15°F731
CS-226

Air University

Department of Cyber Security
(Final-Term Examination: Fall 2024)

Student ID: _____

Student Sign: _____

Subject: Computer Organization and Assembly Language
Class: BS-Cyber Security
Code: CS-226
Section: A/B
FM Name: Ms. Maryam Malik
FM Signature: .....

Total Marks: 100
Date:
Max Duration: 3 Hours
HoD Signature: .....

Instructions:

- You are required to attempt **ALL Questions.**
- This is a closed book/notes exam.
- Calculators are allowed,
- **Return question paper with the answer sheet**

Q. No	Questions	CLO	Marks
1		1	30

A. Differentiate between the following with example

a) Local and Global Labels
b) Call and return function
c) Loopnz and loopz
d) Pusha and pushad

B. MOV EAX, 0xFFFFFF9B
CDQ

How EAX and EDX are affected after CDQ. If you were to divide EAX by 4 using the IDIV instruction, what values will EAX and EDX contain after the division?

C. Describe how the XOR instruction can be used to toggle the case of an ASCII character stored in the AL register.

D. How can the TEST instruction be used to check the state of specific bits in a register without modifying the original value? Provide a practical use case.

E. Explain how the LOOP instruction works. What are its limitations, and how can nested loops be implemented efficiently in assembly language?

2	A. Write instructions that jump to label L2 when the signed integer in AX is greater than the integer in CX.
	
	B. Given the following assembly code, determine the values in the registers after each instruction is executed.
	
	varA BYTE 10h, 20h, 30h, 40h, 50h, 60h
	varB WORD 1234h, 5678h
	varC DWORD 12345678h, 87654321h
	
	mov ax, WORD PTR [varA+2] ; AX = ?
	mov bl, BYTE PTR [varC+5] ; BL = ?
	mov ax, WORD PTR [varB+2] ; AX = ?
	mov eax, DWORD PTR [varC+4] ; EAX = ?
	mov bx, WORD PTR [varA+4] ; BX = ?
	
	C. What will be the final value in EDX after this code executes?
	
	`mov edx,1`
	`mov eax,7FFFh`
	`cmp eax,0FFFF8000h`
	`jl L2`
	`mov edx,0`
	`L2:`
	
	D. Explain bit masking technique and how in assembly we convert the characters from lower case to upper case with that?
		2	40

3	A. Write an assembly program to implement the following pseudocode using x86 assembly language.
	
	if (num1 > num2) {
	result = num1 - num2;
	} else if (num1 < num2) {
	result = num1 + num2;
	} else {
	result = num1 * 2;
	}
	
	B. Write an assembly program to **encrypt** a string stored in memory using a single-byte encryption key and decrypt it back to its original form. The string, "SECURE", is stored in the .data section using **key (5Ah)**. Your program should process each character in a loop, stop at the null terminator, and overwrite the original message with the encrypted and decrypted results.
		3	30

C. Write assembly code to locate the first nonzero value in the array. If no nonzero value is found, the ESI register should point to the sentinel value.

```
.data
array SWORD 50 DUP(?)
sentinel SWORD 0FFFFh
.code
mov esi, OFFSET array   ; Initialize ESI to the start of the array
mov ecx, LENGTHOF array ; Load the array length into ECX
L1: cmp WORD PTR [esi], 0

; (Fill in your code here in the answer sheet)

quit:
```

Complete the assembly code under the label L1

**********End of Paper**********