UNIVERSITY EXAMINATION 2021/2022

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

EEE 4130 MICROPROCESSORS

DATE: APRIL 2022   **TIME: 2 HOURS**

Instructions
This examination paper contains **FIVE** questions.
Attempt **compulsory QUESTION ONE** and **any other TWO** questions.

QUESTION ONE (Compulsory)

a) Describe the following terminologies as used in microprocessor theory.   **(5 Marks)**
   i.   Microprocessor
   ii.   Microcomputer
   iii.   Segmentation
   iv.   Program statement
   v.   A nibble

b) While comparing microprocessors, it is better to consider the applications at hand. Generally, there are three types of microprocessor depending on the usage. Describe each of these while citing examples for each case.   **(6 Marks)**

c) Processor design is the engineering task of creating a processor, a key component of computer hardware. It is a subfield of computer and electronics engineering. You have been assigned a task to design a microprocessor that will be applied for use in a hot tub machine newly commissioned semi-conductor factory at the Dedan Kimathi University of Technology. Give a detailed explanation of how you would carry out the project for the university and the important aspects to consider.   **(5 Marks)**

d) If the 8085 microprocessor adds 87H and 79H, specify the contents of the accumulator and the status of the S, Z, and CY flag registers.   **(3 Marks)**

e) Write the algorithm for an assembly language program to add data at **3005H** and

3006H memory location and store the result at **3007H** memory location. Give the computer instructions for the same. **(4 Marks)**

f) Mention the conditions for which execution unit (EU) of a microprocessor enters into the <u>WAIT</u> mode. **(3 Marks)**

g) Write an Intel 8085/86/88 assembly language program to subtract 8 bit data stored at memory location **2050H** from data stored at memory location **2051H** and store the results at memory location **2052H**. **(2 Marks)**

h) Write an Intel 8085/86/88 assembly language program to find the **<u>minimum</u>** from two 8 bit numbers. **(2 Marks)**

QUESTION 2

a) In electronics, a pinout (sometimes written "pin-out") is a cross-reference between the contacts, or pins, of an electrical connector or electronic component, and their functions. **Fig. 2a** below show the "pin-out" diagram signals of Intel 8086 for minimum mode of operation.
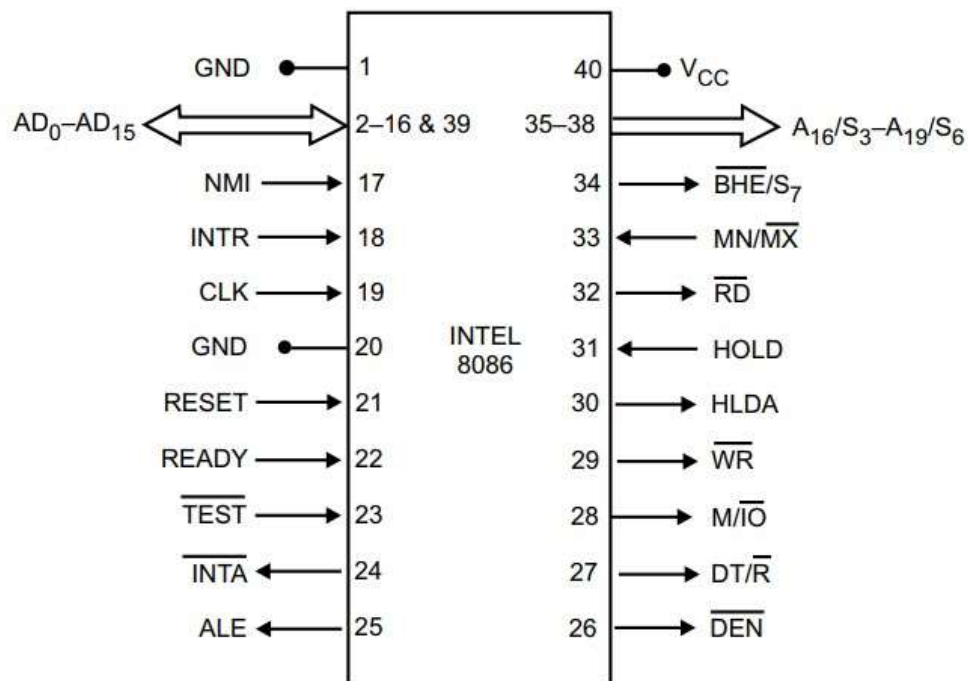
Fig. 2a: Signals of Intel 8086 for minimum mode of operation

