BACHELOR OF COMPUTER SC. & ENGINEERING EXAMINATION, 2015
(2nd Year, 1st Semester)
DATA STRUCTURES AND ALGORITHMS

Time : Three hours **Full Marks : 100**

Answer question no. 1 and any *four* from the rest.

1. (a) What do you mean by Collision in Hashing?

2

(b) What class of recursion is the recursive Depth First Search Traversal algorithm? Explain.

4

(c) What is Balance Factor in the context of AVL tree?

2

(d) Show how the following infix expression is converted to postfix notation giving the status of the stack and the output after each token is processed. $ is the sentinel:

20 – (50 – 30 * 40) + 45 $

4

(e) Show the sparse matrix created from the following triple-based representation:

5	4	4
0	3	-4
2	0	25
2	2	60
4	3	-2

2

(f) What do you mean by Space Complexity of an algorithm? How is it computed?

4

(g) Show how the following array will be sorted in increasing order using Insertion Sort algorithm:
80 90 70 100 10 20 40 60 50.

2

2. Define a Minheap. Develop a method for using a minheap to sort an array of integers in descending order. (no algorithm is necessary) Explain your method by applying it to the following array: 100, 40, 90, 30, 80, 20, 70, 10, 60, 50.

Explain any sorting algorithm which does not use comparison for sorting, using a suitable example.

What is a Stable Sorting Algorithm?

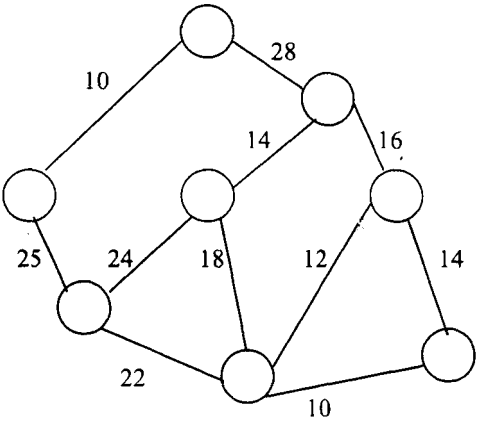
2+6+4+6+2=20

3. Define O(f(n)) and Ω(g(n)).
Prove that O(h(n)) * O(k(n)) = O(h(n) * k(n))

Write a recursive algorithm to find out the n^{th} Fibonacci number. What kind of recursion is it? Analyze the time complexity of your algorithm.

4+3+5+8=20

4. What is a Spanning Tree of a Graph?
For a weighted Graph, what do you mean by a minimum cost spanning tree?
Give an algorithm to find a minimum cost spanning tree of a weighted graph. Explain your algorithm with reference to the following graph



Show how a stack can be implemented by a linked list.

2+2+6+4+6=20

5. Define a B-Tree of order d.
Show how the numbers 1 to 26 can be inserted into a B-Tree of order 5. Assuming that the tree is kept on a hard disk and one node is stored in a disk block, how many disk accesses are needed to insert the keys from 20 to 26?
Give the algorithm to find the In-order successor of the root of a binary tree.

4+8+4+4=20

6. A FIFO Queue has been implemented using an array of items having one integer field *ix* and another float field *fx*. Two integers named *front* and *rear* are used as cursors to the front and rear element of the queue respectively. There is no count element. Give the C language declaration of the Queue type. Hence find out the conditions of the emptiness and fullness of the queue. Write down the functions for initialization, enqueue and dequeue operations.

What is a Priority Queue? Explain how Priority queue can be implemented using linked list.

2+3+4+3+3+5=20

7. Explain the Folding Hash function. Let there be 1000 locations in the Hash Table and the key is k = 12345678911220. Design a folding hash function and show the hash value of the key k.

What is Bucket hashing? Suppose the number of buckets is 7 and the bucket capacity is 3 records. Show how buckets will be filled up for the following key insertion sequence:

10, 5, 20, 8, 4, 3, 19, 45, 71, 29, 84, 49, 54, 42, 73, 24, 18, 94, 84, 59, 77, 92.

What is the major application of Bucket hashing? Explain.

3+6+4+4+3=20

8. Write the following functions in C with proper comments:
   a. To test whether two stacks are equal or not, stacks remaining unchanged after the test. (Define what you mean by equality of two stacks).
   b. To compute the transitive closure matrix of a directed graph.
   c. To traverse a threaded binary tree in in-order fashion. (Define the threaded binary tree node type.)
   d. To rotate-left a binary tree.

6+5+6+3=20

----------X----------