Exam No: _____

GANPAT UNIVERSITY

M. TECH SEMESTER I (COMPUTER ENGINEERING)
REGULAR EXAMINATION NOV/DEC – 2015
3CE103 : COMPUTER ALGORITHMS

Max. Time: 3 hours   Max. Marks: 60

Instructions: 1. This Question paper has two sections. Attempt each section in separate answer book.
2. Figure to the right indicates full marks.
3. Be precise and to the point in answering the descriptive questions.

SECTION – I

Q – 1 (a) Explain empirical and theoretical approach for estimating time complexity. [2]

(b) Show that $f(n) = (n + a)^b = \Theta(n^b)$ [4]

(c) Answer the followings: [4]

1. Prove that $f(n) = 9n^2 + 7n + 13 \neq \Omega(n^3)$

2. Define the asymptotic notation, which is used to represent the upper boundary for the growth of functions.

OR

Q – 1 (a) What is loose bound and incorrect bound? Explain in the context of asymptotic notation. [2]

(b) Express the complexities of the following functions using theta (Θ) notation. Identify necessary values of constants and n_0. [4]

1. $f(n) = n^3 - 2n^2$ 2. $f(n) = n^2 + n \log n$

(c) Answer the followings: [4]
1. Define big-Ω notation. Explain it with the help of graph.
2. Show that $f(n) = 2^n + n^2 \neq O(n^2)$

Q – 2 (a) Solve the recurrence: $T(n) - 2T(n) = (n + 5)3^n$ [4]

(b) Apply Master method on the recurrence: $T(n) = 2T\left(\frac{n}{4}\right) + \sqrt{n}$ [2]

(c) Solve the recurrence using change of variable method: $T(n) = 5T\left(\frac{n}{5}\right) + n$ [4]

OR

Q – 2 (a) Solve the following recurrence and express the time complexity using theta notation : [3]

$$T(n) = \begin{cases} 0 & \text{, if } n = 0 \\ 3 & \text{, if } n = 1 \\ \sqrt{5}\,T(n-1) + T(n-2), & \text{otherwise} \end{cases}$$

(b) Write the recurrence relationship of quick sort for best case and worst case. Solve each of them and represent the time complexity using theta notation. [4]

(c) Solve using recurrence tree method: $T(n) = T\left(\frac{n}{3}\right) + T\left(\frac{2n}{3}\right) + n$ [3]

Q – 3 (a) What is space complexity? Discuss various factors affecting it. [2]

(b) If algorithms A and B have complexity $O(n^2)$ and $\Omega(n^2)$ respectively then which algorithm is better and why? [2]

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(c) Find out the step count for the following function using tabular method. [2]

```
void ABC( int n )
{    for( int i=1; i<= n; i++)
     {    for (int j=1; j<=2^n; )
          {    printf("%d",j);
               j=j*2;
          }
     }
}
```
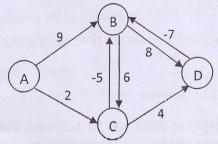
(d) List all the different possible solutions to the recurrence: $T(n) = 3 T(n-1) + n\ 3^n$. Write the general solution to the above recurrence. Do not find any constants. [2]

(e) Illustrate the solution of min-max problem for the array {10, 2, 8, 5} using divide & conquer approach. [2]

SECTION – II

Q – 4 (a) Explain the general concept of Divide and Conquer Method. Show how the problem of merge sort can be solved using it. [3]

(b) Discuss the divide and conquer approach to multiply two integer numbers. Also discuss time complexity of it. [4]

(c) Write and discuss the general characteristics of the problems solvable by greedy approach. [3]

OR

Q – 4 (a) Discuss the divide & conquer approach to implement binary search algorithm. [3]

(b) What is an inversion in an array? Discuss D&C approach to find the total number of inversions in an array. [4]

(c) Which different criteria can be chosen for the selection function to solve the fractional knap-sack problem using the greedy algorithm? Explain with example. [3]

Q – 5 (a) Find the shortest path from A to all other nodes in the following graph using Bellman-Ford algorithm. Relax the edges in the following order: AB, AC, BD, BC, CB, CD and DC. [3]

(b) How divide & conquer differ with Dynamic Programming? Solve binomial coefficient problem using dynamic programming. [4]

(c) Solve the 4-queen problem using backtracking strategy. [3]

OR

Q – 5 (a) What is Minimum Spanning Tree? List out two different methods to find MST from the given tree. How they differ in working? [3]

(b) Solve the 0/1 knapsack problem using dynamic programming. Let $W_i = \{1,2,4,7\}$ and $V_i =$ {2,3,7,12}. The capacity of knapsack is 10. Write the necessary equations to solve the problem. [4]

(c) Solve the assignment problem for the following cost matrix to assign job of 3 persons. Use branch & bound strategy. [3]

	Job1	Job2	Job3
Person1	7	3	2
Person2	5	2	6
Person3	2	5	4

Q – 6 (a) What is class-P and class-NP problem? Explain with example. [2]

(b) What is making change problem? Write an algorithm to solve it using greedy approach. [3]

(c) Solve the matrix chain multiplication using dynamic programming: [5]
A1: 3 x 4   A2: 4 x 2   A3: 2 x 3   A4: 3 x 6   A5: 6 x 5

----- END OF PAPER -----