

Tribhuvan University  
**Institute of Science and Technology**  
 2067  
 ☆

Bachelor Level/ Third Year/ Fifth Semester/ Science  
**Computer Science and Information Technology (CSc. 303)**  
 (Design and Analysis of Algorithm)

Full Marks: 80  
 Pass Marks: 34  
 Time: 3 hours.

*Candidates are required to give their answer in their own words as far as practicable.*  
 The figures in the margin indicate full marks.

**Attempt all the questions.**

*Downloaded from: <http://www.bsccsit.com>*

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

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

$$\begin{aligned} T(n) &= T(n/2) + 1 & n > 1 \\ &= 1 & n = 1 \end{aligned}$$
 (2+6)

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\t %d\t %d\n", a(j), b(j), c(j));
    }
}
```

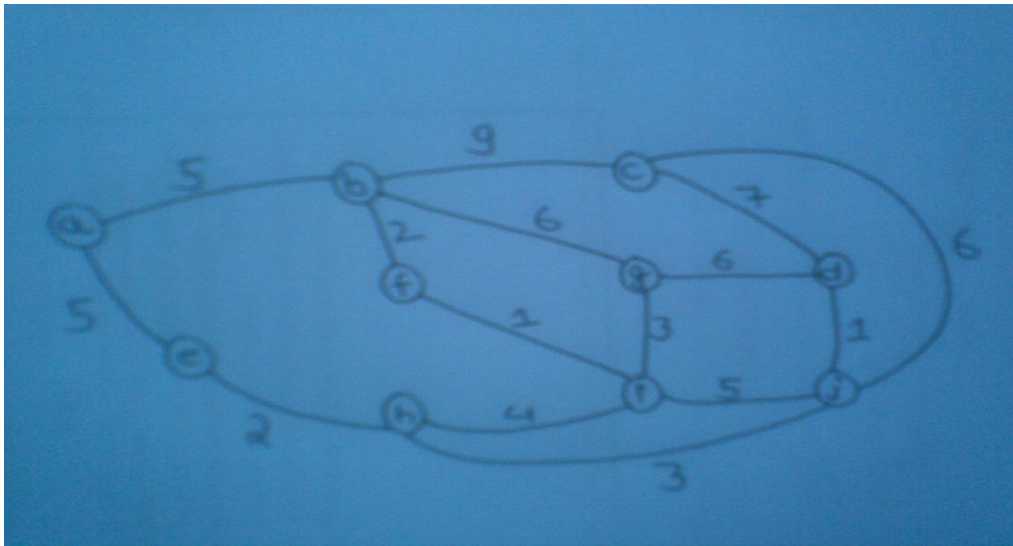
(8)

4. What is order statistics? How can you devise an algorithm that guarantee the selection of  $i^{\text{th}}$  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 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 the following graph to construct minimum spanning tree by prime 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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1. Write down the formal definition of big-oh, big-omega and big-thita notation with examples. (8)

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

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

$$= 1 \quad n = 1 \quad (2+6)$$

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

```
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]);
}
```

(8)

4. What is linear data structure? Write down the algorithm of heap sort and find its complexity analysis. (2+6)
5. What is divide and conquer technique? Using this technique. Write an algorithm of quick sort then analyze it. (2+6)
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. (2+6)

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1. Use RAM model to estimate the big-oh of the running time for following code segment for

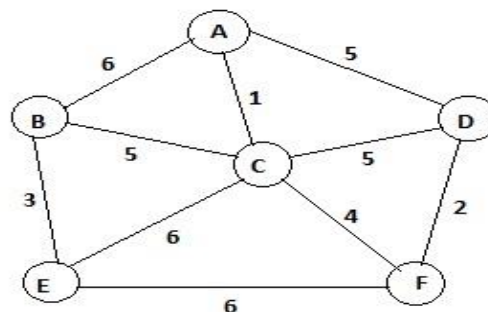
```
(i=1 ; i<n ; i++){
    small pos = i ;
    smallest = Array [small pos] ;
    for (j=i+1 ; j<=n ; j++) {
        if (Array [j] < smallest){
            small pos = j;
            smallest = Array [small pos];
        }
    }
    Array [small pos] = Array[i]
    Array [i] = smallest;
}
```

(8)

2. What do you mean by recurrence relation? Estimate the running time of algorithm given by following recurrence relations using master method.

- $T(n) = 4 T(n/2) + n^3$
  - $T(n) = 2 T(n/2) + n$
  - $T(n) = 3 T(n/4) + n \log n$
- (8)

3. Explain the quick sort algorithm with its complexity analysis. How randomized quick sort works efficiently even for worst case. (6+2)
4. Define order statistics. Write an algorithm that is able to select  $i^{\text{th}}$  largest element from an un-ordered list in linear time and analyze for its complexity. (2+6)
5. Sketch the Prim's algorithm for computing MST of a graph and analyze its complexity. Also trace the algorithm for the following graph. (2+6)

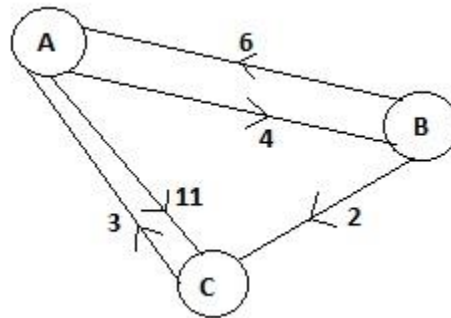


6. Give the job sequencing algorithm with deadlines. You have given 5 jobs with profit  $p_i$  and deadline  $d_i$  as

$$\begin{aligned} \text{job } i &= \{ 1, 2, 3, 4, 5 \} \\ p_i &= \{ 20, 10, 5, 15, 1 \} \\ d_i &= \{ 2, 1, 3, 2, 3 \} \end{aligned}$$

Find the optimal job lists that can be executed in sequence with in their deadlines so as to maximize the profits. (4+4)

7. Explain and analyze the Floyd's warshall algorithm for all pair shortest path problem. Trace the algorithm for the following graph. (4+4)



8. What do you mean by left turn and right turn for given three points in 2D? Explain the method for computing the intersection of two line segment efficiently. (2+6)
9. Explain about class P, class NP and NP complete with suitable examples. (8)
10. Explain the Gram's scan algorithm with example to compute the convex hull of the set of points in 2D. (8)