H Roll No. ....

TMC–501

M. C. A. (FIFTH SEMESTER)
MID SEMESTER EXAMINATION, 2018
DESIGN AND ANALYSIS OF ALGORITHM

Time : 1:30 Hours
Maximum Marks : 50

Note : (i) This question paper contains two Sections.

(ii) Both Sections are compulsory.

Section—A

1. Fill in the blanks :   (1×5=5 Marks)

   (a) .... indicates how fast an algorithm in questions runs.

   (b) The .... notation is used to express algorithm's running time in average case.

   (c) The main tool for analyzing the time efficiency of a recursive algorithm is to set up a .... relation.

   (d) Binary search is a .... algorithm for searching in sorted list.

   (e) Heap sort is an example of .... algorithm to sorting problem.

F. No. : b-43   **P. T. O.**

2. Attempt any *five* parts :   (3×5=15 Marks)

   (a) Explain the various criteria used for analyzing algorithms.

   (b) Give the significance of basic operation in algorithm.

   (c) Design an algorithm for swapping two 3 digit non-zero integers n, m. Besides using arithmetic operations, your algorithm should not use any temporary variables.

   (d) What is pseudo-code ? Design an algorithm for computing gcd (m, n) using Euclid's algorithm.

   (e) Give an example of an algorithm that should not be considered an application of the Brute-force approach. Also give an example of a problem that cannot be solved by a Brute-force algorithm.

   (f) Compare the order of growth of $\frac{1}{2}(n(n-1))$ and n^2.

Section—B

3. Attempt any *two* parts of choice from (a), (b) and (c).   (5×2=10 Marks)

   (a) Describe briefly the notations of complexity of an algorithm.

   (b) Write an algorithm for adding 'n' natural numbers and find its time complexity.

   (c) Consider the following recursive algorithm for computing the sum of the first n cubes :

   $$S(n) = 1^3 + 2^3 + ... + n^3$$

   Algorithm S(n)

   //Input : A positive integer n

   //Output: The sum of the first n cubes

   if $n = 1$ return 1

   else return S $(n-1) + n * n * n$

   (i) Set up and solve a recurrence relation for the number of times of algorithm's basic operation is executed.

   (ii) How does this algorithm compare with the straight forward non recursive algorithm for computing this function ?

4. Attempt any *two* parts of choice from (a), (b) and (c).   (5×2=10 Marks)

   (a) Find the running time for the following code :

   ```
   A()
   {
       For(i=n/2; i<=n; i++)
       For(j=1; j<=n; j=2*j)
       For(k=1; k<=n; k=k*2)
       Printf("GREAT WORK");
   }
   ```

(b) For each of the following functions, indicate how much the function's value will change if its argument is increased fourfold :

(i) $\log_2 n$

(ii) N^2

(iii) 2^n

(iv) N^3

(c) Give an example of a text of length n and a pattern of length m that constitutes the worst case input for the Brute-force string-matching algorithm. Exactly how many character comparisons are made for such input.

5. Attempt any *two* parts of choice from (a), (b) and (c).   (5×2=10 Marks)

(a) Rewrite the quick sort procedure to sort the elements in either ascending for descending order.

(b) Solve $T(n) = 16\,T\left(\dfrac{n}{4}\right) + n^3$ by master method.

(c) Sort the list E, X, A, M, P, L, E in alphabetical order by bubble sort.