

ECE 033: HOMEWORK 7

Due: Friday, November 16, 2018

Problem 1 (50 points)

The following instructions are programmed in an 8085 processor. In each case, provide the answers to the following questions:

- What arithmetic or logic operation is indicated by the code?
- Perform that operation by hand and show the 8-bit numbers next to Operand1, Operand2 and Result, i.e. content of register A, after the operation is completed.
- What will be the binary values of the flags: Z, C, P, and S, after each operation?

The status of the flags before the onset of each operation is indicated in each case. Determine the result of each operation by hand.

NOTE: Constants in hex number system must begin with a digit (i.e. 0, 1, ... or 9) and end in H. If a hex constant begins with a letter (i.e. a, b, ... or f) then an extra zero bit should be added in the MSB position, so the Assembler can properly recognize this as a hex number. For example, if AFH is to be moved into a register, then this should be written as 0AFH. Assembler ignores this extra 0 bit and you should ignore it as well in your hand operation.

HINT: No actual programming is required for this problem. You may do the programming to verify your results, but still need to show how the results are obtained by hand.

a) Flags before: Z = 0 C = 0 P = 0 S = 0

```
MVI  A,    6DH
MVI  B,    93H
ADD  B
```

- Describe the ALU operation:
- Determine result by hand: OPERAND 1 :
 OPERAND 2 :
 RESULT, (A) :

iii) Flags afterwards: Z = C = P = S =

b) Flags before: Z = 1 C = 1 P = 1 S = 1

```
MVI  A,    7CH
MVI  B,    95H
ADC  B
```

- Describe the ALU operation:
- Determine result by hand: OPERAND 1 :
 OPERAND 2 :
 RESULT, (A) :

iii) Flags afterwards: Z = C = P = S =

c) Flags before: Z=0 C=1 P=0 S=1

```
MVI  A,    65H
MVI  B,    0CBH
ANA  B
```

- i) Describe the ALU operation:
- ii) Determine result by hand:
OPERAND 1 :
OPERAND 2 :
RESULT, (A) :
- iii) Flags afterwards: Z = C = P = S =

d) Flags before: $Z = 1$ $C = 1$ $P = 0$ $S = 0$

```
MVI    A,    83H
ORI    9CH
```

- i) Describe the ALU operation:
- ii) Determine result by hand: OPERAND 1 :
 OPERAND 2 :
 RESULT, (A) :
- iii) Flags afterwards: Z = C = P = S =

e) Flags before: $Z = 0$ $C = 0$ $P = 0$ $S = 0$

```

AGAIN:  MVI    C,    2AH
        MVI    B,    05H
        INR    C
        DCR    B
        JNZ    AGAIN
        HLT

```

- i) Describe all arithmetic operations performed by this program:
- ii) What will be the content at the end of this program: Register C :
Register B :
- iii) Flags afterwards: Z = C = P = S =

Problem 2 (50 points)

You may have noticed that the instruction set of the 8085 only includes arithmetic instructions that can perform Additions and Subtractions. In class, we reviewed a program that can be used to multiply two different 8-bit numbers. The algorithm for the multiplication program was based on “successive additions” whereby the multiplicand was added as many times to itself as the magnitude of the multiplier.

You are asked to prepare an Assembly program using the 8085 instructions that can do a division of two 8-bit binary numbers of which the larger is the dividend and the smaller is the divisor. The program should place the quotient in register H and the remainder in register L. In case the divisor is zero the program should place zero to both H and L registers and then abort.

RUN YOUR PROGRAM USING A DIVIDENT VALUE EQUAL TO FCh AND A DIVISOR VALUE EUAL TO 2Ah.

(Note: To load the dividend as a hex number you need to write it as 0FCh as per the statement above in problem 1, alternatively you may load it as decimal or binary number.)

Hint: Consider an algorithm that will be based on successive subtractions and prepare your program accordingly.

SUBMIT YOUR WORK BASED ON THE FOLLOWING FORMAT.

- 1) *Prepare an analysis of this problem and create a flow chart that can illustrate the critical steps necessary for performing a division. You may find it helpful to review the document Help8085 prepared by Prof. Wagh which has been posted on coursesite.*
- 2) *After running the sim85, take a screen shot, and submit:*
 - a. *An enlarged screen shot of the 8085 Registers so their content can clearly be seen after the program is Run.*
 - b. *An enlarged screen shot of the Console so the clock cycles and number of instructions should be clearly visible; your program will be graded on accuracy of results as well as on efficiency.*
- 3) *Cut and past your code OR simply submit a screen shot of it as shown below. MAKE SURE THAT YOUR NAME APPEARS CLEARLY ON YOUR CODE AS SHOWN.*

- 5) *RUN the sim85 program and get a screen shot of its output showing the code, the registers and the memory as shown below. Submit a screen shot after the program is run so the registers have the proper content as per the above program specifications.*

