

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. FIRST SEMESTER EXAMINATION, DECEMBER 2011

FIRST YEAR

COMPUTER SCIENCE (Honours)

Date : 16/12/2011

Time : 11am – 2pm

Paper : I

Full Marks : 75

Answer **any five** out of the following questions

1. a) For a graph with n vertices and k components, prove that number of edges can not be more than $\frac{1}{2}(n-k)(n-k+1)$.
b) “Multiplexers are functionally complete blocks, but Decoders are not” — explain.
c) If $f(n) = 2n^2 + 3n + 1$, then prove that $f(x)$ is order of n^2 . 7+5+3
2. a) Define following terms with proper examples:—
In-degree, complete graph, rank of a graph
b) Illustrate primes algorithm to find a maximal spanning tree of a given connected weighted graph. 6+9
3. a) Design BCD adder using two 4-bit binary adder and NAND gates only.
b) Define following terms with proper examples.
Regular graph, Graph Isomorphism, Bipartite graph
c) Compare polynomial algorithm with exponential algorithm. 7+6+2
4. a) Establish State equation for SR flip-flop.
b) Mathematically prove that $f(x, y) = x' \cdot y'$ is a universal operation.
c) Design an asynchronous mod-10 ripple counter using T flip-flops.
d) Design a 1-bit full-adder using minimum number of NAND gates. 2+3+5+5
5. Discuss Dijkstra’s Algorithm with a non-trivial illustration. Clearly write all of your assumptions and comment on the complexity of the algorithm. 15
6. a) Prove that for a tree with n vertices, there are $(n-1)$ edges.
b) Prove that in a simple connected graph with n vertices, at least two are of equal degrees.
c) What do you mean by graph colouring problem? Explain with examples. 6+5+4
7. a) Design a synchronous 4 bit prime number counter using Master-Slave JK flip-flops.
b) Explain Depth First Search algorithm with an illustration.
c) For a given binary tree with n vertices, find its maximum and minimum possible height. 6+5+4