

**M.Sc. (MATHEMATICS WITH APPLICATIONS
IN COMPUTER SCIENCE) (MACS)
M.Sc. (MACS)**

Term-End Examination

June, 2011

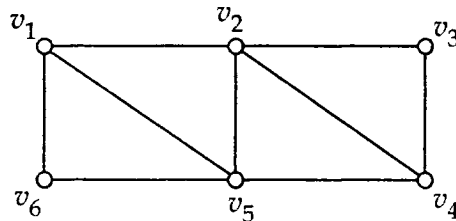
**MMTE-002 : DESIGN AND ANALYSIS OF
ALGORITHMS**

Time : 2 hours

Maximum Marks : 50

Note : Answer *any five* questions. Calculators are *not* allowed.

1. (a) Draw binary search trees of heights 2 and 3 3
for the set of keys
{8, 9, 11, 12, 13, 15, 16}
- (b) Write the breadth first search algorithm. 7
Explain all the steps involved in the
algorithm using the graph given below with
 v_1 as the source vertex.

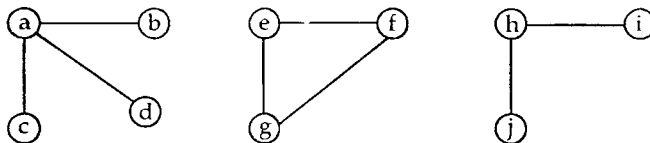


For each stage of the algorithm give

- (i) $d(v)$, $\pi(v)$ for each vertex where $d(v)$ is the distance from the source vertex to v and $\pi(v)$ is the predecessor of v .

(ii) Mark and gray vertices in the form of sets. Also draw the breadth first search tree.

2. (a) Let $f(n) = 1^3 + 2^3 + \dots + n^3$. Show that $f(n) = \Theta(n^4)$ giving the constants. 3
- (b) Describe the algorithm for finding the closest pair of points in a finite subset of the plane. 7
3. (a) Find all the solutions to the equations $35x \equiv 14 \pmod{91}$ using Euclid algorithm. 6
- (b) Illustrate the radix sort algorithm using the array $\{4526, 7839, 6952, 7392, 7631, 3186, 4739, 4366, 1493, 2182\}$. 4
4. (a) Analyse the insertion sort algorithm and show that the best case running time is linear and the worst case running time is quadratic. 5
- (b) Write pseudo-code algorithm to compute connected components of a graph using disjoint set operations. For the graph given below list the vertices in each connected component. Give the detailed output at each iteration. 5



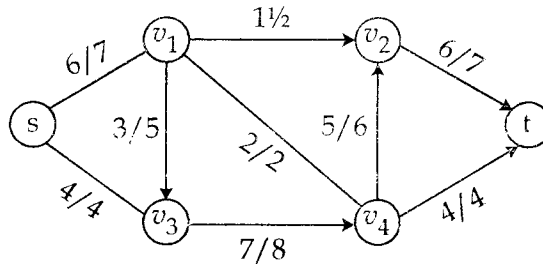
5. (a) Write pseudo-code algorithm and explain the algorithm for splitting a non full internal node in a B-tree. 5

(b) What is the Huffman code for the following set of frequencies : 5

a	b	c	d	e	f
60	22	16	13	6	4

Show all the steps of the algorithm. Also, compute the number of bits required to encode the data.

6. (a) For the following network flow, draw the residual network. 5



Find an augmenting path p and use it to augment the flow along p . Draw the flow network of the augmented flow.

(b) For the polynomials $f(x) = x^2 + 3x + 1$ and $g(x) = x^2 - x + 1$, find the point value representation using the points $[1, -1, i, -i]$. Use the representation to multiply the polynomials f and g in co-efficient form. 5