KADI SARVA VISHWAVIDHYALAYA

M.E. Semester I

Subject code:- MECE101 **Subject Name:-** Advanced Algorithms and Analysis

Date: - 23.05.2013 **Time: -** 10:30 – 1:30 **Total Marks: -** 70

Instructions:

1. Answer each section in separate Answer sheet.
2. Use of Scientific calculator is permitted.
3. All questions are **compulsory**.
4. Indicate **clearly**, the options you attempt along with its respective question number.
5. Use the last page of main supplementary of **rough work.**

Section - I

Q:1 All Compulsory

(A) Define Time complexity of an algorithm. Explain best case, average case and worst case time complexity analysis for linear search. **[5]**

(B) What is recurrence equation? Write and solve the recurrence equation for merge short. **[5]**

(C) Compare and contrast: **[5]**

1. Heap sort and Quick sort
2. Merge sort and Heap sort

OR

(C) Write pseudo code for quick sort and derive its worst case time complexity **[5]**

Q:2 Answer the following question

(A) How heap tree differs from binary search tree. Draw max heap tree and binary search tree for given data sequence: 1 9 4 3 8 7 6 2 **[5]**

(B) Write pseudo code to check over flow and under flow conditions in QUEUE **[5]**

OR

(A) List applications of stack. Explain any one application with example. **[5]**

(B) Explain Red Black tree with suitable example **[5]**

Q:3 Answer the following question

(A) Explain Fibonacci heap with suitable data **[5]**

(B) List advantages and disadvantages of linked list over an array. **[5]**

OR

(A) Explain R tree with suitable data **[5]**

(B) List the techniques to achieve sorting in linear time. Discuss any one method with suitable example **[5]**

Section – II

Q:4 All Compulsory

(A) Differentiate: **[5]**

1. Greedy approach v/s Dynamic programming
2. Backtracking v/s Dynamic programming

(B) Solve the make a change problem using dynamic programming for given data. **[5]**
Denomination d = <1, 3, 4, 6>, Amount N = 9

(C) State and explain principle of optimality with example. Discuss any one problem on which principle of optimality is not applicable. **[5]**

OR

(C) Solve the 0/1 knapsack problem for given data. Comment on the complexity of solution. **[5]**
Items I = <I1, I2, I3, I4>Weights W = <1, 3, 4, 6>, Value V = <3, 5, 7, 8>
Capacity of knapsack is N = 12 unit

Q:5 Answer the following question

(A) Define back tracking and solve 4-Queen problem using it. **[5]**

(B) Define Minimum spanning tree. Discuss Prim's algorithm to find minimum spanning tree for graph shown in figure 1. **[5]**

OR

(A) State the single source shortest path problem and solve it for the graph shown in figure 2. **[5]**

(B) State the All pair shortest path problem and solve it for the graph shown in figure 2. **[5]**

Q:6 Answer the following question

(A) In certain literature probability of occurrence of characters S = <A B C D E > is P <0.5, 0.25, 0.12, 0.09, 0.04 >. Using Huffman coding technique, find out the prefix code for given characters. **[5]**

(B) Solve following recurrences using master method: **[5]**
$T(n) = 2T(n/2) + n$
$T(n) = 2T(n/2) + n^3$

OR

(A) What is heuristic algorithm? Solve ant one problem using heuristic algorithm **[5]**

(B) Discuss: P and NP problem **[5]**

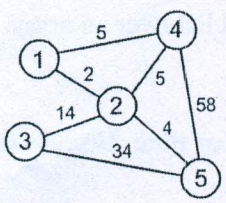

Figure 1

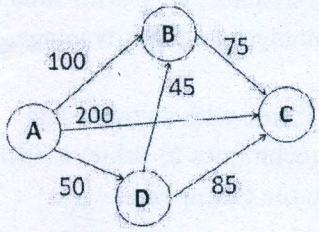

Figure 2

Kadi Sarva Vishwavidyalaya

M.E. Sem-I

Subject: Advanced Algorithms and Analysis

Date: 17th Jan, 2013 Max. Marks:70

Time: 3 Hrs

Instruction: (1) Answer each section in separate Answer sheet
(2) Use of Scientific calculator is permitted

Section-I

Q-1 **Each carries equal marks.** **[15]**

[A] Derive the time complexity of the following (Show the cost analysis of each step).

