



END Semester Examination

(IT-16002) Algorithms and Complexity

Course: B.Tech , Sem VI

Branch : Information Technology

Academic Year: 2016-17

Max Marks: 60

Duration: 3 Hours

Date:03/05/2017

Student MIS No.

| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|

Instructions:

1. Mobile phones and programmable calculators are strictly prohibited.
2. Writing anything on question paper is not allowed.
3. Exchange/Sharing of stationery, calculator etc. not allowed.
4. Write your MIS Number on Question Paper
5. Assume suitable data if necessary.

Q.1

A. Find asymptotic bound for the following:

[6]

a)

```
function(int n){
    int i=1;
    while(i < n)
    { int j=n;
      while(j > 0)
        j=j/2;
      i=2*i;
    }
}
```

b)

```
function(int n){
    if(n<=1) return;
    for(int i=1; i<=n; i++)
        printf("**");
    function(0.8n);}
}
```

c)

```
function ( int n){
    if(n<2) return;
    else counter=0;
    for(i=1;i<=8;i++)
        function(n/2);
    for( i=1; i<= n3; i++)
        counter=counter+1;}
}
```

d)

```
int function(int n){
    if(n == 0)
        return 0;
    if(n==1)
        return 1;
    else
        function(n-1)+function(n-2)}
}
```



- B. Determine the space complexity for the following pseudo code.

[3]

```
function(n)
{ if(n ≥ 1)
  { function(n-1)
    printf(n)
    function(n-1) }}
```

- C. Consider a table size of 7 with hash function $h(k) = k \bmod 7$. Draw the table that results after inserting in the given order, the following values :19,26,13,48,17 for each of the following scenarios below

- When collisions are handled by separate chaining
- When collisions are handled by linear probing
- When collisions are handled by double hashing using a second hash function as $H(k) = 5 - (k \bmod 5)$

Q.II

- A. Find the optimum parenthesization for multiplication of the matrix chain given below. Compute m and s table for storing the cost and indexes achieved.

| Matrix | A1 | A2 | A3 | A4 | A5 | A6 |
|-----------|-------|-------|------|------|-------|-------|
| Dimension | 30x35 | 35x15 | 15x5 | 5x10 | 10x20 | 20x25 |

- B. A single server (such as a processor, a cashier in a bank, etc.) has n customer to serve. The service time required by each customer is known in advance. Customer i will require T_i time units ($1 \leq i \leq n$). Find the solution to minimize the average time a customer spends in the system using greedy method in generalized way.

[5]

- C. A data file of 100,000 characters contains only the characters a-f with the following frequencies. If we use variable length code then how much saving in number of bits can be achieved using Huffman code compared to the fixed length code.

[4]

| character | a | b | c | d | e | f |
|-------------------------------|----|----|----|----|---|---|
| Frequencies (in thousands) | 45 | 13 | 12 | 16 | 9 | 5 |



- D. Determine the cost and structure of an optimal binary search tree for $N=6$, having keys $K_1 \dots K_6$ with the following probabilities [7]

| Index i | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---------|---|----|---|----|----|----|----|
| K_i | | 3 | 7 | 10 | 15 | 20 | 25 |
| P_i | | 10 | 3 | 9 | 2 | 0 | 10 |
| Q_i | 5 | 6 | 4 | 4 | 3 | 8 | 0 |

Q.III

- A. Compute a prefix function Π for the given pattern also determine the occurrences of pattern P in the text T by specifying the shift value, if pattern is found [5]

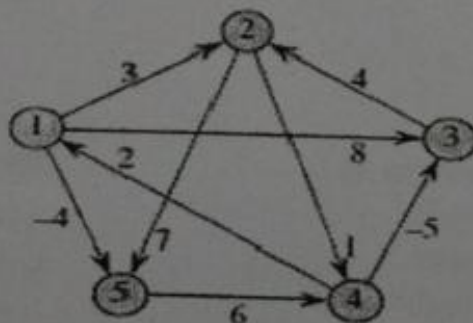
Pattern P : a b a b a c a

Text T : b a c b a b a b a b a c a a b

OR

A clique in an undirected graph $G = (V, E)$ is a subset $W \subseteq V$ of vertices, each pair of which is connected by an edge in E . Prove that clique is NP complete.

- B. Apply Flyod-Warshall algorithm for constructing shortest path between every pair of vertices. Show the matrix D^k that result at each iteration. [7]



Q.IV

- A. Solve travelling salesman problem for the following graph using Branch and bound method in which [8]

City set = $\{A, B, C, D\}$ where A is the home location of the salesman

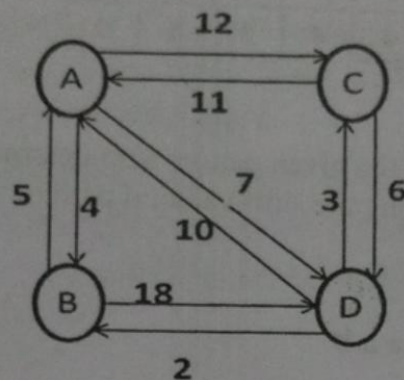


COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)

Distance Information in kilometres :

| | | | | |
|------------------------|------------------------|-----------------------|-----------------------|------------------------|
| $A \rightarrow C = 12$ | $C \rightarrow A = 11$ | $A \rightarrow B = 4$ | $B \rightarrow A = 5$ | $B \rightarrow D = 18$ |
| $D \rightarrow B = 2$ | $C \rightarrow D = 6$ | $D \rightarrow C = 3$ | $A \rightarrow D = 7$ | $D \rightarrow A = 10$ |



- B. Show the portion of state space tree that will be generated to find Hamiltonian circuit for the following graph using backtracking technique. [5]

