June 1, 2009

COMPUTER ENGINEERING DEPARTMENT

COE 205

COMPUTER ORGANIZATION & ASSEMBLY PROGRAMMING

Major Exam II

Second Semester (082)

Time: 7:00 PM-9:30 PM

Student Name : _____

Student ID. : _____

Question	Max Points	Score
Q1	40	
Q2	36	
Q3	24	
Total	100	

Dr. Aiman El-Maleh

[40 Points]

(Q1) Fill the blank in each of the following:

(1) Assume that ESP=00000020H, EAX=12345678H and EBX=90ABCDEFH. After executing the instruction PUSH EAX, the content of ESP=_____ and EAX=_____.

(2) Assume that ESP=00000020H, EAX=12345678H and EBX=90ABCDEFH. After executing the following sequence of instructions, the content of ESP=_____ and EAX=_____.

```
PUSH EAX
PUSH EBX
POP EAX
```

(3) Assuming that ESP=00000020H, after executing the instruction RET 12, the content of ESP=_____.

(4) Assuming that ESP=00000020H, after executing the instruction Call MyProc, the content of ESP=_____.

(5) Assuming thar register AL contains an alphabatic character, to convert the content of register AL to lower case, we use the following instruction _____.

(6) The code to Jump to label L1 if bits 0, 2, and 5 in AL are all set is
_____
_____
_____

(7) The assembly code given below implements the high-level statement
_____

```
        CMP AL, BL
        JBE NEXT
        CMP BL, CL
        JBE NEXT
        MOV X,1
NEXT:
```

(8) The assembly code given below implements the high-level statement
_____

```
        CMP AL, BL
        JG  L1
        CMP AL,CL
        JLE NEXT
L1:     MOV X,1
NEXT:
```

(9) The assembly code given below implements the high-level statement
_____

```
        CMP EBX,VAR1
        JA  NEXT
TOP:    ADD EBX, 5
        DEC VAR1
        CMP EBX, VAR1
        JBE TOP
NEXT:
```

(10) Assuming that AX=5678H and CL=85H, executing the instruction SHL AX, CL will set AX=_____ and CF=_____.

(11) Assuming that AX=8678H and CL=0CH, executing the instruction SAR AX, CL will set AX=_____ and CF=_____.

(12) Assuming that AX=6789H and CL=20H, executing the instruction ROL AX, CL will set AX=_____ and CF=_____.

(13) Assuming that AX=1234H and BX=5678H, executing the instruction SHRD AX, BX, 8 will set AX=_____ and BX=_____.

(14) To multiply the content of register EAX by 23 without using multiplications instructions, we use the following instructions:

_____
_____
_____
_____
_____
_____

(15) Assuming that AX=02ECH and BX=0020H, executing the instruction DIV BL will result in AX=_____.

(16) Assuming that AX=FFF4H and BX=FFFBH, executing the instruction IDIV BL will result in AX=_____.

(17) Assuming that AX=02ECH and BX=0020H, executing the instruction MUL BX will result in AX=_____, and CF=_____.

(18) Assuming that AX=FFF4H and BX=FFFBH, executing the instruction IMUL BX will result in AX=_____, and CF=_____.

(19) Macros are more efficient than procedures in _____ and less efficient in _____.

(20) We can define the macro SAVE_REGS to save only the registers passed as arguments by pushing them on the stack as follows:

_____
_____
_____
_____
_____

[36 Points]

(Q2) Answer the following questions. Show how you obtained your answer:

(i) Given that **TABLE** is defined as: **TABLE Byte 'Ahmad Ali Anas'**

Determine the content of register **AH** after executing the following code:

```
        XOR AH, AH
        MOV ECX, lengthof TABLE
        LEA EBX, TABLE
        DEC EBX
Next:   JECXZ ENL
        INC EBX
        MOV AL, [EBX]
        OR AL, 20H
        CMP AL, `a`
        LOOPNE Next
        JNE  ENL
        INC AH
        JMP Next
ENL:
```

(ii) Determine the content of registers **EAX** and **EBX** after exeucting the following code:

```
        MOV EAX, 7532h
        MOV ECX, 32
        XOR EBX, EBX
Next:
        ROL EAX, 1
        ADC EBX, 0
        LOOP Next
```

(iii) Determine what will be displayed after executing the following code**:**

```
        MOV  EAX, 0F5h
        XOR  ECX, ECX
        MOV  EBX, 10
L1:     XOR  EDX, EDX
        DIV  EBX
        ADD  DL, '0'
        PUSH EDX
        INC  ECX
        CMP  EAX, 0
        JNZ  L1
L2:     POP  EAX
        Call WriteChar
        LOOP L2
```

(iv) Determine what will be displayed after executing the following code**:**

```
        MOV EAX, 1
        JMP   MT[EAX*4]
L1:     MOV AL, 'C'
        JMP EL
L2:     MOV AL, 'O'
        JMP EL
L3:     MOV AL, 'E'
EL:     Call WriteChar
        exit
        MT  DWORD L1, L2, L3
```

(v) Determine what will be displayed after executing the following code**:**

```
PUSH 4
PUSH 3
CALL MYPROC
exit

MYPROC:
      JMP SKIP
      MSG BYTE 10, 13, "Greater!!", 0
            BYTE 10, 13, "Smaller!!", 0
   Skip:
      MOV EBP, ESP
      LEA EDX, MSG
      MOV ESI, [EBP+4]
      MOV EDI, [EBP+8]
      CMP ESI, EDI
      JG Display
      ADD EDX,  lengthof  MSG
Display:
      Call WriteString
      RET 8
```

(vi) Determine what will be displayed after executing the following code**:**

```
DDIV MACRO  X, Y

      MOV EAX, X
      MOV EBX, Y
      XOR EDX, EDX
      DIV EBX
      CALL WriteDec
      MOV AL, '.'
      CALL WriteChar
      MOV EAX, 10
      MUL EDX
      DIV EBX
      CALL WriteDec

ENDM

        DDIV 15, 6
```

[24 Points]

(Q3)

(i) Write a procedure, **SelectionSort**, to sort an array of integers (i.e. 32-bit signed numbers) in an **ascending** order. The number of integers to be sorted and the address of the array to be sorted are assumed to be passed on the stack. The procedure should maintain the content of all registers to their state before its execution. **Do not use the USE directive, local directive, pusha and popa instructions in your solution**.

The pseudocode for the **SelectionSort** procedure is given below:

```
SelectionSort (Array, Size)
        for (position= 0 to Size-2)
                MinValue = Array[position]
                MinPosition = position
                for (j=position+1  to Size-1)
                        if (Array[j] < MinValue) then
                                MinValue = Array[j]
                                MinPosition = j
                        end if
                end for
                if (position ≠ MinPosition) then
                        Array[MinPosition] = Array[Position]
                        Array[Position] = MinValue
                end if
        end for
end SelectionSort
```

(ii) Write a complete program, showing the place of procedure definition, to use the procedure **SelectionSort** to sort the Array given below:

Array Dword 10, 2, 0, 15, 25, 30, 7, 22

Note that the Content of Array after sorting will be:
Array Dword 0, 2, 7, 10, 15, 22, 25, 30