take a canoe trip," and "If we take a canoe trip, then we will be home by sunset" lead to the conclusion "We will be home by sunset."

(OR)

c) Let A = {0, 1, 2, 3, 4}. Find the equivalence classes of the equivalence relation R = {(0, 0), (0, 4), (1, 1), (1, 3), (2, 2), (3, 1), (3, 3), (4, 0), (4, 4)} defined on A. Draw digraph of R and write down the partition of A induced by R.

d) Find the transitive closure of the Relation which is represented by

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

2. a) Find the number of integer solutions of the equation: $x_1 + x_2 + x_3 + x_4 + x_5 = 30$, under the Constraints $X_i \geq : 0$ for all i = 1, 2, 3, 4, 5 and further x_2 is even and x_3 is odd.

b) Out of 32 people who save paper or bottles (or both) for recycling, 30 save paper and 14 save bottles. Find the number m of people who

a) save both

b) save only paper and

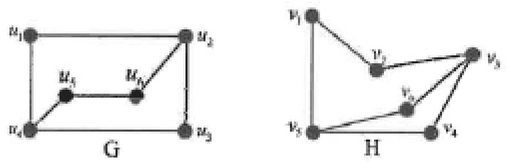
c) save only bottles.

(OR)

c) Find the solution to the recurrence relation: $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ with the initial conditions $a_0=2, a_1=5$ and $a_2=15$.

d) Explain about Pigeonhole principle. Using this principle, how many students in a class must there be to ensure that 6 students get the same grade (one of A, B, C, D or F)

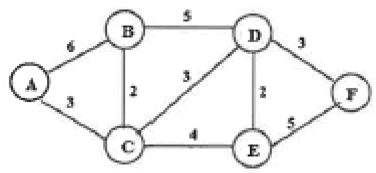
3. a) Determine whether the graphs G and H are isomorphic or not.



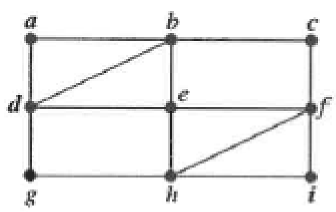
b) Illustrate tree traversing techniques with suitable example.

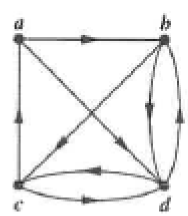
(OR)

c) Find the shortest path from A to F using Dijkstra algorithm of the following graph.



d) Check the following graphs are Eulerian or not, if exists find the Euler's paths.





4. a) Use K-maps to minimize the sum-of-products for the expansion:

$xyz' + xy'z' + x'y'z + x'y'z'$

b) Construct circuits from inverters, AND and OR gates to produce the outputs: $xyz + x'y'z'$

(OR)

c) Construct deterministic finite-state automata that recognize the following languages:

i) The set of bit strings that end with two 0's

ii) The set of bit strings that contain at least two 0's

d) Construct phrase-structure grammar to generate for the following languages:

i) $\{0^n 1^n | n \geq 0\}$

ii) $\{0^n 1^{2n} | n \geq 0\}$

SECTION -B

5. **Answer any FIVE Questions. Each questions carries 3 marks.** **(5×3=15)**

a) Write the duality law of logical expression? Give the dual of $(PVF) \wedge (QVT)$.

b) Without using truth table show that $P \rightarrow (Q \rightarrow P) \equiv \neg P \rightarrow (P \rightarrow Q)$

c) How many different eleven person cricket team can be formed each containing 5 female members from an available set of 20 females and 6 male members from an available set of 30 males.

d) What is finite state machine with no output?

e) Give the Boolean expression $xyz' + y'z + xz'$ in sum of product form.

f) What is minimum spanning tree? Give an example.

g) Define complete graph and bipartite graphs.

h) Solve the recurrence relation $a_k = 3a_{k-1}$ for $k = 1,2,3...$ and initial condition $a_0 = 2$.
