

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION

WINTER SEMESTER, 2015-2016

DURATION: 1 Hour 30 Minutes

FULL MARKS: 75

CSE 4303: Data Structures

Programmable calculators are not allowed. Do not write anything on the question paper.

There are 4 (four) questions. Answer any 3 (three) of them.

Figures in the right margin indicate marks.

1. a) What are the major operations in Data Structure? Briefly Explain. 5
- b) Explain why quicksort algorithm has an average case running time of $O(n \log_2 n)$ but worst case running time of $O(n^2)$. 8
- c) What is sparse matrix? Devise a formula that can map the nonzero elements of an upper triangular matrix stored in a two-dimensional array to a linear array. 5
- d) Suppose information of several data items are encoded as given in Table 1: 7

Table 1 : Table for Question 1(d)

Age	Gender	SSN
7 bits	1 bits	8 bits

Write the set of operations required to set Age value to 23 and gender value to 1, without changing the rest of the information.

2. a) Consider the code fragment given in Figure 1. 2+8

```

int q(int n){
    int res;
    if(n==0){
        return n;
    }
    else{
        res = n + q(n-1);
        printf("%d\n",res);
        return res;
    }
}

```

Figure 1: Code for question 2(a)

Answer the following questions:

- i. What will be the output of $q(4)$ in the code?
- ii. Show the contents of the STACK (local variables and return address) for each of the recursive function call. 3x3+6
- b) Consider the linked list representation of the priority queue in Figure 2. Answer the following questions:
 - i. Use two-dimensional array to represent the same information.
 - ii. Apply ENQUEUE ('SSS', 1), ENQUEUE ('TTT', 2), ENQUEUE ('CC', 4), ENQUEUE ('DDD', 2) operations on the priority queue.
 - iii. Apply DEQUEUE (1), DEQUEUE (5) operations on the priority queue.
 - iv. Write an algorithm that will increase the priority of all the first element by 1.

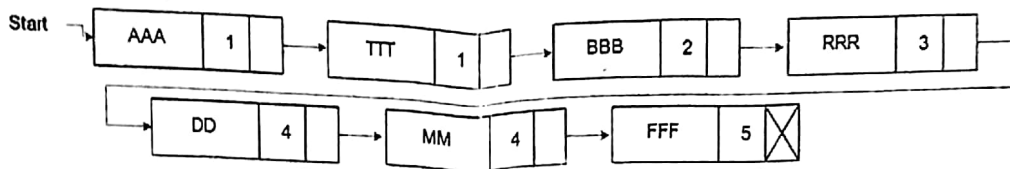


Figure 2: Figure for the question no. 2 (b)

3. a) Consider the following infix expression.

6+4

$$(12/(7-3)+2*(1+5))$$

- Convert this infix expression into an equivalent postfix expression.
 - Evaluate this expression using a STACK.
- b) Show the step by step process to sort (ascending order) the following set of numbers using Heap sort algorithm.

10

22 55 12 63 89 45 36 45 1 100

- c) Suppose, you are trying to figure out the top 5 scorers of La Liga. For this, you need to sort the list of scores by different players in descending order. If you only have bubble sort and quick sort algorithm to choose from, which sorting algorithm would you pick? Explain your answer for this particular context.

5

4. a) Consider the binary tree in Figure 3.

8+7

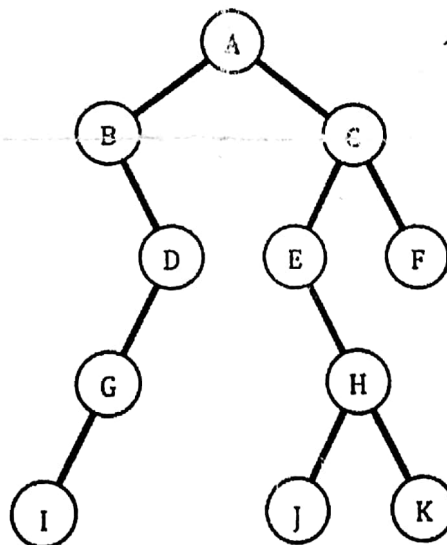


Figure 3: Figure for the question no. 4(a)

Answer the following questions:

- Write pre-order, in-order, post-order and breadth first traversal of the tree.
 - Use a STACK to implement the post order traversal. (Show detailed procedure)
- b) Create a binary search tree (BST) given the following set of numbers.

10

40 66 12 50 33 25 100 22 11 63

Perform the following operations on the BST: (Show Detailed Steps)

- Delete Node 12.
- Insert Node 112.
- Delete Node 100.