Nirma University

Institute of Technology

Semester End Examination (IR/RPR), May - 2018

B. Tech. in Computer Engineering / Information Technology, Semester-VI

CE601 Design and Analysis of Algorithms

Roll / Exam No. | Supervisor's Initial with Date

Time: 3 Hours | Max Marks: 100

Instructions:
1. Attempt all the questions.
2. Figures to right indicate full marks.
3. Draw neat sketches wherever necessary.
4. Assume suitable data wherever required

Q-1 Do as directed **[16]**

A State and prove "Limit rules" for comparing two functions f(n) and g(n) asymptotically. [8]

B Write the "PARTITION" algorithm invoked by the quicksort. Trace it on the sequence of elements <2, 8, 7, 1, 3, 5, 6, 4>. [8]

Q-2 Do as directed **[18]**

A Find out the exact solution of the following recurrence relation:- [6]

$T(n) = \sqrt{2}\, T(n/2) + \sqrt{n}$, where $T(1) = 1$ and $n=2^k$.

OR

A What is amortized analysis? Explain the significance of "Potential function" method of amortized analysis. [6]

B In the algorithm SELECT, the input elements are divided into groups of 5. Will the algorithm work in linear time, if they are divided into groups of 7? Show that SELECT does not run in linear time if groups of 3 are used. [6]

OR

B Write "Heap sort" algorithm and analyse its time complexity. [6]

C Calculate the running time of the following function :- [6]

```
int  func(int n)
{
  int i, j, k=0;
  for ( i = n/2; i <= n; i++ )
     for ( j=2; j<=n; j = j*2 )
          k = k + n/2;
  return k;
}
```

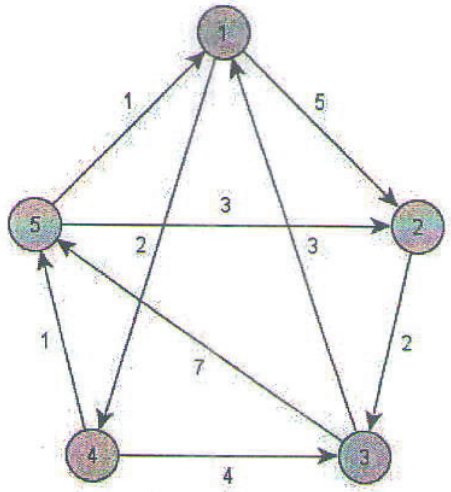
Q-3 Do as directed **[16]**

A Show that the second smallest of n elements can be found with n + ceil(log n) – 2 comparisons in the worst case. [8]

B Show that the running time of Quick sort is $\theta(n^2)$ when the array A is sorted in descending order? [8]

Q-4 Do as directed **[16]**

A For the following graph, solve all pair shortest path using Flloyd's algorithm and show that how it differs from Dijkstra Algorithm? [8]



B Find an optimal Huffman code for the following set of frequencies. A = 50, B = 25, C = 15, D = 40 and E = 75. Also prove that Huffman Code follow the greedy choice property. [8]

Q-5 Do as directed **[18]**

A Show that Hamiltonian-path problem is NP Complete. [6]

OR

A For the following two strings: A = PROPERTY and B = PROSPERITY find the longest common string (LCS) using Dynamic programing approach [6]

B Define how knapsack problem is solved by using Dynamic Programing approach ? Consider n = 4 and maximum capacity of Knapsack is 10, find the optimal solution? [6]

Wi	5	4	6	3
Vi	10	40	30	50

OR

B Strassen's Algorithm is an efficient algorithm to multiply two matrices. A simple method to multiply two matrices need 3 nested loops and is $O(n^3)$. Strassen's algorithm multiplies two matrices in $O(n^{2.8974})$ time, Prove it for the following example: [6]

$A = \begin{bmatrix} 1 & 2 \\ 4 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}$

C Write an algorithm for Making change problem using Greedy Approach. Explain it with suitable example. [6]

Q-6 Do as directed **[16]**

A For the following chain matrix multiplications, find out the optimal parenthesization? (Use Dynamic Programing approach) [8]

Matrix	Dimensions
A1	30 X 35
A2	35 X 15
A3	15 X 5
A4	5 X 10
A5	10 X 20
A6	20 X 25

B Given a set of cities and distance between every pair of cities, the problem is to find the shortest possible tour that visits every city exactly once and returns to the starting point using Branch and Bound (Hint Travelling Salesman Problem). [8]

For example, consider the graph shown in figure. A TSP tour in the graph is 0-1-3-2-0. The cost of the tour is 10+25+30+15 which is 80.