National University of Computer & Emerging Sciences, Karachi

Fall-2024 CS-Department

Assignment No. 01

5th September 2024

Course Code: EE-2003	**Course Name: Computer Organization & Assembly Language**
Instructor Name / Names: Shoaib Rauf, Kashan, Aashir Mahboob, Atiya, Muhammad Kariz,Muhammad Usman, Nauraiz Subhan	

Instructions:

- Attempt all the questions.
- Don't share your work, if your submission is matched to any member of your class, both will be marked 0 straight without asking who shared or who magically copied.
- You have to submit in Hard copy in the class timing on XXXXX i.e. 16th Sept,2024.
- No late submissions will be accepted.

Max Points: 50

Question 1. [6] Points

a) Compare High level languages with Assembly language, elaborating on there similarities and relationship.

b) Briefly explain the contrast between Assemblers and Compilers.

c) By referring to your explanation in part a and b, explain why High level languages are regarded as more portable as compared to Assembly languages. Justify your answer, with at least two examples.

Questions 2 [4] Points

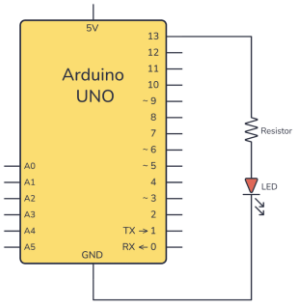
Following is an Arduino compatible C program to blink an LED. Explain, by referring to the levels, the concept of virtual Machines. Also ***identify*** the VM(s) as VM(1) and VM(0), where compilation and translation occur respectively.

Level 3

```
#define F_CPU 16000000
#define BLINK_DELAY_MS 1000

#include <avr/io.h>
#include <util/delay.h>

int main (void)
{
  // Arduino digital pin 13 (pin 5 of PORTB) for
output
  DDRB |= 0B100000; // PORTB5

  while(1) {
    // turn LED on
    PORTB |= 0B100000; // PORTB5
    _delay_ms(BLINK_DELAY_MS);

    // turn LED off
    PORTB &= ~ 0B100000; // PORTB5
    _delay_ms(BLINK_DELAY_MS);
  }
}
```

Level 2

```
main:
  sbi 0x04, 5       ; PORTB5 output
loop:               ; main loop begin
  sbi 0x05, 5       ; PORTB5 high
  call delay_1000ms ; delay 1s
  cbi 0x05, 5       ; 5 PORTB5 low
  call delay_1000ms ; delay 1s
  rjmp  loop        ; main loop

delay_1000ms:       ; subroutine for 1s delay
                    ; initialize counters
  ldi r18, 0xFF     ; 255
  ldi r24, 0xD3     ; 211
  ldi r25, 0x30     ; 48
inner_loop:
  subi  r18, 0x01   ; 1
  sbci  r24, 0x00   ; 0
  sbci  r25, 0x00   ; 0
  brne  inner_loop
  ret
```

Level 1	Level 0
AVR enhanced Reduced Instruction Set Computer architecture	

Question 3 [4+2+2+2] Points

Mnemonic	Description
SUB	Subtract one value from another
MOV	Move (assign) one value to another

```
MOV EAX, F_F_F_F_h      ;Enter the last 4 digits of your roll number in the
                        ;empty spaces e.g roll# = 16K2404 --> F2F4F0F4h
ADD EAX, 10000100h      ;Add 10000100h to the contents of EAX
```

a. Fill the table with the updated Flag values after the execution of the aforementioned Assembly language instructions.

FLAGS	VALUE
Carry Flag (CF)	
Overflow Flag (OF)	
Zero Flag (ZF)	
Sign Flag (SF)	
Parity Flag (PF)	
Auxiliary Carry Flag (AF)	

b. Explain why 8086 processors operating in Real Address Modes, can only access **1MB** of RAM at a time.

c. Using the following Logical Address find the physical address of this memory location.

1 2 A B : 0 2 5 F

d. Although 8086 processor has a 20 bit address bus, the segment address and offset are not in 20 bits representation. **Explain why?**

Question 4 [5] Points

Write a program that defines symbolic constants for all seven days of the week. Create an array variable that uses the symbols as initializers.

Question 5 [5] Points

Using the DUP directive, allocate space for 5 doublewords and 2 bytes in a data segment. Then fill the next 15 spaces with the character &, the 7 spaces that follow with the character % and the space after that with the character capital M.

Question 6 [5+5] Points

What are the values of AL register and overflow (OF), Sign Flag (SF)and carry flags (CF) after the execution of code below? Justify your answer. (Show all working of it)

i)

```
mov al, 88h
add al, 90h          ; al=    , OF=    , CF=
```

ii)

```
mov al, 5
add al, 123        ; al=   , SF=    , OF=   , CF=
```

Question 7 [5+5] Points

Let's suppose 'dwList LABEL DWORD' be added in the following code. What are the values of registers in (A-D) in the code below? If there is an error, write ERROR and justify your answer. Please write in hexadecimal form

```
.data
dwList LABEL DWORD
arrayW WORD  1000h, 2000h, 3000h
arrayDW DWORD 1111h, 2222h, 3333h
...
.code
mov eax, dwList       ; (A) eax=?
mov ebx, [dwList + 1] ; (B) ebx=?
mov ecx, [dwList + 2] ; (C) ecx=?
mov edx, [dwList + 3] ; (D) edx=?
```