

**INDIAN STATISTICAL INSTITUTE
CHENNAI CENTRE**

**M. Stat. (NB Stream) – Semester II
2014–2016**

**Programming and Data Structures
End-term Examination**

Total Marks: 50 Maximum Marks: 50

Date: 1 May 2015

Duration: 3 hours

1.

(a) Write the Quicksort algorithm (pseudo-code) [3]

(b) Show that its average case time complexity is $O(n \log n)$. [3]

2.

Explain the steps to simulate stack ADT (the operations `create-stack`, `push`, `pop`) using only queue ADT. What is the worst case running time of the stack operations in your simulation. [4]

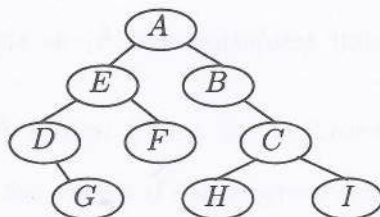
3.

(a) Give an algorithm to reverse a singly linked list. Analyse the complexity of your algorithm. [4]

(b) Give a linear time algorithm to detect the presence of a cycle in a singly linked list. [3]

4.

(a) Write the sequence of nodes of the following binary tree in preorder, inorder and postorder traversals. [3]



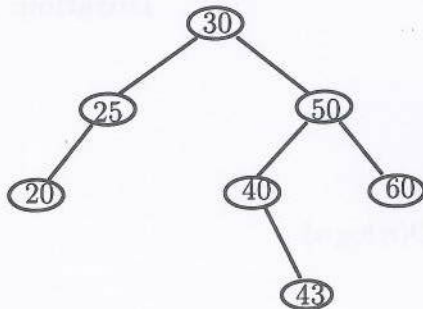
- (b) Draw the expression tree and find the infix and the prefix notation for the following postfix expression.

$$AB * CD / + EF - *$$

[3]

5.

- (a) Give an algorithm to check whether a Binary tree is a BST or not. [2]
 (b) Derive lower and upper bounds for the number of nodes in an AVL tree of height h . [3]
 (c) Explain the steps to insert 42 in the following AVL tree.



[2]

- (d) Explain the steps to delete 25 in the resulting AVL tree of (c). [2]

6.

Consider the following hash functions.

$$h_1(k) = k \pmod{13}$$

$$h_2(k) = 7 - (k \pmod{7})$$

Draw the hash table (of size 13) after inserting the elements (in that order):

28, 31, 49, 51, 20, 7, 23, 60, 138

- (a) Use the method of linear probe for collision resolution and the hash function h_1 . [2]
 (b) Use the method of double hashing for collision resolution and h_1 as the main hash function, h_2 as the second hash function. [2]

7.

Make a heap out of the data read from the keyboard (draw the trees after each insertion).

33, 24, 45, 90, 11, 44, 85, 104, 121

[4]

8.

What does the following function do for a given linked list with first node as head?

```
void fun1(struct node* head){
    if(head == NULL)
        return;

    fun1(head->next);
    printf("%d ", head->data);
}
```

[1]

9.

What is the output of following function for start pointing to first node of following linked list: 1- > 2- > 3- > 4- > 5- > 6?

```
void fun(struct node* start){
    if(start == NULL)
        return;
    printf("%d ", start->data);

    if(start->next != NULL )
        fun(start->next->next);
    printf("%d ", start->data);
}
```

[1]

1. Identify errors, if any, in the following programs.

2. Write the output if the program compiles without any error.

3. Each question carries 1 mark.

10.

```
#include <stdio.h>
int main(){
int a = 10;
double b = 5.6;
int c;
c = a + b;
printf("%d", c);
}
```

11.

```
#include <stdio.h>
int main(){
int a = 10, b = 5, c = 5;
int d;
d = a == (b + c);
printf("%d", d);
}
```

12.

```
#include <stdio.h>
#define R 10
#define C 20
int main(){
    char (*p)[R][C];
    printf("%d", sizeof(*p));
    return 0;
}
```

13.

```
#include <stdio.h>
#include <stdlib.h>
int main(void){
    int i;
    int *ptr = (int *) malloc(5 * sizeof(int));
    for (i=0; i<5; i++)
        *(ptr + i) = i;
    printf("%d ", *ptr++);
}
```

printf("%d ", (*ptr)++);
 printf("%d ", *ptr);
 printf("%d ", *++ptr);
 printf("%d ", ++*ptr);

}

14.

```

#include<stdio.h>
int fun(){
    static int num = 16;
    return num--;
}
int main(){
    for(fun(); fun(); fun())
        printf("%d ", fun());
    return 0;
}
  
```

15.

```

#include<stdio.h>
struct st{
    int x;
    static int y;
};
int main(){
    printf("%d", sizeof(struct st));
    return 0;
}
  
```

16.

```

#include <stdio.h>
int main(){
    int x = 3;
    if (x == 2); x = 0;
    if (x == 3) x++;
    else x += 2;
    printf("x = %d", x);
    return 0;
}
  
```


17. *Graphs of functions, curves, and surfaces*

```
union test{
    int x;
    char arr[4];
    int y;
};

int main(){
    union test t;
    t.x = 0;
    t.arr[1] = 'G';
    printf("%s", t.arr);
    return 0;
}
```