



RAJARATA UNIVERSITY OF SRI LANKA  
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences  
First Year Semester II Examination – March/April 2013

COM1303 – DATA STRUCTURES AND ALGORITHMS

Answer all questions

Time: 3 hours

1).

a) What is a data structure? Give three frequently used operations on data structures.

(2 marks)

b) Write an algorithm to find the maximum value of the dataset given below?

10	8	34	56	67	12
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(5 marks)

c) What do you mean by space complexity and time complexity of an algorithm?

(2 marks)

d) Give the running time of the two algorithms in asymptotic notations given below. Which is the fastest algorithm?

$$T_A = 4 \log n + 2n$$

$$T_B = n \log n + n + \log n + 100$$

(4 marks)

e) Fill the blanks (A, B, C, D, E, F and G) in the following code segment given in Code 1.

(7 marks)

```

#include<stdio.h>

int top, maxSize, stackArray[];

int isEmpty(){
    if (  ) return 1;
    else return 0;
}

int isFull(){
    if (  ) return 1;
    else return 0;
}

void push(int value){
    if (isFull()==1)
        printf("\nStack is Full\n");
    else{
         ;
        printf("Push - %d Top - %d\n",value,top);
    }
}

int pop(){
    if (isEmpty()==1){
        printf("\nStack is Empty\n"); return 99;
    }
    else {
        int temp =  ;
         ;
        printf("Pop - %d Top - %d\n",temp,top);
        return temp;
    }
}

int main(){
    maxSize=5;
    stackArray[  ];
    top=  ;

    return 0;
}

```

2).

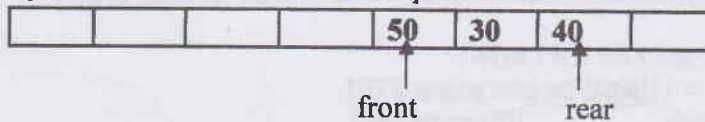
a) Give two properties of a Queue.

(1 mark)

b) Suggest a method to implement a Queue using two Stacks?

(4 marks)

c) Draw sequence of Queue frames showing the progress of each of the following operations. Clearly show the both front and rear pointers. Assume that the queue was a Circular one.



- i. enqueue (45);
- ii. peekFront( );
- iii. dequeue ( );
- iv. enqueue (20);
- v. dequeue ( );

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(5 marks)

d) Construct a Linked list data structure to handle the details of students in a class. Complete the following C structure to keep the student name, address, age and a pointer to the next node.

```

struct node {
    /* Variables */
} p*;
  
```

(4 marks)

e) Write an algorithm to add a student to the beginning of the Linked List.

(6 marks)

3)

a) Discuss the differences between linear search and binary search.

(4 marks)

b) Apply the binary search for the following array. Clearly show the steps you follow.

21	25	35	36	45	56	64	69	77	83
----	----	----	----	----	----	----	----	----	----

(6 marks)

c) Discuss the advantages and disadvantages of direct address tables.

(2 marks)

d) Briefly explain how hash function works. Give the search time of a hash function.

(4 marks)

e) Briefly explain the types of hash functions.

(4 marks)

4)

- a) Compare time complexities of Insertion Sort, Selection Sort and Bubble Sort.

(3 marks)

- b) Fill in the blanks in the Bubble Sort algorithm given in **Algorithm 1**.

(3 marks)

**Algorithm: (Bubble Sort) BUBBLE (DATA, N)**  
**Here DATA is an array with N elements. This algorithm sorts the elements in DATA.**

1. Repeat steps 2 and 3 for K = 1 to N-1
2. Set PTR = 1 [Initializes pass pointer PTR]
3. Repeat while [ ] [Executes Pass]
  - If [ ] then:
    - Interchange DATA [PTR] and DATA [PTR+1]
    - [End of if Structure]
    - Set [ ]
  - [End of inner loop]
- [End of step 1 outer loop]
4. Exit

#### Algorithm 1

- c) Use the Bubble sort algorithm to sort the array given below. Show the steps clearly.

(3 marks)

- d) Discuss the underline mechanisms of Merge Sort and Quick Sort algorithms.

(4 marks)

- e) Apply the Quick Sort algorithm on the array given below. Show the steps clearly.

25	10	8	42	16	96	57	2	31	19
----	----	---	----	----	----	----	---	----	----

(7 marks)

5)

- a) Give the meaning of following terms with respect to trees using a diagram of a tree.

- i. Level
- ii. Depth
- iii. Root
- iv. Height
- v. Leaf nodes
- vi. Parent

(3 marks)

- b) Considering the tree given in **Figure 1**, traverse the tree in Pre Order and Post Order.

(4 marks)

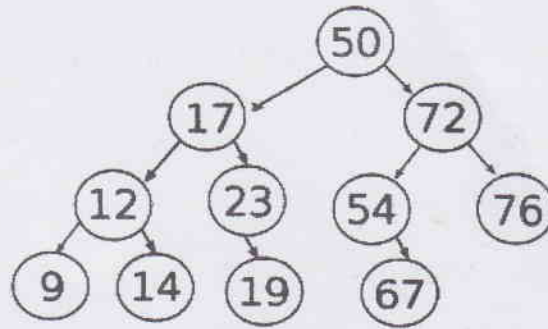


Figure 1

- c) Explain the difference between a full binary tree and a complete binary tree using examples. (3 marks)
- d) Give the adjacency matrix and adjacency list representation of the graph given in Figure 2. (4 marks)

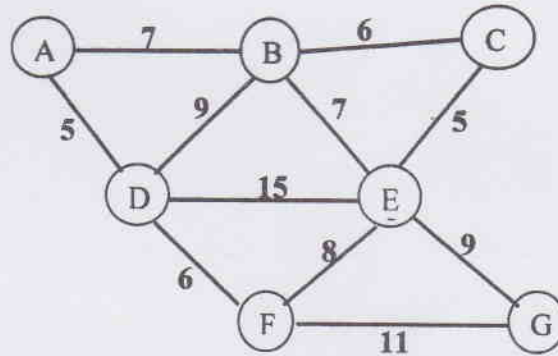


Figure 2

- e) Explain the term Hamiltonian Cycle using an example (2 marks)
- f) Draw the spanning trees of the graph given in Figure 3. (4 marks)

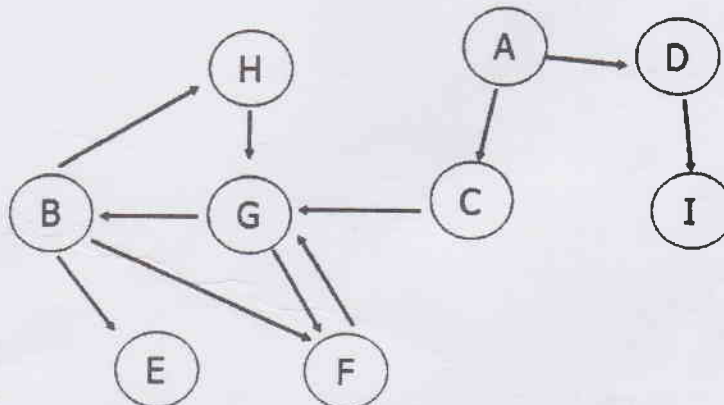


Figure 3