National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	**COAL - LAB**	**Course Code:**	**EL2003**
Program:	**BS(CS)**	**Semester:**	**Fall 2023**
Duration:	**2 Hour**	**Total Marks:**	**80**
Paper Date:	**October 23, 2023**	**Weight:**	**25%**
Section:	**BCS-H**	**Pages:**	**2**
Exam:	**Midterm**		

Student : Name:_____ **Roll No.**_____ **Section:**_____

Instruction/Notes:

- Understanding the question paper is also part of the exam, so do not ask for any clarification.
- Talking/Discussion is not allowed. You are responsible for protecting your code and saving it from being copied. If you don't protect it all matching codes are considered copy/cheating cases.
- Failure to observe above mentioned instructions will lead to a negative mark on the Exam.
- The path for submission is: **\\cactus1\Xeon\Fall2023\Salman Mubarik\COAL Lab\BSCS H**

Question 1: Crypto-Catcher: Decipher the Hidden Patterns (16-bit) [Marks 50]

You've uncovered a secret decryption algorithm for 16-bit numbers that deciphers messages encoded using specific bit patterns. This algorithm involves checking the entire binary representation of the number in sets of three bits. Based on these patterns, specific operations are applied for decryption.

Here's the challenge:

Write an assembly subroutine that takes a 16-bit integer as a parameter and decrypts it using the following patterns:

- Check the entire binary representation in sets of three bits starting from the **right side (least significant bit side)**.
- If the pattern "000" is found in any set, perform one right shift.
- If the pattern "010" is found in any set, execute one left shift.
- When the pattern "100" is detected in any set, rotate the bits right twice.
- Rotate the bits left twice if the pattern "110" is observed in any set.
- All operations are performed on the decrypted number according to the pattern of the original number.

Example:

Encrypted Number: (1100010111000110) = (50630) = 0xC5C6

- 110 → 0001011100011011
- 000 → 0000101110001101
- 111 → do nothing
- 010 → 0001011100011010
- 100 → 1000010111000110

Decrypted number: (1000010111000110) = (34246) = 0x85C6

Question 2: [Marks 30]

Write an assembly subroutine that searches the video screen for a particular string and returns the row and column number of the first occurrence of the string on the screen. The subroutine takes as a parameter the address i.e. offset of the string, defined in your code, and the length of the string. The parameters are passed via stack and it returns the row and column number via stack as a single 16-bit number, where the higher byte is the row and the lower byte is the column number. In case the string is not found the subroutine returns 0xFFFF i.e. -1 as both row and column values.