Exam No: _____

GANPAT UNIVERSITY

M. TECH SEM. I COMPUTER ENGINEERING/INFORMATION TECHNOLOGY

REGULAR EXAMINATION NOV-DEC 2017

3CE102/3IT102: 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) Let t_A (n) and t_B (n) denote the running times of two programs A and B respectively. For following pairs find the value of n for which program A is faster than program B. **(2)**

1. $t_A(n) = 2n^3$, $t_B(n) = 10n$ **2.** $t_A(n) = 100n$, $t_B(n) = n^2$

(b) Find omega (Ω) notation for the following functions. Clearly indicate value of constant C and n_0. **(2)**

1. $f(n)=2*6^n + 2n$ **2.** $f(n)=2n^2 + 6\,n * \lg n + 6n$

(c) Write sequential search algorithm and analyze it for best and worst case using tabular method. **(6)**

OR

Q – 1 (a) If $P(n) = a_0 + a_1 n + a_2 n^2 + \ldots\ldots + a_m n^m$ then Prove that $P(n) = \Theta(n^m)$ where $a_0, a_1, a_2 \ldots a_m$ are constants. **(4)**

(b) Design binary search algorithm to search an element from descending order sorted data and draw the tree that shows the number of comparisons required to search each element of list having 8 elements. **(6)**

Q – 2 (a) Express complexity of following functions using theta (Θ) notation. Clearly indicates value of constants C_1, C_2 and n_0. **(3)**

1. $f(n)= 6\sqrt{n} + n^{1.5}$ **2.** $f(n) = 8\,n^4 + n + n^2 \lg n$ **3.** $f(n) = 2n! + 6n^n$

(b) Write recurrence relation of worst case of Quick sort algorithm and represent the answer using theta notation. **(3)**

(c) Solve the recurrence: $T_n = 3T_{n-1} + 4 + 2^n$ with initial conditions T(0)=0 and T(1)=6. **(4)**

OR

Q – 2 (a) Arrange the following functions from the lowest to highest asymptotic order: **(2)**
$O(n^{1.5})$, $O(2^n)$, $\Omega(n \log n)$, $O(\log n)$, $O(n!)$, $O(n^3)$

(b) Solve the recurrence $T(n) = 4T(n/2) + n^3$. **(3)**

(c) Solve recurrence $T_n = 2\,T_{n-1} + (n+3)\,4^n$ with initial conditions T(0)=0, T(1)=12. **(5)**

Q – 3 (a) Design an algorithm to calculate x^n. Algorithm should have time complexity O(lg n). **(5)**

(b) Analyze following algorithm for its Worst case time complexity using tabular method. Represent the time complexity using Theta (Θ) notation. **(5)**

Algorithm **Best-Luck (n)**{

```
1.    int i, j;
2.    for (i=0; i<n; i=i+2) {
3.        for (j=1; j<n ;j=j*5)    {
4.            printf("Thank God") }   } }
```

SECTION – II

Q – 4 (a) Consider the knapsack problem with items n =5, weights (w1, w2, w3, w4, w5) = (20, 10, 30, 60, 50) and values (p1, p2, p3, p4, p5) = (20, 30, 60, 15, 100), Capacity M=75. Apply minimum weight and maximum of P/W greedy strategy to find solutions and also indicate optimal solution out of both strategies. **(5)**

(b) Solve the following Assignment Problem (i.e. find the optimal assignment value) using Branch and Bound technique. **(5)**

	1	2	3	4
P	2	20	7	11
Q	10	9	6	4
R	14	11	13	6
S	12	8	16	3

OR

Q – 4 (a) Draw the search space tree for 4-queen problem with no constraint (brute-force) and row/column constraint. Also draw the pruned tree with logic of Backtracking. **(5)**

(b) Show the working of merge sort algorithm on following data: 10, 25, 6, 13, 2, 16, 9, 15, 11, 50 **(3)**

(c) For graph coloring problem write optimization and decision based problems. **(2)**

Q – 5 (a) Design a dynamic programming algorithm for making change problem. Also construct the table to give change of 10 using denominations 1, 2, 4, 6. **(5)**

(b) Define Minimal Spanning Tree (MST). Find the MST using Kruskal algorithm from graph given in figure A of Q-5(b). Also draw the MST obtained using Kruskal algorithm. **(5)**

OR

Q – 5 (a) Show that Clique of a graph is a NP problem. **(5)**

(b) Find the shortest path for the following graph using Dijkstra's algorithm. Take 'a' as single source. **(5)**

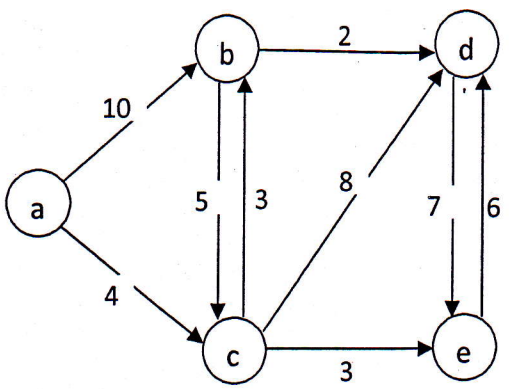

Figure A

Q – 6 (a) Find the optimal way of multiplying following matrices using dynamic programming. **(6)**
A:3 x 5, **B:** 5 x 10, **C:**10 x 8, **D:** 8 x 6

(b) Draw any undirected graph having at least two cycles and apply DFS algorithm to find display sequence. Also draw DFS tree correspond to your graph. **(4)**

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