DATA MANIPULATION

1. Suppose registers E and F contained AA and CC, respectively. What bit pattern would be in register D after executing each of the following instructions (refer to language description table)?

AA (16) = 1010 1010 (2) ; CC (16) = 1100 1100 (2)

A. 7DEF: OR the contents of E and F into D

1010 1010 OR 1100 1100 = 1110 1110 (2) -> Reg D = 1110 1110 (2)

B. 8DEF: AND the contents of E and F into D

1010 1010 AND 1100 1100 = 1000 1000 (2)

Reg D = 1110 1110 (2)

C. 9DEF XOR the contents of E and F into D

1010 1010 XOR 1100 1100 = 0110 0110 (2)

2. If registers 0, 1, and 2 contain the patterns A5, A5, and B7, respectively, which of the following instructions will result in a jump to location AA? (refer to the language description table.)

A. B0AA   B. B1AA   C. B2AA

3. If registers 0 and 1 contain the patterns B5 and F0, respectively, what will be in register 1 after executing each of the following instructions? (Refer to the language description table.)

A. A102: ROTATE 2 bits to the right in register 1 -> F0 (16) = 1111 0000 (2) -> 0011 1100 = 3C (16)

B. 4001 : MOVE the contents of register 0 to register 1 -> Reg 1 will be: B5

C. 4010 : MOVE the contents of register 1 to register 0 -> Reg 1 will be: F0

4. Suppose the instruction B1A5 (as described in the language description table) is stored in main memory at addresses E0 and E1. Moreover, suppose registers 0 and 1 both contain the pattern FF. What value will be in the CPU's program counter immediately after executing the instruction?

Answer:

B1A5 = JUMP to A5 if Reg 1 = Reg 0 (FF =FF)

PC = A5

5. Suppose the instruction B1A5 (as described in the language description table) is stored in main memory at addresses E0 and E1. Moreover, suppose registers 0 and 1 contain the patterns FF and 75, respectively. What value will be in the CPU's program counter immediately after executing the instruction?

Answer:

B1A5 = JUMP to A5 if Reg 1 = Reg 0 (FF != 75)

PC will be E2

6. Encode each of the following commands in terms of the machine language described in the language description table.

A. **27A5**   LOAD register 7 with the value A5.

B. **17A5**   LOAD register 7 with the contents of the memory cell at address A5.

C. **5456**   ADD the contents of registers 5 and 6 as thought they were values in two's complement notation and leave the result in register 4.

D. **7456**   OR the contents of registers 5 and 6, leaving the result in register 4.

7. Encode each of the following commands in terms of the machine language described in the language description table.

A. **A705**   ROTATE the contents of register 7 to the right 5 bit positions.

B. **B2B2**   JUMP to the instruction at address B2 if the content of register 2 equals that of register 0.

C. **6456**   ADD the contents of registers 5 and 6 as thought they were values in floating- point notation and leave the result in register 4.

D. **8456**   AND the contents of registers 5 and 6, leaving the result into register 4.

8. Decode each of the following instructions that were encoded using the language description table.

A. 4034   MOVE the contents of register 3 into 4

B. 8023   AND the contents of register 2 and 3 into register 0

C. B288   JUMP to the instruction at address 88 if the content of register 2 equals that of register 0.

D. 2345   LOAD register 3 with the value 45

9. Decode each of the following instructions that were encoded using the language description table.

A. A004   ROTATE the contents of register 0 to the right 4 bit positions

B. 1234   LOAD register 2 with the contents of the memory cell at address 34

C. 5678   ADD the contents of register 7 and 8 into register 6

D. C000   HALT

10. The following table shows a portion of a machine's memory containing a program written in the language described in the language description table. Answer the questions below assuming that the machine is started with its program counter containing 00.

address	content		address	content
00	10		07	00
01	02		08	C0
02	24		09	00
03	04		0A	C0
04	B4		0B	00
05	0A		0C	C0
06	C0		0D	00

A. What bit pattern will be in register 0 when the machine halts?

   PC00 = 1002 -> R0 = 24 = 0001 0100 (2)

B. What bit pattern will be in register 4 when the machine halts?

   PC02 = 2404 -> R4 = 04
   PC04 = B40A -> R4 = 04 = 0000 0100 (2)
   PC06 = C000 -> HALT
   PC08

C. What bit pattern will be in the program counter when the machine halts?

   PC08 = C0 = 1100 0000 (2)