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SY Computer Science – Div 1

Question: Implement a stack of integers using array.

header.h: This File includes the declarations of structures and function prototypes

```c
typedef struct Stack {
    int top;
    int size;
    int *array;
} Stack;

void init(Stack *s, int size);
int isEmpty(Stack s);
void isFull(Stack *s);
void push(Stack *s, int data);
int peek(Stack s);
int pop(Stack *s);
void display(Stack s);
```

logic.c : contains the definition of all the functions declared in the header file along with some helper functions

```c
#include<stdio.h>
#include<stdlib.h>
#include<limits.h>
#include "./header.h"

void init(Stack *s, int size){
    if(size < 1){
        return;
    }
    s->size = size;
    s->top = 0;
    s->array = (int *) malloc(sizeof(int) * size);

    return;
}
```

```c
int isEmpty(Stack s){
    if((s.top) == 0){
        return 1;
    }

    return 0;
}

void isFull(Stack *s){
    if((s->top) == (s->size)){
        s->array = realloc(s->array, (2 * s->size) * sizeof(int));
    }
    return;
}

void push(Stack *s, int data){
    isFull(s);
    s->array[s->top++] = data;
    return;
}

int peek(Stack s){
    if (isEmpty(s)){
        return INT_MIN;
    }

    return s.array[s.top - 1];
}
int pop(Stack *s){
    if (isEmpty(*s)){
        return INT_MIN;
    }

    return s->array[--(s->top)];
}
void display(Stack s){
    if(s.top == 0){
        printf("The Stack is Empty!\n");
        return;
    }

    printf("Displaying the stack\n");

    for(int i = 0; i < s.top; i++){
        printf("%d ", s.array[i]);
    }
    printf("\n");
}
```

main.c : This contains the code to test the implementation

```c
#include <stdio.h>
#include "logic.c"

int main() {
    Stack s;
    init(&s, 1);
    display(s);
    printf("Is the Stack Empty? %d\n", isEmpty(s));

    push(&s, 1);
    push(&s, 2);
    push(&s, 3);

    display(s);

    pop(&s);
    pop(&s);

    display(s);

    printf("Peeked Element: %d\n", peek(s));

    pop(&s);

    printf("Is the Stack Empty? %d\n", isEmpty(s));
    return 0;
}
```

Output:

```
Labwork 11 Stack>gcc .\main.c -Wall -o main
Labwork 11 Stack>.\main.exe
The Stack is Empty!
Is the Stack Empty? 1
Displaying the stack
1 2 3
Displaying the stack
1
Peeked Element: 1
Is the Stack Empty? 1
Labwork 11 Stack>
```