    i.   Draw the pin diagram for the Intel 8086 operating in MAX mode. **(4 Marks)**
    ii. What is the technology used in 8086 μP manufacturing? **(2 Marks)**
    iii. Distinguish between the lower sixteen address lines from the upper four.
                                                      (3 Marks)
    iv. In how many modes the minimum-mode signal can be divided? **(1 Mark)**
    v. Discuss the Reset pin of 8086. **(3 Marks)**

b) Mention the different varieties of 8086 and their corresponding speeds.   **(3 Marks)**

c) Computer instructions are made up of two parts. The first part is called the "Operation Code or op-code" for short, which specifies the operation to be performed. The second part called the "Operand" is the item in an operation from which the result is obtained by means of defined actions i.e., it indicates the source and/or destination of the data acted on by the op-code.   **(4 Marks)**

    i.   Is direct memory to memory data transfer possible in 8086?

    ii.   Can the data segment (DS) register be loaded directly by its address?

QUESTION 3

a) The 8086 (also called iAPX 86) is a 16-bit microprocessor chip designed by the Intel between early 1976 and June 8, 1978, when it was released. The Intel 8088, released July 1, 1979, is a slightly modified chip with an external 8-bit data bus (allowing the use of cheaper and fewer supporting ICs), and is notable as the processor used in the original IBM PC design.

    i. Draw a well labelled diagram of the iAPX 86 microprocessor internal architecture (logical diagram) showing all main sections of the Bus Interface Unit (BIU) and the Execution Unit (EU).   **(5 Marks)**

    ii. Explain each component and their purpose; for every section of the architecture you have drawn in **a (i)** above.   **(10 Marks)**

    iii. Describe segmentation in the Intel 8086 microprocessor using a well labelled diagram. Elaborate the formula for physical address access of the memory locations (1 MB) of the microprocessor.   **(5 Marks)**

QUESTION 4

a) Registers are a type of computer memory used to quickly accept, store, and transfer data and instructions that are being used immediately by the central processing unit (CPU). The registers used by the CPU are often termed as processor registers. Describe the Intel 8086 registers, giving **two** examples for each type, and the main function(s) of the examples given.   **(10 Marks)**

b) Interfacing is the process of making two or more devices or systems operationally compatible with each other so that they function together as required. The term "Interface" is used to describe a hardware system that provides standard logic circuits and input/output channels for the connection of peripheral units to a central processor (CPU). Explain the Input/Output (I/O) devices and their interfacing in microcomputer systems.   **(6 Marks)**

c) What is program compilation? Enumerate the three major steps that a compiler does during compilation. **(4 Marks)**

QUESTION 5

a) Addressing modes are an aspect of the instruction set architecture in most central processing unit (CPU) designs. The various addressing modes that are defined in a given instruction set architecture define how the machine language instructions in that architecture identify the operand(s) of each instruction. Explain **five** any of the Intel 8086 addressing modes, giving **two** examples for each type, and the description of the examples given. **(10 Marks)**

b) With the aid well labelled diagrams, discuss the following microprocessor architectures while giving their major advantage and/or disadvantage. **(6 Marks)**
   i.   The Von-Neumann architecture
   ii. The Harvard architecture

c) The Intel 8008 is considered as the first microprocessor, which had an address space of 16KB and only two addressing modes. 8080, 8085, 8088, and 8086 microprocessors followed it. Both the 8088 and the 8086 can address a 1-M bytes (8- bit wide) or a 512K word (16-bit wide) memory. The 8086 is more powerful than 8088, with exactly the same 16-bit instruction set and memory addressing, but with greater processing speed. What are the main differences between the iAPX 8085 and the iAPX8086 microprocessors? Use **Table. 5c** to below to give the different comparisons. **(4 Marks)**

Table. 5c: Comparisons of the iAPX 8088 and the iAPX8086

	Property	8085 Microprocessor	8086 Microprocessor
1	Data Bus Size		
2	Address Bus Size		
3	Clock Speed		
4	Duty Cycle for clock		
5	Flags		
6	Pipelining Support		
7	Memory Segmentation supports		
8	Number of transistors		