1)
```
sum = 0;
for(i=0;i<n;i++)
        if(isEven(i))
        {
                for(j=0;j<m;j++){ sum++;}
        }
        else
        {Sum = sum+n;}
```

2)
```
count =1;
while (n>1){
        count = count + 1;
        n=n/2;
        return count;
 }
```

[B] Explain worst case and Best case complexity of Insertion sort.

[C] Justify whether the Master's theorem can be applied to the following or not. Give an asymptotic upper bound for each recurrence.

1) $T(n)=3T(n/4) + n \lg n$
2) $T(n) = T(2n/3) + 1$

OR

[C] Use a recurrence tree to give an asymptotically tight solution to the recurrence $T(n) = T(n-a) + T(a) + cn$, where $a \geq 1$ and $c > 0$ are constants.

Q-2 **[10]**

[A] Is the sequence {23, 17, 14, 6, 13, 10, 1, 5, 7, 12} a max-heap? If not, construct a max-heap from given elements. Illustrate the operation of HEAPSORT on it.

[B] What is a Binary Search Tree? For the set of keys {1, 4, 5, 0, 16, 17, 21}, draw binary search trees of height 2, 3, 4, 5 and 6.

OR

Q-2

[A] Analyze and discuss the performance of quick sort with example. **[5]**

[B] 1) Write recursive version of TREE-MINIMUM procedure and discuss its time complexity. **[3]**

[2]

2) Suppose that we have numbers between 1 and 1000 in a binary search tree and want to search for the number 363. Which of the following sequences could not be the sequence of nodes examined?

a. 2, 252, 401, 398, 330, 344, 397, 363
b. 924, 220, 911, 244, 898, 258, 362, 363
c. 925, 202, 911, 240, 912, 245, 363
d. 935, 278, 347, 621, 299, 392, 358, 363

Q-3 **[10]**

[A] List out the advantages of Red-Black Tree and how it differs from AVL tree. Construct Red-Black Tree for given data:
28, 25, 20, 17, 14, 8, 4

[B] Create a Binomial-heap for following list: {25, 17, 10, 37, 40, 61, 30, 47, 3, 33, 51, 95, 70}.

OR

Q-3 **[10]**

[A] Construct B-tree for the sequence of data: F, S, O, K, A, L, H, T, V, W, M, R, N, B, P, X, Y, D, E, Z in order into an empty B-tree of order 4. Delete the keys X and N from it.

[B] Explain uniting two Fibonacci heaps with suitable example.

Section-II

Q-4 **Each carries equal marks.** **[15]**

[A] Derive recurrence to find the longest common subsequence and solve for following sequences: P = (A,B,D,B,C,D,C,C,D); Q= (B,D,C,E)

[B] Explain Kruskal's algorithm with time and space complexity analysis.

[C] Prove or give counter example to justify whether following statements are true or false:
1) if a graph is bi-connected, then it is bi-coherent
2) if a graph is bi-coherent, then it is bi-connected

OR

[C] Give non recursive solution for BFS. Explain applicability of BFS in place of DFS with suitable example.

Q-5 [10]

[A] Find an optimal solution for the knapsack instances n=6, M=15. $(P_1,P_2,\ldots,P_7)=(15,10,7,6,18,3)$ and $(W_1,W_2,\ldots,W_7)=(3,2,1,4,7,4)$

[B] Explain how order statistic tree can be used to determine the rank of an element from given array.

OR

Q-5 [10]

[A] How is heuristic Algorithm more efficient than dynamic programming? Explain with example.

[B] In an activity selection problem, suppose that instead of always selecting the first activity to finish, we instead select the last activity to start that is compatible with all previously selected activities. Describe how this approach is a greedy algorithm, and prove that it yields an optimal solution.

Q-6 [10]

[A] Explain with example cost optimal prefix computation problem on the PRAM with its analysis.

[B] Sort following elements using parallel merge sort algorithm. Number of available processors are 4.
13, 17, 21, 11, 20, 6, 5, 72, 55, 14, 13, 67, 10. What is the complexity of parallel merge sort algorithm for P available processors?

OR

Q-6 [10]

[A] Explain with example bitonic merging network and its analysis.

[B] Explain P and NP-class problems through example. Is the problem 'The salesman has to visit every city of a map exactly once', NP-complete or NP-hard problem? Justify.