

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), April-May 2016
B. Tech in Computer Science Engineering, Semester VI

Roll No.....

CSE602: DESIGN & ANALYSIS OF ALGORITHMS

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

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- i. A complete graph can have
 - a) n^2 spanning trees; b) $n^n - 2$ spanning trees; c) $n^n + 1$ spanning trees; d) n^n spanning trees
- ii. What data structure is used for depth first traversal of a graph?
 - a) queue; b) stack ; c) list; d) none of the above
- iii. Find the odd out
 - a) Prim's Minimal Spanning Tree Algorithm;
 - b) Kruskal's Minimal Spanning Tree Algorithm;
 - c) Floyd-Warshall's All pair shortest path Algorithm;
 - d) Dijkstra's Minimal Spanning Tree Algorithm
- iv. What is not true about insertion sort?
 - a) Exhibits the worst case performance when the initial array is sorted in reverse order.
 - b) Worst case and average case performance is $O(n^2)$
 - c) Can be compared to the way a card player arranges his card from a card deck.
 - d) None of the above!
- v. Which method can find if two vertices x & y have path between them?
 - a) Depth First Search ; b) Breadth First Search; c) Both A & B; d) None A or B
- vi. The number of binary trees with 3 nodes which when traversed in in- order gives the sequence ?
 - a) ACB ; b) ABC; c) CAB; d) ABC
- vii. Index of arrays in C programming language starts from
 - a) 0; b) 1; c) either 0 or 1; d) undefined
- viii. In the deletion operation of max heap, the root is replaced by
 - a) next available value in the left sub-tree.
 - b) next available value in the right sub-tree.



- c) any random value from the heap.
- d) last element of the last level
- ix The following sorting algorithms maintain two sub-lists, one sorted and one to be sorted -

- a) Selection Sort ; b) Insertion Sort; c) Merge Sort; d) both a & b;
- x In context with time-complexity, find the odd out -

- a) Deletion from Linked List.
- b) Searching in Hash Table
- c) Adding edge in Adjacency Matrix
- d) Heapify a Binary Heap

Q.2 Short answer type questions (4 questions @ 2.5 marks)

- a. Give five examples greedy algorithms.
- b. How insertion sort and selection sorts are different?
- c. What do you understand by Spanning Tree?
- d. What is the difference between array and linked list?



10

Q.3A What is time complexity of fun()?

05

- a.

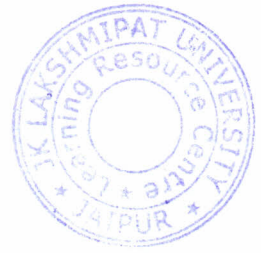
```
int fun(int n)
{
    int count = 0;
    for (int i = n; i > 0; i /= 2)
        for (int j = 0; j < i; j++)
            count += 1;
    return count;
}
```
- b.

```
int fun(int n)
{
    int count = 0;
    for (int i = 0; i < n; i++)
        for (int j = i; j > 0; j--)
            count = count + 1;
    return count;
}
```

Q.3B a. Place following functions, f1, f2, f3 and f4 in increasing order of asymptotic complexity with valid justifications.

05

- $f1(n) = 2^n$
- $f2(n) = n^{(3/2)}$
- $f3(n) = n \log n$
- $f4(n) = n^{(\log n)}$



- b. In the following C function, let $n \geq m$.

```
int gcd(n,m)
{
    if (n%m == 0) return m;
    n = n%m;
    return gcd(m, n);
}
```

How many recursive calls are made by this function in terms of n ?
Justify your answer with numbers.

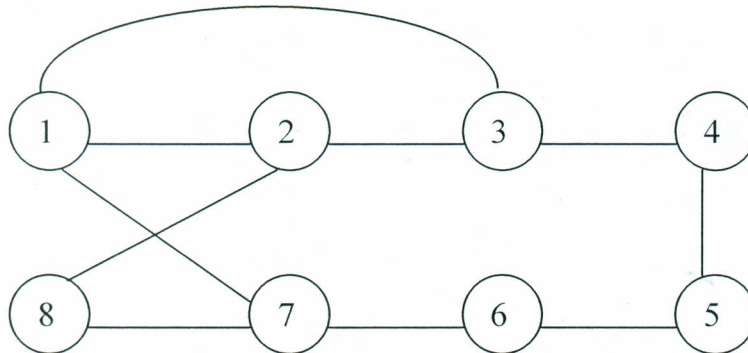
- Q.4A a. Strassen's algorithm is slightly faster than the general matrix multiplication algorithm. Justify the statement with numbers. 05
b. Differentiate between Binary Search tree and Balanced Binary Search Tree.
- Q.4B a. Differentiate between 0/1 Knapsack and Fractional Problems. Which algorithmic approaches are utilized to solve each of them. 05
b. What do you understand by Graph coloring problem. Give three applications of Graph coloring problem.
- Q.5A a. Describe backtracking and its possibilities in solving a problem. Explain it with respect to N-Queens problem. What are the constraints in solving N-Queen's problem. 05
b. Describe Travelling salesman problem. Showcase Time complexity of Brute Force approach of solving Travelling Sales man problem.
- Q.5B a. What is Convex Hull? Explain it with diagram. List down the applications of Convex Hull Searching Problem. 05
b. Consider a string "AABAACAADAABAAABAA", Pattern AABA is to be searched. Use Knuth-Morris-Pratt Algorithm to search the pattern.
- Q.6A Indicate the difference between O Notation, Ω Notation and θ Notation taking an example of Binary Search Algorithm. 05
- Q.6B Give sample Asymptotic notations for each of the following. 05
- constant
 - logarithmic
 - linear
 - quadratic
 - cubic
 - exponential

OR

- Q.6 B Describe the utility of Floyd's Algorithm. List a practical situation where you will use Floyd's Algorithm and not Dijkstra's algorithm.

