00339

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

Term-End Examination

December, 2010

MMTE–002 : DESIGN AND ANALYSIS OF ALGORITHMS

*Time : 2 hours*   *Maximum Marks : 50*

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

1. (a) Let $T : N \rightarrow R^{+}$ be a function satisfying   **3+2=5**

    $$T(n) = 2 \, T\left(\left[\frac{n}{3}\right]\right) + \textcircled{H}(n^2).$$

    (i)   Use recursion tree method to find a bound for $T(n)$.

    (ii) Use substitution method to verify the bound.

    (b) Explain the Kruskal's algorithm for finding the minimal spanning tree in a weighted graph using pseudo code. Use the algorithm to find the minimal spanning tree in the following graph.   **3+2=5**
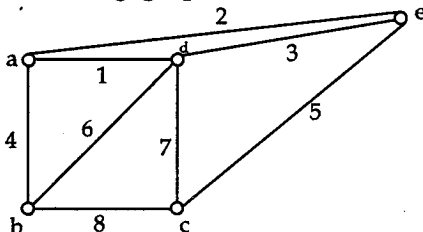
2. (a) For the following network flow, draw the   5
residual network.
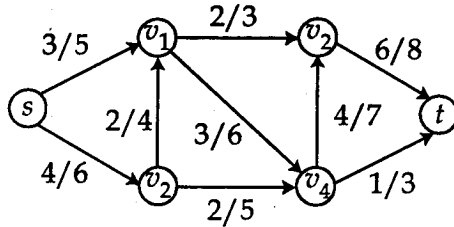
Find the augmenting path p and use it to
augment the flow. Draw the flow network
of the augmented flow.

(b) Prove that for Rabin-Karp string matching   5
algorithm, the preprocessing time is $(H)(m)$
and the matching and verification time is
$(H)((n-m+1)\,m)$ where n is the length of the
text and m is the length of the pattern.

3. (a) Give all the properties of a B-tree. Verify   6
that the following is a B-tree
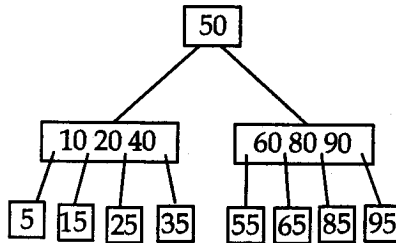
(b) State precisely a loop invariant for the loop
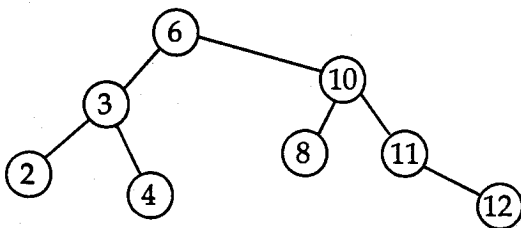given below and justify your answer.   4
SUM-OF-ODD-NUMBERS
$m \leftarrow 1$
For $i \leftarrow i$ **to** n
$\qquad m \leftarrow m + (2i+1)$

4. **(a)** Illustrate the procedure PARTITION, used   **4**
in quick sort, using the array
{ 4, 6, 3, 7, 2, 5 }

(b) Give an algorithm in pseudo code for   **6**
deleting a node from a binary search tree.
What binary search tree will you get if you
remove the node containing the key 10 in
the following binary tree.

5. **(a)** Explain the counting sort algorithm using   **4**
the array $A = [1, 2, 1, 4, 3, 2, 5, 3]$.

(b) Find an optimal parenthesisation of a   **6**
matrix chain product whose sequence of
dimensions is { 5, 7, 29, 8, 9 } using dynamic
programming.

6. **(a)** Give the recursive Euclid's algorithm for   **5**
finding the gcd of two numbers in pseudo
code. Analyse the running time of the
algorithm.

(b) Explain Dijkstra's shortest path algorithm.   **5**
Also, give the algorithm in pseudo code.

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