

Ankara University
Computer Engineering Department
COM325 / COM3525 Microprocessors Final Exam

Name-Surname:

Number:

Signature:

Duration: 150mins.

Notes: 1. The questions will be answered by only using the techniques discussed in the classes.

2. The microprocessor system that will be considered is the 16-bit 8086 architecture. Newer properties, instruction sets cannot be employed to answer the questions.

3. Use the given spaces under each question to write your answers by giving detailed descriptions and using minimal number of assembly instructions, each line commented.

4. You cannot make any assumptions about any existing code; you need to write down all the necessary code to perform the tasks to get marks.

Good luck!

QUESTIONS

1. (15 points) Answer the following questions considering microprocessors:

a. (5 points) Draw the block diagram of the simple microprocessor based personal computer system, identifying the main components and buses.

b. (5 points) Write down the three main tasks performed by microprocessors.

c. (5 points) List the three types of buses used by the microprocessor indicating the type of information carried by each.

2. (15 points) Perform the following base conversions between different number systems. Write the full number, do not perform any rounding.

a. (5 points) Convert unsigned binary 1011.1101 to decimal.

b. (5 points) Convert hexadecimal 0xDEFA to binary.

c. (5 points) What number does unsigned decimal 170 represent in signed decimal system? (Use 8-bit representation.)

3. (20 points) Answer the following questions considering the registers available in 8086 microprocessors.

a. (5 points) Which two registers are used for identifying the next line of code to be executed?

b. (5 points) Which two registers are used to access the stack?

c. (5 points) Which two registers are used by the LODS and STOS instructions for identifying the target memory locations?

d. (5 points) Which two registers are used to store the result of MUL instruction for 16-bit multiplication?

4. (5 points) What is an interrupt?

5. (5 points) What is the advantage of using segment and offset addressing?

6. (10 points) Find the value of the accumulator register (AL) which initially stores the hexadecimal value 0xD1 and the carry flag (CF) after the following operations. Assume that the operations are to be applied to this original value separately (not one after another) and assume that CF is cleared before all operations.

a. (5 points) ROL AL, 2

AL

--	--	--	--	--	--	--	--

CF

--

b. (5 points) RCR AL, 3

AL

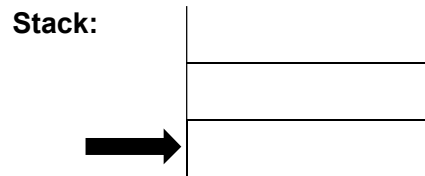
--	--	--	--	--	--	--	--

CF

--

6. (10 points) Fill in the stack with appropriate address values until right before the first return (RET) instruction is executed for the given code below. Bottom (and top) of the stack, which is initially empty, is shown with the arrow. **Hint:** Only three address values are required here.

Memory Address	Code
0000h	call f1
0003h	hlt
	f1 proc
0004h	call f2
0007h	ret
	f1 endp
	f2 proc
0008h	call f3
000Bh	ret
	f2 endp
	f3 proc
000Ch	ret
	f3 endp



7. (30 points) Write down the assembly code for the following questions. Do not make any assumptions, write all the necessary code for the required tasks using the specified methods.

a. (15 points) Write the assembly code to count the number of odd numbers and store the result in DX register. The data is stored as a list in memory location named TABLE stored as word values. It is known that the TABLE ends with the special value of 0xFFAAh Use the function that loads values to the accumulator register rather than directly accessing to the TABLE.

b. (15 points) Implement the following polynomial in assembly language as a procedure, considering x is already stored in AX, the final result must be stored in DX register. You must define another procedure that takes the n^{th} power of a number where the number is stored in BX and the power is stored in CX and use this procedure in your implementation:

$$y = 4x^4 + 3x^3 + 2x^2 + x$$