



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EEE 406: MICROPROCESSORS

DATE: 16/3/2022

TIME: 11:00 – 1:00 PM

INSTRUCTIONS:

Answer QUESTION ONE and any other TWO.

QUESTION ONE (30 MARKS)

- (a) Describe the stack structure of the 8086. (6 marks)
- (b) Write an assembly language program to move a string of data words from offset 2000H to Offset 3000H. The length of string is 0FH. (6 marks)
- (c) The physical address used to access memory should be 20 bits long. Compute the physical address in the following cases: (6 marks)
 - (i) The segment register = 1000H and the Offset= 1234H
 - (ii) CS = 1000H, DS = 3000H, SS = A000H, ES = 8000H, BX = 0200H.
- (d) Discuss hardware interrupts in the 8086. Highlight the actions taken by the 8086 microprocessor when the INTR and NMI pins are activated. (9 marks)
- (e) Explain the chronology of actions taken by the 8086 microprocessor when the following interrupt is executed: **INT3-Break Point Interrupt Instruction**. (3 marks)

QUESTION TWO (20 MARKS)

- (a) Give a brief but detailed classification of all the registers in the 8086 microprocessor. Note: There is no need to describe the registers. (4 marks)
 - (b) Explain what is accomplished by the following instructions. (5 marks)
 - i) MOV AX,40[BX][SI]
 - ii) MOV AX,[BX]
 - iii) M BX,2257H.
 - iv) MOV AL,[2000H]
 - v) MOV AX,[BX][SI]
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- (c) Given a displacement of 5000H, calculate the effective address as a result of executing the following instructions given the following data: [AX]- 1000H, [BX]- 2000H, [SI]- 3000H, [DI]- 4000H, [BP]- 5000H, [SP]- 6000H, [CS]- 0000H, [DS]- 1000H, [SS]- 2000H, [IP]- 7000H.
- MOV AX, [5000H]
 - MOV AX, [BX]
 - MOV AX, 5000H [BX]
- (6 marks)
- (d) Draw the architecture of the 8086 microprocessor and then discuss the distinct roles of the EU and BIU. (5 marks)

QUESTION THREE (20 MARKS)

- (a) Data transfer in 8086 microprocessor can be classified as either Microprocessor controlled or Device Controlled like DMA. Discuss the DMA data transfer. (5 marks)
- (b) Find the contents of the stack and stack pointer after the execution of the CALL instruction shown next: Assume that SS:1296 right before the execution of CALL and SUM is a NEAR procedure. (5 marks)

```
CS:IP
2450:673A    CALL SUM
2450:673D    DEC AH
```

- (c) Find the precise offset location in memory of each ASCII character or data in the following: (10 marks)

```
                ORG 20H
Data1  DB      73H, 2FH
Data2  DB      "737 3527"
                ORG 30H
Data3  DW      2560H, 101100010101B
                ORG 40H
Data4  DD      25684FC4H
Data5  DQ      7F5EC4527271FEH
```

QUESTION FOUR (20 MARKS)

- (a) The following program adds four words and saves the result. The program contains some errors, fix all the errors. (5 marks)

```
TITLE          PROBLEM PROGRAM
PAGE          60, 132
STSEG         SEGMENT
              DB 32 DUP(?)
STSEG         END
;-----
DTSEG         SEGMENT
DATA          DW 1234H, 3344H, 5FE2H, 85FAH
              ORG 10H
SUM           DW ?
DTSG          ENDS

CDSEG         SEGMENT
START:        PROC FAR
              ASSUME CS:CDSEG, DS:DTSEG, SS:STSEG
              MOV DS, DTSEG
              MOV CS, 4
              MOV BX, 0
              MOV DI, OFFSET DATA
LOOP1         ADD BX, [DI]
              INC DI
              DEX BX
              JNZ LOOP1
              MOV SI, OFFSET RESULT
              MOV [SI], BX
              MOV AH, 4CH
              INT 21H
CDSEG:        ENDS
START        ENDP
              END CDSEG
```

- (b) Write an Assembly Language Program that summarize eight unsigned byte numbers stored in memory and store the result back to the next memory location. The data segment can be defined as following:

```
DTSEG         SEGMENT
              Data      DB 23H, 34H, 32H, 45H, 1FH, 27H, 7FH, 90H
              Result    DW ?
DTSEG         ENDS
```

(6 marks)

- (c) For each of the CF, PF, ZF, SF, and OF flags, briefly describe the meaning when it is set. Give conditional jump instructions that can be used to test each one.. (5 marks)
- (d) Explain how the 8086 uses 16-bit segment registers to access memory in a 1MB address space. (4 marks)

QUESTION FIVE (20 MARKS)

- (a) Identify the addressing mode used in each of the following instructions, and state the size of The operands: (5 marks)
- i) MOV DX, [47H]
 - ii) MOV [BP+0DH], DH
 - iii) ADD AX, BP
 - iv) MOV BX, 8H
 - v) INC AX
- (b) The microprocessor performs a large number of functions, state any five of them. (3 marks)
- (c) Discuss the functions of the ALU. (3 marks)
- (d) There are four segment registers in the 8086 microprocessor. Describe the role played by each of these registers. (4 marks)
- (e) Describe the indirect addressing mode in the 8086. (5 marks)