BTS.III.11.14. 0959 Reg. No. | | | | | | | | |

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B.Tech. Degree III Semester Examination November 2014

CS/IT 1303 DISCRETE COMPUTATIONAL STRUCTURES

(2012 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 × 5 = 40)

I. (a) Write an equivalent formula for $R \leftrightarrow S$, which does not involve biconditional and conditional connectives.

(b) State the rule of resolution in proving theorems. Using resolution rule, prove the following argument.

(i) a

(ii) $\overline{a} \vee c$

(iii) $\overline{c} \vee d$

(c) Using pigeonhole principle, show that if 9 colours are used to paint 100 houses, at least 12 houses will be of same colour.

(d) Differentiate between worst-case time analysis and best-case time analysis of algorithms.

(e) Explain how a graph can be represented using adjacency matrix.

(f) What is post order traversal of a graph? Give an algorithm for the post order traversal.

(g) Consider the set $A = \{1,3,5,7,\}$, the set of positive odd integers. Determine whether A is closed under addition and multiplication.

(h) What is an algebraic system? Describe about the different properties of a binary system.

PART B

(4 × 15 = 60)

II. (a) Using the principle of mathematical induction, show that $n! = 2^{n-1}$, *for* $n = 1,2,....$ (8)

(b) Using the proof by contrapositive method, prove that the following statement is valid: "If the square of a number is odd then the number is odd". (7)

OR

III. (a) What is an equivalence relation? Show that the relation '=' defined on a set of integers is an equivalence relation. (8)

(b) Let 'f' and 'g' be functions defined on a set of positive integers defined by the equations f(n)=2n+1; g(n)=3n-1. Find the compositions fof, fog, gof and gog. (7)

IV. (a) What is meant by the complexity of an algorithm? What are the different asymptotic notations used for representing the complexity of algorithms? (6)

(b) Show that $\lg n! = \Theta(n \lg n)$. (9)

OR

V. (a) If C(n, r) represents the number of combinations of 'n' different things taken 'r' at a time, then prove that $C(n,r) = \frac{n!}{(n-r)!r!}$ (8)

(b) How many words can be constructed of three English alphabets (i) when repetition of alphabets is allowed and (ii) when repetition is not allowed? (7)

(P.T.O.)

VI. (a) Differentiate between the adjacency matrix representation and incidence matrix representation of graphs. Using each method represent a complete graph K_4 and a complete bipartite graph $K_{3,4}$. (8)

(b) What are planar graphs? Prove that the complete graph K_5 is not planar. (7)

OR

VII. (a) What is spanning tree of a graph? Give an algorithm for finding the minimal spanning tree of a graph. (7)

(b) Describe the characteristics of a binary search tree. Explain how the following operations are being done in a binary search tree. (8)

(i) Inserting elements in the order 55, 77, 22, 33, 66, 60, 63, 75 and 99.

(ii) Searching the tree for elements 60 and then 65.

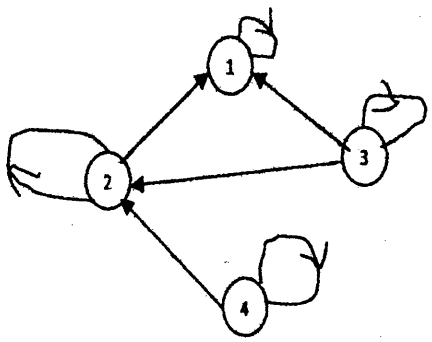
(iii) Deleting the element 77 and then 99.

VIII. (a) What is a semigroup? If $(S1,*)$ and $(S2,*)$ are semigroups, prove that $(S1 \times S2,*)$ is a semigroup, where the operator '*' is defined by: $(s1',s2')*(s1'',s'') = (s1'*s1'',s2'*s2'')$. (8)

(b) Determine whether the algebraic system $(Q,+)$ is a group where Q is the set of rational numbers and '+' is an addition operation. (7)

OR

IX. (a) What are hasse diagrams? Determine the hasse diagram of the partial order having the directed graph as shown: (6)



(b) Differentiate the characteristics among rings, monoids and abellian groups. (9)

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