

**B3.2-R4-DISCRETE STRUCTURE****NOTE :**

1. Answer question 1 and any FOUR questions from 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.

**Time : 3 Hours****Total Marks : 100**

1. (a) What are the types of Normal Forms?  
 (b) Explain Propositional Equivalences and Propositional Logic.  
 (c) The graph G has 6 vertices with degrees 2, 2, 3, 4, 4, 5. How many edges does G have? Could G be planar? If so, how many faces would it have. If not, explain.  
 (d) What do you understand by Boolean expression and Boolean functions?  
 (e) Describe Karnaugh maps with an example.  
 (f) Explain the various Connectives in Propositional Logic with tables.  
 (g) Explain the ways a set can be represented. (7x4)
  
2. (a) Use k-map and minimize the following Boolean expression -  

$$F(A, B, C) = A'BC + A'BC' + AB'C' + AB'C$$
  
 (b) What are the different Rules of Interface used for simplification?  
 (c) Explain different graph traversal methods briefly.  
 (d) Briefly Describe Divide and Conquer algorithm. (5+5+4+4)
  
3. (a) Write short note on Insertion sort, heap sort, merge sort and quick sort working.  
 (b) Describe cardinality and different types of sets.  
 (c) Explain composition of function and injective and bijective properties.  
 (d) What is the principle of mathematical induction? Explain. (4+5+4+5)
  
4. (a) What is Venn diagram? Also describe different set operations using Venn diagram.  
 (b) Explain worst case, best case, and average case efficiency in case of algorithms.  
 (c) Describe different features of postulates and De Morgan's Law.  
 (d) Differentiate between Abelian group and cyclic group. (4+4+4+6)
  
5. (a) Explain the concept of Principle of Transfinite Induction for a well ordered set.  
 (b) Write a short note on various asymptotic Notations used for algorithms.  
 (c) Prove that  $L = \{a^i b^j c^k : j = \max\{i, k\}\}$  is not context free.  
 (d) State and explain the rules for converting Mealy to Moore machine equivalent to it. (3+4+5+6)

6. (a) Describe partially ordered set and hasse diagram with example.  
(b) Explain lattices and different properties of lattices.  
(c) Show that the following grammar is ambiguous :

$S \rightarrow L$

$L \rightarrow E$

$E \rightarrow LE$

$E \rightarrow \text{if } B \text{ E else E}$

$E \rightarrow \text{if } B \text{ E}$

$E \rightarrow x$

$E \rightarrow y$

$B \rightarrow 0$

$B \rightarrow 1$

(6+6+6)

7. (a) Show how a universal turing machine can simulate various TM.  
(b) By using the Boolean identities, minimize the following Boolean expression :

$F(A, B, C) = (A+B)(B+C)$  and

$F(A, B, C) = A'B + BC' + BC + AB'C$  ?

(9+9)

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