Computer Systems Organization

Spring 2025

International Institute of Information Technology, Hyderabad
Assignment 1
Deadline : 23:59, 11/03/25
We allow upto 3 days delay with 20 percent penalty, post which marks obtained will be 0.
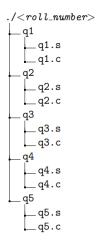
Welcome to Assignment 1 of the Computer Systems Organisation Course. The aim of this assignment is to familiarize you with writing x86 Assembly code. On completion of this assignment you should be able to successfully write arithmetic, conditional, looping components, and conditional jumps in x86-64.

Instructions : Read the below instructions carefully before you start working on the assignment.
• Writing complete code with successful execution guarantees full marks. Ensure that all edge cases are handled.
• Strict plagiarism checks will be performed on all submissions. Any and all forms of plagiarism will result in zero marks for this assignment.
• Hard coded solutions will get a straight zero.
• Comment your code properly explaining why you are doing what you are doing.
• Total marks for assignment is 50 (30 marks for working code submission, 20 marks for viva).
• C files should be used only to take input, call the function and give output. The complete logic of the function itself should be in assembly language, failing which, you will be awarded zero for that particular question.
• For the questions which require you to return an array as output, you can create an array for output in C and pass its pointer as one of the arguments to your function.

Submission format : Strictly adhere to the following submission format. Failure to do so will result in penalty.
• The following directory structure is expected:

```
./<roll_number>
├── q1
│   ├── q1.s
│   └── q1.c
├── q2
│   ├── q2.s
│   └── q2.c
├── q3
│   ├── q3.s
│   └── q3.c
├── q4
│   ├── q4.s
│   └── q4.c
└── q5
    ├── q5.s
    └── q5.c
```

• Zip the ./<roll_number>folder and name the zipped folder as <roll_number>assign1.zip
Assume all the integer variables to be long long int.

Problem 1 (6 marks) :

You are given an array of 3n+1 numbers. All the numbers are present exactly thrice in the array except for one number which is present only once. Find that lonely number.

Input/Output Format
• INPUT: First line of input contains one number, n. Second line of input contains 3n + 1 numbers which are elements of the array.
• OUTPUT: M, The number which is present only once in the array.

Sample Test Case
Input:
3
1 2 4 3 2 4 1 4 1 2
Output:
3

Problem 2 (6 marks) :

You are given an array of n numbers. Rotate the array towards right by 2 indices.

Input/Output Format
• INPUT: First line contains a single integer n, the size of the array. Second line contains n integers, elements of the array
• OUTPUT: OUTPUT: Output n integers, elements of the array after rotating.

Sample Test Case
Input:
5
1 2 3 4 5
Output:
4 5 1 2 3

Problem 3 (6 marks) :

Given a string S, determine if it is a palindrome. A palindrome is a string that reads the same forward and backward. Return 1 if string is palindrome and 0 otherwise.

Input/Output Format
• INPUT: String with lowercase english alphabets.
• OUTPUT: 1 if its a palindrome, 0 otherwise

Sample Test Cases

Input:
level
Output:
1

Input:
zero
Output:
0

Problem 4 (6 marks) :

You are given an array A of size n. Determine the difference between the largest and smallest elements in the array A.

Input/Output Format
• INPUT: First line contains a single integer n, the size of the array. Second line contains n integers, elements of the array
• OUTPUT: A single number representing the difference between the largest and smallest number of given array.

Sample Test Cases
Input:
5
1 2 3 4 5
Output:
4

Input:
6
-1 0 14 10 2 -3
Output:
17

Problem 5 (6 marks) :

Given an integer array nums, return an array answer such that answer[i] is equal to the product of all the elements of nums except nums[i]

Input/Output Format
• INPUT: First line contains a single integer n, the size of the array. Second line contains n integers, elements of the array
• OUTPUT: An array of n numbers fulfilling the given criterion.

Sample Test Case
Input:
4
1 2 3 4

Output:
24 12 8 6

Input:
5
-1 1 0 -3 3
Output:
0 0 9 0 0