MCA (Revised)

Term-End Examination

June, 2010

13462

MCS-031 : DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 hours   *Maximum Marks : 100*

Note : *Question No. 1 is compulsory. Attempt any three from the rest.*

1. (a) (i) What are the different methodologies should involved in the design of an algorithm.   **4**

   (ii) Arrange the following growth rates in the increasing order. $0(n^3)$, $0(1)$, $0(n^2)$, $0(n \log n)$.   **4**

   (b) (i) Draw the recursion tree for the following - and write the following.   **4**

   $$T(n) = 4\ T\left(\frac{n}{2}\right) + n^2 \text{ in } \theta \text{ notations.}$$

   (ii) Use Master's method to find tight asymptotic bounds for the following recurrence :   **4**

   $$T(n) = T(n-1) + n$$

(c) (i) For the following four matrices find   **4**
the order of parenthesization for the
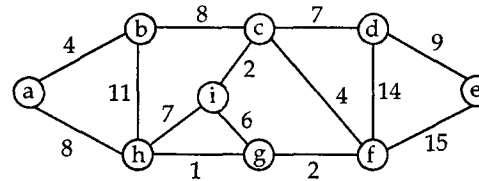optimal chain multiplication.

$A_1 = 15 \times 5$

$A_2 = 5 \times 10$

$A_3 = 10 \times 20$

$A_4 = 20 \times 25$

$A_1 \ldots A_4$ are the matrices of given
order.

(ii) Give greedy algorithm for Huffman   **4**
code.

(d) (i) Give a divide and conquer based   **4**
algorithm to find i^{th} largest element
in an array of size n.

(ii) Find the minimum spanning for the   **4**
graph using Prim's algo.

(e) (i) Construct a turing machine that finds   **4**
the sum of two natural numbers.

(ii) Consider the following instance of the   **4**
PCP

Alphabet $\Sigma = \{0, 1, 2\}$

List L $= (0, 1, 2)$

List M $= (00, 11, 22)$

Does PCP have a solution ?

2. (a) (i) Find the topological ordering of given graph : **6**
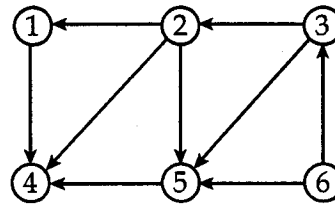
(ii) Apply DFS algorithm on the above graph. **6**

(iii) Write Kruskal's algorithm also evaluate its time Complexity. **8**

3. (a) What are regular expressions ? Write a regular expression over $\Sigma = \{a, b\}$ to generate all string that end with three a's. **7**

(b) Represent the following graph using (i) arrays (ii) Adjacency list. **6**
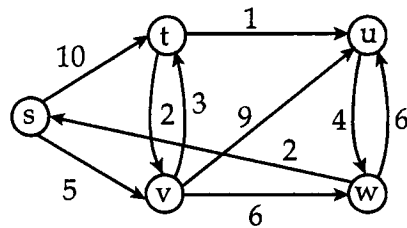
(c) Prove that the Halting problem is undecidable. **7**

4. (a) "Merge Sort is considered to be best if space   **6**
complexity is not a constraint". Explain the
statement by some mathematical proof.

(b) Write the algorithm for Best First Search. **4+4**
What is minimax principal.

(c) Discuss the relationship between class P,   **6**
NP, NP complete and NP Hard problems
with suitable example of each class.

5. (a) To sort the list 15, 10, 13, 9, 12, 17 stored in   **6**
A [1..6] using heap sort first build a heap
for the list and then recursively delete the
root and restore the heap.

(b) Write the algorithm for binary search also   **8**
evaluate its time complexity.

(c) Sort the given list using merge sort :   **6**

25, 12, 15, 11, 17, 8

also find the number of comparisons and
assignment operations required.

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