CS1356 Introduction to Information Engineering

Homework 5

1. Suppose the memory cells at addresses 00 through 05 in the machine described in Appendix C contain the following bit patterns:

Address	Contents	Meaning
00	10	LOAD data stored in memory cell 04_H to register 0
01	04	
02	30	STORE data in register 0 to memory cell 45_H
03	45	
04	C0	Halt
05	00	

When answering the following questions, assume that the machine starts with its program counter =00.

a. Translate the instructions that are executed into English.
b. What bit pattern is in the memory cell at address 45 when the machine halts? C0
c. What bit pattern is in the program counter when the machine halts? 06

2. Suppose the memory cells at addresses 00 through 09 in the machine described in Appendix C contain the following bit patterns:

Address	content
00	1A
01	02
02	2B
03	02
04	9C
05	AB
06	3C
07	00
08	C0
09	00

Assume that the machine starts with its program counter containing 00.

a. What will be in the memory cell at address 00 when the machine halts? 29_H
b. What bit pattern will be in the program counter when the machine halts? $0A_H$

3. Suppose the memory cells at addresses 00 through 07 in the machine described in Appendix C contain the following bit patterns:

Address	Contents
00	1A
01	06
02	3A
03	07
04	C0
05	00
06	23
07	00

a. List the addresses of the memory cells that contain the program that will be executed if we start the machine with its program counter containing 00. [00-05]
b. List the addresses of the memory cells that are used to hold data. [06-07]

4. In each of the following cases, write a short program in the machine language described in Appendix C to perform the requested activities. Assume that each of your programs is placed in memory starting at address 00.

a. Move the value at memory location 8D to memory location B3.

Address	Contents
00	10
01	8D
02	30
03	B3
04	C0
05	00

b. Interchange the values stored at memory locations 8D and B3.

Address	Contents
00	10
01	8D
02	11
03	B3
04	30
05	B3
06	31
07	8D
08	C0
09	00

c. If the value stored in memory location 45 is 00, then place the value CC in memory location 88; otherwise, put the value DD in memory location 88.

Address	Contents
00	11
01	45
02	20
03	00
04	22
05	CC
06	B1
07	0A
08	22
09	DD
0A	32
0B	88
0C	C0
0D	00

5. Write a program in the machine language of Appendix C to compute the sum of the two's complement values stored at memory locations Al, A2, A3, and A4. Your program should store the total at memory location A5.

Address	Contents
00	10
01	A1
02	11
03	A2
04	12
05	A3
06	13
07	A4
08	54
09	01
0A	55
0B	23
0C	56
0D	45
0E	36
0F	A5
10	C0
11	00

6. Perform the indicated operations

a.
```
  111000
AND 101001
```
101000

b.
```
  000100
AND 101010
```
000000

c.
```
  000100
AND 010101
```
000100

d.
```
  111011
AND 110101
```
110001

e.
```
  111000
OR  101001
```
111001

f.
```
  000100
OR  101010
```
101110

g.
```
  000100
OR  010101
```
010101

h.
```
  111011
OR  110101
```
111111

i.
```
  111000
XOR 101001
```
010001

j.
```
  000100
XOR 101010
```
101110

k.
```
  000100
XOR 010101
```
010001

l.
```
  111011
XOR 110101
```
001110

7. Identify both the mask and the logical operation needed to accomplish each of the following objectives:

a. Put 0s in the middle four bits of an eight-bit pattern without disturbing the other bits.
   AND 11000011

b. Complement a pattern of eight-bits.
   XOR 11111111

c. Complement the most significant bit of an eight-bit pattern without changing the other bits.
   XOR 10000000

d. Put a 1 in the most significant bit of an eight-bit pattern without disturbing the other bits.
   OR 10000000

e. Put 1s in all but the most significant bit of an eight-bit pattern without disturbing the most significant bit.
   OR 01111111