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

Term-End Examination

June, 2013

MMTE–002 : DESIGN AND ANALYSIS OF ALGORITHMS

Time : 2 hours   *Maximum Marks : 50*

*Note :   Do **any five** questions from questions **1** to **6**. Calculators are **not allowed***

1. (a) Explain what is an algorithm with the help   2
         of an example.

    (b) Sort the following sequence of numbers   3
         using INSERTION SORT showing all the
         steps 8,2,4,3,1,5.

    (c) Build a max heap by successive insertion of   5
         the following sequence of data :
         5, 3, 17, 10, 84, 19.

2. (a) Explain the counting sort algorithm using   5
         the following array :

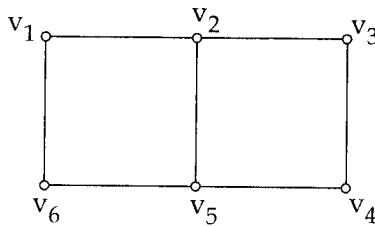   {3, 5, 2, 3, 4, 1, 2, 1, 4, 3}

(b)   State the properties of a B-tree. Verify   5
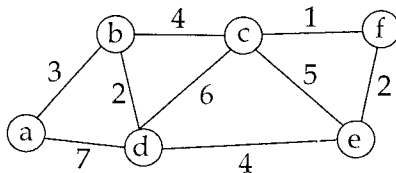whether the following is a B-tree.
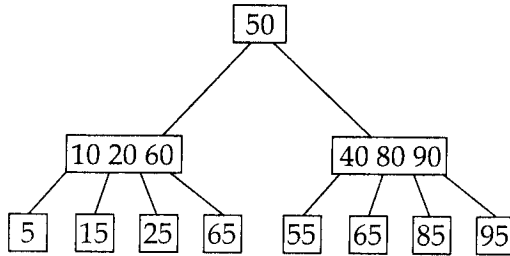
3.   (a)   Give in pseudo code the MERGE procedure   6
of MERGE SORT algorithm. Explain it with
the following arrays.

| 2 | 4 | 6 | 8 | | 1 | 3 | 5 | 9 |

(b)   Illustrate the Depth-first search algorithm   4
using the following graph, starting form v_1.

4.   (a)   Find a minimal spanning tree of the   5
following graph using Prim's algorithm.

(b)   Find the longest common subsequence of the   5
following string using Dynamic
Programming :

X = (D, C, B, C, A, D, C)

Y = (C, A, B, D, C, D)

5.   (a)   Show the comparisons that the naine string   4
matches makes for the pattern

P = aaab and T = abaaababaaab.

(b)   Define a flow network. Show that, if f_1 3
and f_2 are flows, $\alpha\, f_1 + \beta f_2$ is also a flow
where $\alpha + \beta = 1$, $0 \leq \alpha$, $\beta \leq 1$.

(c)   Let $f(n) = 2^3 + 4^3 + 6^3 + ... + (2n)^3$. Find a   3
function $g(n)$ such that $f(n) = \Theta(g(n))$.

6.   (a)   Give the recursive fast fourier transform   6
algorithm in pseudo code. Illustrate it using
the vector (0, 1, 2, 3).

(b)   For the polynomials $f(x) = x^2 + 1$ and   4
$g(x) = x^2 - x - 1$, find the point value
representation using the points
$[1, -1, i, - i]$. Use the representation to
multiply the polynomials.