Q.7A Write down Quick sort algorithm to sort the data and calculate its complexity. 05

Q.7B List down possible Hamiltonian cycles of following graph. 05



OR

Q.7B Which Sorting Algorithm is showcased below? What would be while condition? 05

procedure Sort(A : array of items)

int holePosition

int valueToInsert

for i = 1 to length(A) inclusive do:

/* select value to be inserted */

valueToInsert = A[i]

holePosition = i

/*locate hole position for the element to be inserted */

while () do:

A[holePosition] = A[holePosition-1]

holePosition = holePosition -1

end while

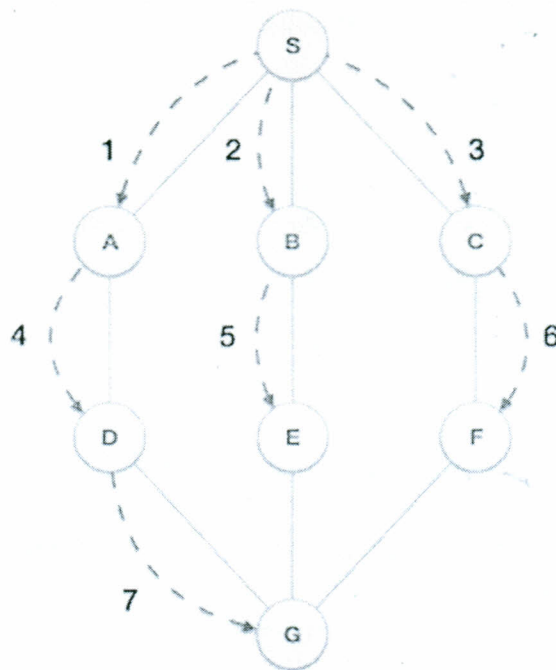
/* insert the number at hole position */

A[holePosition] = valueToInsert

end for

end procedure

Q.8A What is the difference between traversing of tree and traversing a graph. Use Breadth First Search Algorithm to traverse the following graph. 10



Below is implementation of BFS,
procedure bfs(G, s):

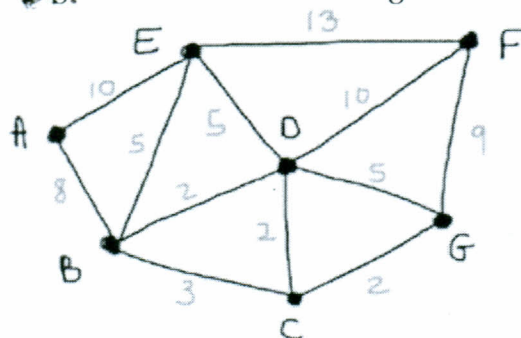
```

Q := queue containing only s
while Q not empty
  v := Q.front();
  Q.remove front();
  for w ∈ G.neighbors(v):
    if w not seen:
      Q.enqueue(w)

```

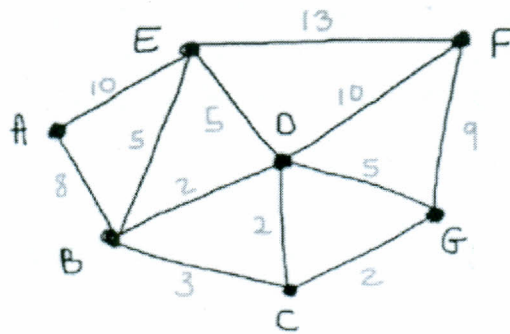
A statement "mark w seen" is to be added in above code where it has be added indicate it.

- Q.9A A, B, C....G are computer terminal with figures displayed representing the time taken (in seconds) for data to travel from one computer to another,. Using Dijkstra's Algorithm, find the shortest path from A to F, clearly displaying the implementation of the algorithm. What is the length of this path? 10



- Q.9B A, B, C....G are computer terminal with figures displayed representing the distance in meters between the various computers. Required is to set up a local area network with the minimum length of cabling. Using Prim's algorithm, find 10

the minimal spanning tree, clearly displaying the implementation of the algorithm. What is the length of the minimal spanning tree?



OR

- Q.9B What do you understand by ASCII representation? ASCII value of a is 97 and space is 32. A string "Happy Hip Hop" is to be code as per ASCII representation. Calculate its Size. Code same String using Huffman Coding Scheme after generating Huffman Tree and finding respective codes of each character. Compare both the schemes and calculate difference in percentage. 10

