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ECE 5484, Homework 4

1. Consider the MARIE program below.

a) List the hexadecimal code for each line of the program (including the symbols).

hex

100 1109 Begin LOAD Base

101 310A ADD Offs

102 410B Loop SUBT Two

103 210C STORE Addr

104 8800 SKIPCOND 800

105 9108 JUMP Done

106 A000 CLEAR

107 110A LOAD Offs

108 7000 Done HALT

109 0200 Base HEX 200

10A 000B Offs DEC 11

10B 0002 Two HEX 0002

10C 0007 Addr HEX 007

b) Draw the symbol table.

|  |  |
| --- | --- |
| Symbol | Location |
| Addr | 10C |
| Base | 109 |
| Begin | 100 |
| Done | 108 |
| Loop | 102 |
| Offs | 10A |
| Two | 10B |

c) What is the value stored in the AC when the program terminates?

000B (Hex)

2. Write the assembly language equivalent of the following MARIE machine language instructions:

a) 0100 0001 1000 0101

Subt 185

b) 1000 0100 0000 0000

Skipcond 400

c) 0111 0000 0000 0000

Halt

3. ORG 100

If, Load X /Load X

Subt One /Subtract 1, store result in AC

Skipcond 000 /If AC < 0 (X < 1), skip the next instruction

Jump Endif /Jump to Endif if X is not less than 1

Then, Load X /Reload X so it can be subtracted

Subt Two /Subtract 2 from X

Store Y /Y = X - 2

Clear /Move 0 into AC

Store X /Set X to 0

Endif, Load Y /Load Y into AC

Add Seven /Add 7 to Y

Store Y /Y = Y + 7

Halt /Terminate program

X, Dec ? /X has starting value, not given in problem

Y, Dec ? /Y has starting value, not given in problem

One, Dec 1 /Use as a constant

Two, Dec 2 /Use as a constant

Seven, Dec 7 /Use as a constant

4. Fill in the following table to show how the given integers are represented, assuming 16-bits are used to store values and the machine uses 2’s complement notation.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Integer | Binary | Hex | 2 Byte Big Endian | 2 Byte Little Endian |
| 7 | 0000000000000111 | 0007 | 0007 | 0700 |
| 1329 | 0000010100110001 | 0531 | 0531 | 3105 |
| -7 | 1111111111111001 | FFF9 | FFF9 | F9FF |
| -27109 | 1001011000011011 | 961B | 961B | 1B96 |
| 31307 | 0111101001001011 | 7A4B | 7A4B | 4B7A |

5.

|  |  |
| --- | --- |
| Mode | Value loaded into AC |
| Immediate | 0x600 |
| Direct | 0x500 |
| Indirect | 0x100 |
| Indexed | No Answer |

6.