

# Data Structures (CS201)

## Lab Assignment 1 (Graded)

**August 01, 2023**

Instructor: Anil Shukla

Due: August 05, 11:59 pm

Total Marks: 20

Note: Graded means the marks will be counted for the final grading. Place proper comments in your source code. Write in C only. C++ is not allowed.

Note: Plagiarism is strictly prohibited. An appropriate disciplinary action will be taken if you are found to be involved in plagiarism.

Note: The instructions for submitting the assignment is mentioned in the google classroom. Carefully read the same and follow the instructions.

Note: At the end, find some test cases for each problem.

- (1) Using an array of size 100, implement a data structure in C that supports Push, Pop, and a third operation FindMin, which returns the smallest element in the data structure, all in  $O(1)$  worst case time and  $O(1)$  extra space. Refer test input cases for the details. (10 marks)
- (2) Write a C program to convert a given decimal number into its 2's complement representation. The program first ask the user to enter a number and then print its 2's complement representation nicely. See some test cases at the end. Assume that you are working with 32 bits machine. (5 marks)
- (3) Write a C program to convert a sequence of binary numbers into its equivalent decimal number. Interpret the sequence as a 2's complement representation. The program first ask user to enter a sequence of bits of arbitrary lengths (but  $\leq 32$  bits). Then your program should first save this sequence in a 32 bit format without changing the original value and print the same. Then print its original decimal value. See some test cases at the end. (5 marks)

### Test Cases

#### Test cases for problem (1):

Enter 10 integers to push in stacks:

87, 40, 20, 22, 32, 44, 7, 55, 67, 9

top == 10

min == 7

i) Push :

d) Pop :

m) min :

t) top :

q) quit :

Enter your choice : d  
 9 popped  
 i) Push :  
 d) Pop :  
 m) min :  
 t) top :  
 q) quit :  
 Enter your choice : d  
 67 popped  
 i) Push :  
 d) Pop :  
 m) min :  
 t) top :  
 q) quit :  
 Enter your choice : m  
 min == 7  
 i) Push :  
 d) Pop :  
 m) min :  
 t) top :  
 q) quit :  
 Enter your choice : q

**Test Cases for (2):**

Enter Number: 8  
 2's complement representation of 8 is: 0000 0000 0000 0000 0000 0000 0000  
 1000  
 Enter Number: -1  
 2's complement representation of -1 is: 1111 1111 1111 1111 1111 1111 1111  
 1111  
 Enter Number: -64  
 2's complement representation of -64 is: 1111 1111 1111 1111 1111 1111 1100  
 0000  
 Enter Number: -3  
 2's complement representation of -3 is: 1111 1111 1111 1111 1111 1111 1111  
 1101  
 Enter Number: -7  
 2's complement representation of -7 is: 1111 1111 1111 1111 1111 1111 1111  
 1001

**Test Cases for question (3):**

Enter sequence of binary strings: 1111111  
 Equivalent 32 bit format while interpreting as 2's complement: 1111 1111 1111  
 1111 1111 1111 1111 1111  
 Equivalent decimal number: -1  
 Enter sequence of binary strings: 0100  
 Equivalent 32 bit format while interpreting as 2's complement: 0000 0000 0000

0000 0000 0000 0000 0100

Equivalent decimal number: 4

Enter sequence of binary strings: 10000000

Equivalent 32 bit format while interpreting as 2's complement: 1111 1111 1111  
1111 1111 1111 1000 0000

Equivalent decimal number: -128

Enter sequence of binary strings: 11001

Equivalent 32 bit format while interpreting as 2's complement: 1111 1111 1111  
1111 1111 1111 1111 1001

Equivalent decimal number: -7