UNIVERSITY OF LIMPOPO

FACULTY OF SCIENCE AND AGRICULTURE

SCHOOL OF MATHEMATICAL AND COMPUTER SCIENCES

DEPARTMENT OF COMPUTER SCIENCE

DEGREE AND DIPLOMA SUPPLEMENTARY EXAMINATION   OCT/NOV: 2023

MODULE: SCOA022   PAPER: P
          (COMPUTER ARCHITECTURE)

TIME: 3 HOURS   MARKS: 100

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THIS PAPER CONSISTS OF FIVE (05) PAGES INCLUDING COVER PAGE

INSTRUCTIONS:

1. Answer all the questions.
2. Write neatly and legibly.

Question 1 [20]

1.1 Define the following concepts as applied in assembly language. [10]

    1.1.1 Portability
    1.1.2 Device driver
    1.1.3 Directive
    1.1.4 String constant
    1.1.5 Instruction mnemonic
    1.1.6 Assembler
    1.1.7 Pipelining
    1.1.8 Register
    1.1.9 DUP operator
    1.1.10 Virtual machine concept

1.2 Compare the adaptability of assembly language to high-level languages in relation to various types of applications. [10]

Question 2 [11]

2.1 With the aid of a figure/diagram, give a detailed description of the assemble-link-execute cycle. [5]

2.2 Comments are an important way for the writer of a program to communicate information about how the program works to a person reading the source code and can be specified in two ways: Single line comments and Block comments. Use the correct assembly language block comment syntax to comment the following sub-sequent lines of text: [2]

    This line is a comment.
    This line is also a comment.

2.3 Declare a label named favColor of bytes that contains the string 'Blue'. [2]

2.4 Consider the doubleword 12345678h, if placed in memory at offset 0000. Show the memory representation using little endian order for Intel processors. [2]

Question 3 [20]

3.1 Write a CALL statement that calls a procedure named **MyProc** in an external link library. [2]

3.2 Write two statements that will cause a program to pause for 700 milliseconds. [2]

3.3 What are the required input parameters for the ReadString procedure? [2]

3.4 Write statements that prompt the user for a South African Identification number and input a string of digits into an array of bytes. [4]

3.5 What will be the value of the stack pointer after the following instructions execute? [2]

mov sp, 6800

push ax

push bx

push cx

3.6 Write a single instruction using 16-bit operands that clears the high 8 bits of AX and does not change the low 8 bits. [2]

3.7 Which conditional jump instruction is equivalent to the JNGE instruction? [2]

3.8 Write a single instruction that converts an uppercase character in AL to lowercase but does not modify AL if it already contains a lowercase letter. [2]

3.9 Write instructions that jump to label L1 when the unsigned integer in DX is less than or equal to the integer in CX. [2]

Question 4 [14]

4.1 Study the following code segment and answer question 4.1.1 and 4.1.2

```
.data
arrayW DWORD 100h,200h,300h,400h
.code
mov eax, [arrayW - 4]        ; 4.1.1 eax =          [2]
mov eax, [arrayW+16]         ; 4.1.2 eax =          [2]
```

4.2 Write down the value of each of the following destination operands.

```
.data
varB BYTE 65h,31h,02h,05h
varW WORD 6543h,1202h
varD DWORD 12345678h
.code
mov ax,WORD PTR [varB+2]        ; 4.2.1 ax =                                [1]
mov bl,BYTE PTR varD            ; 4.2.2 bl =                                [1]
mov bl,BYTE PTR [varW+2]        ; 4.2.3 bl =                                [1]
mov ax,WORD PTR [varD+2]        ; 4.2.4 ax =                                [1]
mov eax,DWORD PTR varW          ; 4.2.5 eax =                               [1]
```

4.3 Study the code fragment below and fill the symbol table built by the assembler. Assume that the data segment begins at 0000:   [5]

```
.data
value WORD 0
sum DWORD 0
marks WORD 10 DUP (?)
message BYTE 'The grade is:', 0
char1 BYTE ?
```

Name	offset
value	4.3.1
sum	4.3.2
marks	4.3.3
message	4.3.4
char1	4.3.5

Question 5 [20]

5.1 What will be the value of AX after the following instructions execute?   [4]

```
mov  ax , 0fe4h
and  ax, 7865h
```

5.2 What will be the final value in EDX after this code executes?   [4]

```
mov edx, 1
mov eax, 7FFFh
cmp eax, 0FFFF8000h
JL     L2
mov edx, 0
L2 :
```

5.3 Implement the following pseudocode in assembly language program.   [4]

if (var1 <= var2)

var3 = 10;

else

{

var3 = 6;

var4 = 7;

}

5.4 What will be the value in the destination register after each of the following instructions executes in sequence, given that CL, DX, and AL are initialized to 3, 1001111010111100b, and 01010111b respectively?

```
shr dx, 1        ; a.                                              [2]
shr dx, cl       ; b.                                              [2]
rol dx, cl       ; c.                                              [2]
ror al, 1        ; d.                                              [2]
```

Question 6 [15]

6.1 Translate the following high level language expression into assembly language code.

[5]

Rval = Xval - (-Yval + Zval)

6.2 Write an Assembly language program that allow a user to input his/her age, then the program will show if the person is eligible to vote. A person who is eligible to vote must be older than or equal to 18 years old.   [10]