

**University of Ruhuna- Faculty of Technology**  
**Bachelor of Information and Communication Technology Degree**  
**Level 2 (Semester 1) Examination, October 2018**

**Course Unit:** ICT2113- Data Structure and Algorithms      **Time Allowed:** 2 hours

Answer all four (04) questions

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This question paper contains 06 pages.

**Question 01**

a) Define the following terms

- I. Algorithm.
- II. Time complexity.
- III. Big O notation.

b) Write time complexity of the following code segments in Big O notation.

I. void printPairs(int arr[], int size)

```
{  
    for (int i = 0; i < size; i++)  
    {  
        for (int j = 0; j < size; j++)  
        {  
            printf("%d = %d\n", arr[i], arr[j]);  
        }  
    }  
}
```

II. for (int i = 0; i < n; i++)  
 for (int j = i+1; j > i; j--)  
 for (int k = n; k > j; k--)  
 printf("\*");

c) "Selection sort is faster than bubble sort" Do you agree with this statement? justify your answer.

- d) Write a C program for Bubble sort, considering the algorithm given below.

```
void bubblesort (double arr[], int size)
{
    i=0;
    for ( i < No of times to repeat)
        j=0;
        for ( j < No of times to repeat)
            if current > next
                swap current, next
}
```

- e) Write down one advantage and one disadvantage of following sorting algorithms. Bubble, Insertion, Selection, Quick, Heap and Merge sorting.

- f) Consider the following array

-2 5 7 18 19 29 46 78 102 112

Show all steps on how to search for 103 in the above array using "Binary Search" method.

## Question 02

- a) Write down meanings of following stack operations.

- Push
- Pop
- IsEmpty
- IsFull

- b) Convert the following **infix** expressions into equivalent **prefix** and **postfix** forms.

- $A + B * C + D$
- $A * B + C * D$
- $(A + B) * (C + D)$

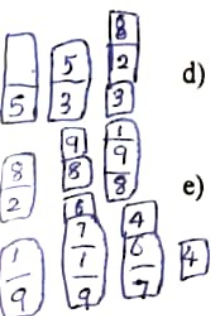
- c) Write down the output of the following sequence of stack operations.

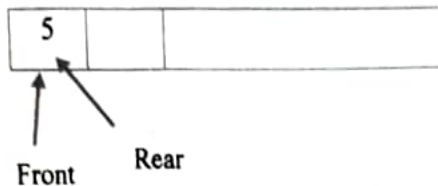
push (5), push(3), pop(), push(2), push(8), pop(), pop(), push(9), push(1), pop(), push(7), push (6), pop(), pop(), push(4), pop(), pop()

- d) Briefly describe the usage of stack for following applications.

- Compilers.
- Web browsers.

- e) Consider following linear queue. Draw **separate frames** and **output** when each of the following operations are applied one after the other.





enqueue(3) -> dequeue() -> enqueue(7) -> dequeue() -> front() -> dequeue() -> dequeue()  
 isEmpty() -> enqueue(9) -> enqueue(7) -> size() -> enqueue(3) -> enqueue(5) -> dequeue()

Your answer should be as follows:

**Operation**

**Output**

**Frame**

enqueue(3)

-

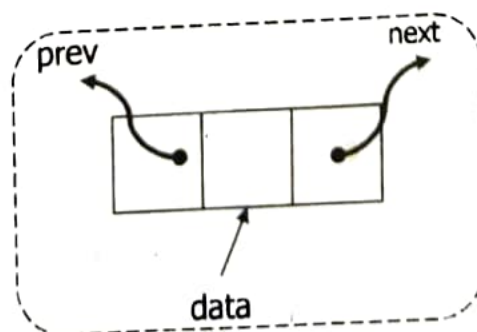
|   |   |  |
|---|---|--|
| 5 | 3 |  |
|---|---|--|

f) What is a circular queue? Explain with an example.

### Question 03

- a)
- What is a Link list? Explain functionality of a link list.
  - Write down two advantages of Link list over arrays.
  - Name three types of Link list and describe each.
  - Following diagram is used to create a double link list. Complete the given C code to implement this.

node



```
typedef struct node {
    .....
    .....
    .....
} node;
```

V.

Consider following *link list*. The function ***displayList()*** is written to display the contents of *link list*. Complete the blank lines (**A, B, C, and D**) with suitable C statements to display the content of the list.



```
void displayList()
{
    struct node *tmp;
    if( -----) //Line A
    {
        printf(" List is empty.");
    }
    else
    {
        tmp = stnode;
        while(-----) //Line B
        {
            printf(" Data = %d\n, -----); // Line C
            tmp = -----; // Line D
        }
    }
}
```

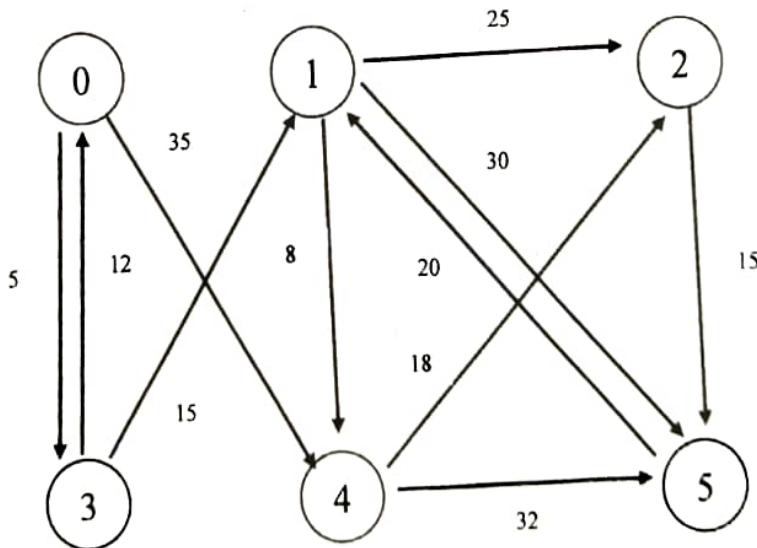
b) Following data is inserted into a binary tree.

89 12 37 50 76 25 65

- I. Draw the binary tree diagram after inserting data.
- II. Print the data that you have inserted into tree in the part (I) in the following orders
  - i. Post Order
  - ii. Pre Order
- III. How many leaves are there in above tree?
- IV. What is the height of node 37?
- V. Insert 63 to the above tree and draw the resultant tree.
- VI. Draw binary trees for following expressions.
  - i.  $A * B - (C + D) * (P / Q)$
  - ii.  $A + (B * (C / D))$

#### Question 04

- a) Write three types of real word applications that use in graph data structure.
- b) Consider the weighted graph given below,



- I. Write the adjacent matrix for the above weighted graph.
- II. Write the adjacency list for the above graph without considering their weights.
- III. Write one advantage and disadvantage of adjacent matrix representation.

c)

- I. How do you define recursion in computer programming?
- II. What are the three main components of a recursive algorithm?
- III. Write down above three components that you mentioned in c (II) for **Factorial N** ( $N!$ ).

d)

- I. What is a Hash function?
- II. Write two main features of Hash function.

-----End of the paper-----