

2011

DISCRETE MATHEMATICAL STRUCTURE

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

- i) The number of arrangements of 25 objects where 7 are of the first kind, 12 are of the second kind, 3 are of the third kind and 4 are of the fourth kind is given by

- a) $(25!)/(7!2!3!4!)$ b) $(25!)/(7!2!)$
c) $(25!)/(3!4!)$ d) none of these.

- ii) Which one is a singleton set ?

- a) $\{0, 1\}$ b) $\{1, 11, 111\}$

- c) $\{0\}$ d) none of these.

- viii) A spanning tree has
- a) only one circuit
 - b) two circuits
 - c) no circuit
 - d) none of these.
- ix) The type-3 Grammar in relation to the automata theory is known as
- a) context sensitive grammar
 - b) regular grammar
 - c) context free grammar
 - d) none of these.
- x) If p : 'Anil is rich' & q : 'Kanchan is poor' then the symbolic form for the statement 'Either Anil or Kanchan is rich' is
- a) $p \vee q$
 - b) $p \vee \sim q$
 - c) $\sim p \vee q$
 - d) $\sim (p \wedge q)$.
- xi) How many arrangements are possible by the word "LETTER" ?
- a) 720
 - b) 360
 - c) 60
 - d) 180.

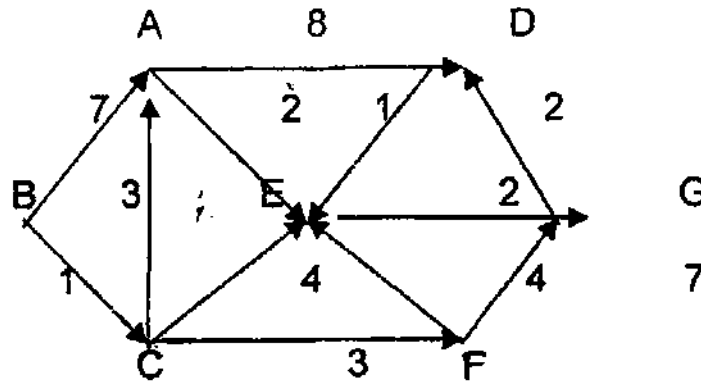
GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Obtain equivalent disjunctive normal form of $\sim G \wedge (H \leftrightarrow G)$.
- b) Solve the following recurrence relation using generating function :
 $a_n - 2a_{n-1} + a_{n-2} = 2^{n-2}$ for $n \geq 2$ and $a_0 = 1, a_1 = 5$.
- c) Determine whether the posets $(\{1, 2, 3, 4, 5\}, |)$ and $(\{1, 2, 4, 8, 16\}, |)$ are lattices. Here the relation ' $|$ ' implies "divides".

8. a)



Find the shortest distance between B and G applying Dijkstra's Algorithm.

- b) Give an example of a relation on A (described by you) which is symmetric and transitive but not reflexive (with justification).
- c) Show that $(p \vee q) \wedge (\sim p \wedge \sim q)$ is a contradiction.

9. a) Prove that if there is one and only path between every pair of vertices in a graph G, then G is a tree.
- b) Construct the truth table for :
- $$(p \rightarrow (q \rightarrow r)) \rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r)).$$
- c) If P (S) is the power set of a set S and \cup and \cap are taken as the join and meet, prove that $(P(S), \subseteq)$ is a lattice.
10. a) Use mathematical induction to prove that $n^3 + 2n$ is divisible by 3.
- b) What do you mean by disjunction and conjunction ?
- c) Convert the given Moore Machine to its equivalent Mealy

Machine :

Present state	Next state		Output
	Input a=0	Input a=1	
q ₀	q ₃	q ₁	0
q ₁	q ₁	q ₂	1
q ₂	q ₂	q ₃	0
q ₃	q ₃	q ₀	0

11. a) Prove the following equivalence :

$$p \leftrightarrow (p \wedge q) \vee (p \wedge \neg q)$$

b) Construct a DFA from the NFA :

State	Input (0)	Input (1)	Output
A	B	B,C	0
B	A, C	----	0
C	A	B, C	1

c) Write a short note on Fuzzy sets.