Nirma University

Institute of Technology

Semester End Examination (RPR), December - 2018

B. Tech. in Computer Engineering, 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 questions of Section I and II separately in same Answerbook.
2. Figures to right indicate full marks.
3. Draw neat sketches wherever necessary.
4. Assume suitable data wherever required.

Section I

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

A Write INSERTION-SORT algorithm. Determine its total running time by specifying the cost incurred in each step of your algorithm. [8]

B Can we improve the time complexity of multiplying large integers using Divide and Conquer? Prove your answer with suitable example of multiplying 981 X 1234. (Hint: Karatsuba Algorithm) [8]

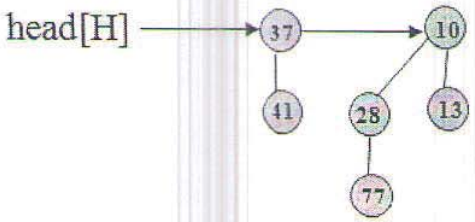
Q-2 Do as directed **[18]**

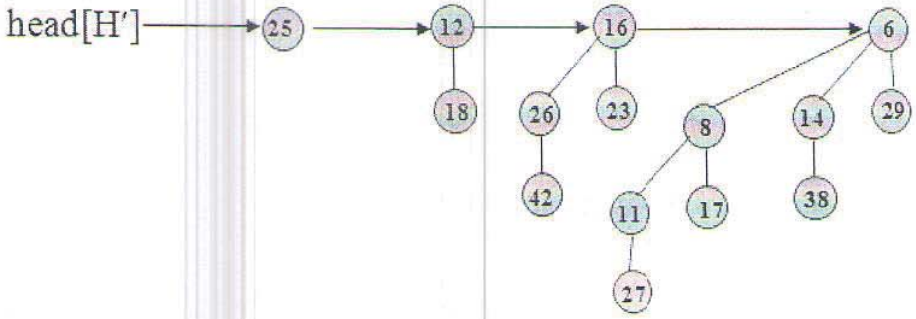
A Solve the following recurrence relation by Recursion Tree method :- $T(n) = 4T(n/3) + n$ [6]

OR

A Prove the correctness of "MERGE" procedure in Merge sort. [6]

B Given the two heaps H and H' find the union of these two heaps. [6]





OR

B Explain all the operations (along with time complexities of each of them), that are supported by a Binomial Heap. [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 The following table indicates daily price (in Rs.) of stock in the ABC company, after the close of trading over a period of 17 days. [8]

Day	0	1	2	3	4	5	6	7	8
Price	100	113	110	85	105	102	86	63	81

Day	9	10	11	12	13	14	15	16
Price	101	94	106	101	79	94	90	97

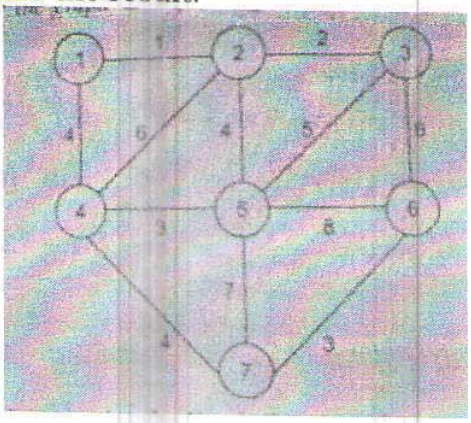
Identify and write the suitable algorithm and trace it to determine the following :-

After which day should a person buy the stock and after which day should a person sell the stock, in order to maximize the profit?

B What is the purpose of MAX-HEAPIFY algorithm? Write its algorithm and show the trace of MAX-HEAPIFY(A,3) on the given array A = {27, 17, 3, 16, 13, 10, 1, 5, 7, 12, 4, 8, 9, 0}. [8]

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

A Consider the graph G = (V, E) given below. Find the minimum spanning tree by Kruskal's Algorithm and Prim's Algorithm and compare the result. [8]



B We have set of n jobs to execute, each of which takes unit time. At any time T = 1,2,.... We can execute exactly one job. Job i earn us a profit Pi > 0 iff it is executed no late than time di (deadline). Develop a greedy algorithm to solve the above problem. Run your above algorithm for n = 4 and the following values: [8]

i	1	2	3	4
Pi	50	10	15	30
di	2	1	2	7

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

A Is Travelling Salesman Problem is NP-Complete? Justify your answer. [6]

OR

A Explain the Algorithm for solving Knapsack (0/1) problem for the following data using Branch and Bound. Maximum knapsack capacity W = 7 [6]

Items	Weight	Value
I_1	5	6
I_2	4	5
I_3	3	4

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

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 Making change problem can be solved by Greedy Algorithm as well as Dynamic programing approach. True / false justify with suitable example. [6]

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

A The N Queen is the problem of placing N chess queens on an N×N chessboard so that no two queens attack each other, Design an algorithm for solving N-Queen Problem using backtracking [8]

B 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