

Question #1 (10 points)

Here is a class declaration of array-implemented stack.

/ Stack.h contains the declaration of class Stack.*

Basic operations:

- Constructor**: constructs an empty stack
- Empty** : checks if stack is empty
- Push** : modifies stack by adding a value at the top
- Pop** : modifies stack by removing the value at the top
- Top** : retrieves the top of the stack without changing the stack

Class Invariant:

1. The stack elements (if any) are stored in consecutive positions in **myArray**, beginning at position 0
2. $-1 \leq \text{myTop} < \text{STACK_CAPACITY}$

**/*

```
#ifndef STACK
#define STACK
const int STACK_CAPACITY = 128;
typedef int StackElement;
class Stack
{
    /***** Function Members *****/
public:
    // --- Constructor ---
    Stack();
    // --- is the Stack empty ? ---
    bool Empty() const;
    // --- Add a value to the stack ---
    void Push (const StackElement value);
    // --- Return value at the top of the stack ---
    StackElement Top() const;
    // --- Remove value at the top of the stack ---
    void pop();
    /***** Data Members *****/
private:
    StackElement myArray[STACK_CAPACITY];
    int myTop;
}; // end of class declaration
#endif
```

a) Develop the routines defined into the class STACK.

Question #2 (10 points)

A string is said to be a **palindrome** if it does not change when the order of its characters is reversed. For example,

madam
123321

are palindromes. Write a function that, given a string, returns true if the string is a palindrome and false otherwise.

Question #3 (10 points)

A **double ended queue (deque)** is a linear list in which additions and deletions may be made at either end. Write algorithms to add and delete elements from either end of the queue.

Question #4 (10 points)

Convert the following arithmetic expressions from infix to postfix & prefix:

$$((a * b - c / d ** e) + f \% g * (h * k))$$

$$(a * \sim b - c + d - (\sim e / f ** g ** h \% i))$$

Question #5 (10 points)

Answer the following:

a) The value of $\sim 4 \ 5 + 7 \ 9 + *$ is:

b) The value of $* - + 4 \ 5 - 7 \ 9$ is:

c) Convert $(a - (b + c)) / d * e \% f$ to postfix & prefix.

d) Convert $(G/H/(I*J)) * (D-E/F)$ to postfix & prefix.

Question #6 (10 points)

A matrix is given in the following table:

X	X	X	X	X	X
X	X	X	X	X	X
X	X	X	X	X	X
.
X	X	X	X	X	X
X	X	X	X	X	X

Write a function, that given an array of rows and columns with the number of rows and the number of columns, will zero both the inverse diagonal and the part below the inverse diagonal of that array.

Question #7 (12 points)

a) What is the decimal value of the following binary number **1011.1010** ?

b) Assume that **stack** has **stacktype** as **int**, and **stack-capacity** = 5. Give the contents of **top** & all **array** data members of **s** after the code segment is executed.

i) stack s;
s.push (123);
s.push (456);
s.pop();
s.push(789);
s.pop();

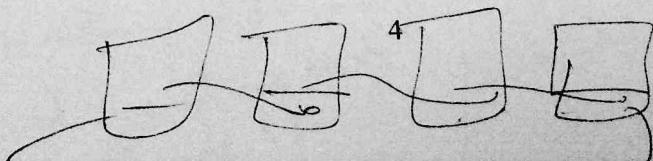
ii) stack s;
s.push (101);
i = s.top();
s.push (218);
s.pop();
s.push (2*3+i);

iii) stack s;
for (int i = 0; i <= 4; i++)
s.push(2 * i + 4);
s.pop();
s.pop();
s.push(i*2 + 5);

c) Assume that the base address of an array A[5][3] of type **double** is **240** and the storage is column wise. What will be the addresses of the following data items in the array: A[3][2] and A[4][1] ?

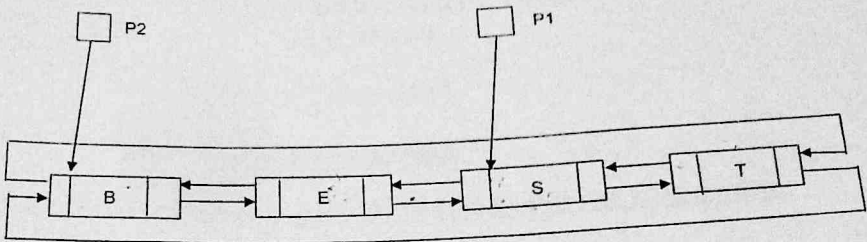
Question #8 (10 points):

Write a C++ code to determine the highest value in a circular linked list of integer numbers with first node pointed to by **first**.



Question #9 (8 points):

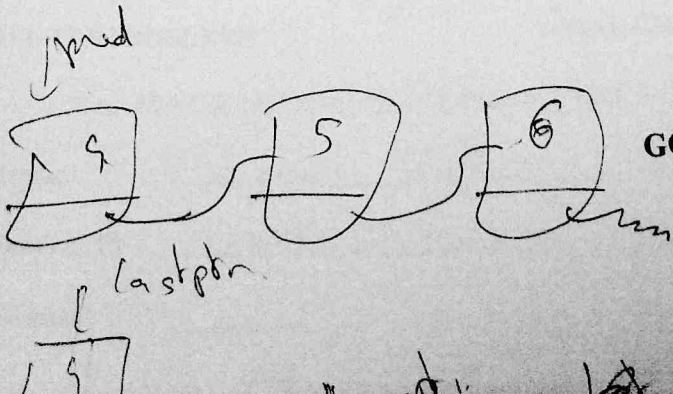
For the following circular doubly-linked list, find the value of each expression:



- a) $p2 \rightarrow data$
- b) $p2 \rightarrow next \rightarrow next \rightarrow data$
- c) $p1 \rightarrow prev \rightarrow prev \rightarrow prev \rightarrow next$
- d) $p1 \rightarrow next \rightarrow next$
- e) $p1 \rightarrow prev \rightarrow next \rightarrow next \rightarrow prev$
- f) $p1 \rightarrow prev \rightarrow prev \rightarrow data$
- g) $p1 \rightarrow prev \rightarrow prev \rightarrow prev \rightarrow prev$
- h) $p1 \rightarrow prev \rightarrow prev \rightarrow next \rightarrow data$

Question #10: (10 pts)

Write a C++ code to reverse a linked list. For example if the list is {4, 5, 6}, than after reversing it becomes {6, 5, 4}.



GOOD LUCK