

M.Sc. 2nd Semester Examination, 2013

COMPUTER SCIENCE

(Design and Analysis of Algorithm)

PAPER—CS-203

Full Marks : 50

Time : 2 hours

Answer Q. No. 1 and any two from the rest

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

1. (a) What do you mean by time complexity and space complexity of an algorithm? 2
- (b) Consider the algorithm COUNT whose input is a positive integer n .

(Turn Over)

(2)

Algorithm : COUNT

1. Count $\leftarrow 0$
2. for $i \leftarrow 1$ to n
3. $j \leftarrow \lfloor n/2 \rfloor$
4. while $j \geq 1$
5. Count \leftarrow Count + 1
6. if j is odd then $j \leftarrow 0$ else $j \leftarrow j/2$
7. end while
8. end for.

(i) What are the maximum number of times step 5 is executed when n is a power of 2 and n is a power of 3 ?

(ii) What is the time complexity of the algorithm expressed in the O-notation ?

5 + 3

2. (a) Use the master method to find tight bound for the recurrence

$$f(n) = 3f(n/4) + n/g n,$$

where n is a positive integer.

3

- (b) Use the substitution method to find the upper bound for the recurrence

$$f(n) = 2f(n/2) + n^2, n \geq 3, f(1) = 1$$

where n is a power power of 2. 5

- (c) Write down algorithm design techniques. Discuss any *two* techniques among these.

3 + 2 + 2

3. (a) Write Binary search algorithm and derive its best case and worst case running time. 5 + 3

- (b) To find suboptimal solution by arranging profit in non-increasing order 7

$$P = [18, 15, 10, 7, 6, 5, 3]$$

$$W = [4, 5, 2, 9, 1, 3, 1]$$

4. (a) Explain Strassen's algorithm for matrix multiplication. 7

- (b) Use Floyd - Warshall algorithm to compute the distance matrix for the directed graph with the length of edges between all pairs of vertices are as given by the matrix 8

$$\begin{pmatrix} 0 & 2 & 4 & 6 \\ 2 & 0 & 1 & 2 \\ 5 & 9 & 0 & 1 \\ 9 & \infty & 2 & 0 \end{pmatrix}$$

(4)

5. (a) Write a greedy algorithm to find a minimum cost spanning tree for the undirected graph and what is the time complexity of that algorithm. 8

(b) Use MATRIX-CHAIN algorithm to multiply the following four matrices

$$M_1 : 2 \times 3, M_2 : 3 \times 4, M_3 : 4 \times 5, M_4 : 5 \times 6$$

Find the minimum number of scalar multiplications needed to multiply these four matrices. 7

[*Internal Assessment* : 10 Marks]
