Tribhuvan University

Bachelor of Science in Computer Science and Information Technology

Design and Analysis of Algorithms

Model Question

FM = 80

PM = 32 **Time: 3 hours.**

1. Can we apply master method to find the big-O estimate of the recurrence T(n) = 4T(n/2) + n2logn? Why or why not? Find the big-O estimate for this recurrence by using recursion tree.

2. Given the following block of code, write a recurrence relation for it with reason and also find asymptotic upper bound (Assume that a dotted code takes linear time)

```
fun(int n)
{
        ……..
        if(condition 1)
        x = fun(n/)
        else if(condition 2)
        x = fun(2n/)
        else
        x = fun(n/)
        ……..
}
```

3. What do you mean by order statistics? How can you devise an algorithm that guarantee the selection of i^{th} order statistics in linear time? Write the algorithms of it and also analyze it.

4. In what situations the dynamic programming algorithms are useful? What are the application areas of Longest Common Subsequence? Write the recursive definition for finding LCS and find the LCS of the strings “Monkey” and “Money”.

5. What is the advantage and disadvantage of greedy algorithms over dynamic programming algorithms? Under what circumstances greedy algorithm gives us optimal solution? Devise the greedy algorithm that makes the change of n rupees (n<55000 and n is multiple of 10) with minimum number of notes (consider 100 notes of 10 rupees, 80 notes 20 rupees, 60 notes of 50 rupees, 50 notes of 100 rupees, 40 notes of 500 rupees and 30 notes of 1000 rupees).

6. In which case adjacency matrix representation of graph is better? Explore DFS with example and give its asymptotic and aggregate analysis.

7. What is the main concept behind randomized algorithms? Write algorithm for randomized quick sort and analyze it.

8. What is NP completeness? What approaches are used in proving NP-completeness of the problems? “Proving a problem as NP-complete is considered as good contribution in computer science” why? Justify with strong argument.

9. What is left turn and right turn? Give an algorithm for finding whether two line segments intersects or not by using left and right turn. Justify with example that algorithm works for all cases.

10. Suppose that our machine does not supports direct multiplication operation. Multiplication must be done by repeated addition. Devise Iterative and Recursive algorithm for it and analyze them.

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2067

Bachelor Level/Third Year/Fifth Semester/Science **Full Marks: 60**

Computer Science and Information Technology **Pass Marks: 24**

(CSC 303 – Design and Analysis of Algorithms) **Time: 3 Hrs.**

Candidates are required to give their answers in their own words as for as practicable.

The figures in the margin indicate full marks.

Attempt all questions.

1. Explain worst case, best case and average case of algorithm analysis with as example. (8)

2. What is recurrence relation? Find big-O of following recurrence using recurrence tree method.

   $T(n) = T\left(\frac{n}{-}\right) + 1$ *n>1*

   $= 1$ *n=1* (6+2)

3. Make a tight big-O analysis of following code.

```
void main()
{
        int m, n, I, j, a[], b[], c[];
        printf(''Enter value of m and n");
        scanf("%d%d", &m, &n);
        for(i = 0; i < n; i ++)
        {
        a[i] = i ;
        b[i] = i * i ;
        c[i] = - i ;
        }
        for(j = 0; j < m; j ++)
        {
        Printf("%d it %d it %d in", a(j), b(j), c(j));
        }
}
```

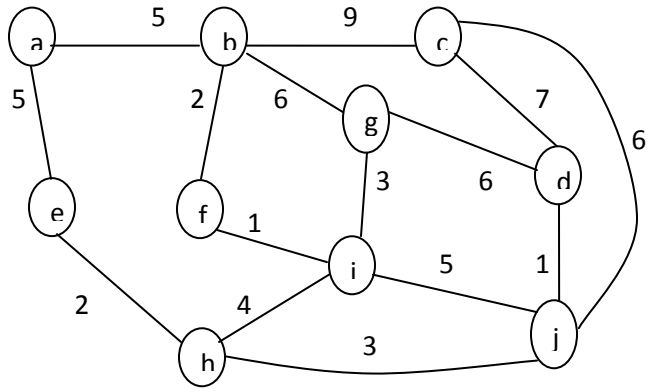
   (8)

4. What is order statistics? How can you devise an algorithm that guarantee the selection of i^{th} order statistics in linear time? Write the algorithm of it and analyze it. (1+3+4)

5. What is the main idea of randomized algorithm? Write an algorithm for randomized quick sort and analyze it. (2+6)

6. Define greedy paradigm. How can you define Huffman algorithm is Greedy algorithm? Explain. (2+6)

7. What is minimum spanning tree? Write the execution trace of following graph to construct minimum spanning tree by Prims algorithm. (2+6)



8. Explain Graham's Scan algorithm to compute convex hull. (8)

9. Define the terms "Class P", "Class – NP" and "NP – completeness". (8)

10. What is the concept of dynamic programming? Find the longest common-subsequence (LCS) between "XMJYAUZ" and "MZJAWXU". (2+6)

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Candidates are required to give their answers in their own words as for as practicable.

The figures in the margin indicate full marks.

Attempt all questions.

1. Write down the formal definition of big-oh, big-omega and big-Θ notation with examples. (8)
2. What is recurrence relation? Find the big-O of following recurrence by using recurrence tree method (2+6)

$$T(n) = 2T(n/2)+n \quad n>1$$
$$= 1 \quad n=1$$

3. Make a tight big-O analysis of following code segment. (8)

```
Void main()
{
Int m,n,i,j,a[],b[];
Printf("Enter value of m and n");
scanf("%d%d",&m,&n);
for(i=1,i<=m,i++)
        a[i]=i*i;
for(j=1,j<=n;j++)
        b[j]=-j;
for(i=1,i<=m,i++)
        printf("%d",a[i]);
for(j=1,j<=n;j++)
        printf("%d",b[j]);
}
```

4. What is linear data structure? Write down the algorithm of heap sort and find its complexity analysis. (2+6)
5. What is devide and conquer technique? Using this technique. Write an algorithm of quick sort then analyze it.
6. What are the advantages of dynamic programming? Find Longest Common Subsequence (LCS) between "abbaab" and "aabaabb". (2+6)
7. What is shortest path problem? Explain Dijkstra's algorithm for shortest path problem. (2+6)
8. What is left turn and right turn? Give an algorithm for finding two lines segments intersect or not by using left turn and right turn. Does this algorithm works for all cases? Justify with example. (2+6)
9. Define the terms "Class P", "Class NP" and "NP Completeness". (8)
10. What is the concept of randomized algorithm? Write an algorithm of approx-vertex cover problem and analyze it.