Project 1: ICOM 4215 – Computer Architecture and Organization

Test file, Spring 2012

The following file is provided for testing the correctness of the first project:

| Location of Instruction (hex) | Instruction | Opcode | Operand | IR (bin) | Effect |
|---|---|---|---|---|---|
| 00 -01 | LDI 50 | 01 110 | 000 0011 0010 | 0111000000110010 | The accumulator gets a 00110010. Zero, Carry, Overflow and Negative flags are set to 0 (false). Note: the number in accumulator is 50. |
| 02-03 | STA r1 | 01 011 | 001 0000 0000 | 0101100100000000 | Register 1 gest a 00110010. Note: the number on register 1 is a 50. |
| 04-05 | LDI -10 | 01 110 | 000 11110110 | 0111000011110110 | The accumulator gets a 11110110. Negative flag changes to a 1. Note: the number in the accumulator is a -10 following 2's complement notation. |
| 06-07 | STA r2 | 01 011 | 010 0000 0000 | 0101101000000000 | Register 2 gest a 11110110. Note: The number in register 2 is -10, following 2's complement notation. |
| 08-09 | ADDC r1 | 00 011 | 001 0000 0000 | 0001100100000000 | ALU adds 11110110 and 00110010 getting a 00101000 and carry. Negative flag changes to 0 and carry flag gets a 1. Note: The number in the accumulator is a 40. |
| 0A-0B | STA r7 | 01 011 | 111 0000 0000 | 0101111100000000 | Register 7 gest a 28 in hex (40 in decimal). This will be used to jump to address 28. |
| 0C-0D | LDI 2 | 01 110 | 000 0000 0010 | 0111000000000010 | The accumulator gets a 00000010. Note: The number in the accumulator is a 2. Carry is zero. |
| 0E-0F | STA r3 | 01 011 | 011 0000 0000 | 0101101100000000 | Register 3 gets a 00000010. Note: The number in register 3 is a 2. |
| 10-11 | STA [128] | 01 101 | 000 1000 0000 | 0110100010000000 | Memory location 128 (80 in hex) gets a 00000010. Note: address 128 gets a 2. |
| 12-13 | RLC | 01 000 | 000 0000 0000 | 0100000000000000 | Rotate left through carry. The number 00000100 is loaded into the Accumulator. All flags set to 0. Note: The accumulator contains a four (4). |
| 14-15 | STA [129] | 01 101 | 000 1000 0001 | 0110100010000001 | Store 0100 0001 into memory location 129 (81 in hex). Note: the contents of the accumulator, that is, a 4, is saved in address 129. |
| 16-17 | ADDC r2 | 00 011 | 010 0000 0000 | 0001101000000000 | ALU adds 0000 0100 and 11110110 getting a |

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|---|---|---|---|---|---|
| | | | | | 11111010. Carry flag and neg set to 1. Overflow and Zero set to 0. Note: Add 4 plus -10 using 2's complement notation. Results in -6 with no overflow, but carry. |
| 18-19 | STA [130] | 01 101 | 000 1000 0010 | 0110100010000010 | Store 11111010 in memory location 130 (82 in hex). Note: -6 is saved in address 130. |
| 1A-1B | MAC r3 | 00 101 | 011 0000 0000 | 0010101100000000 | Multiply-accumulate 1010 to 0010. Obtain a 0010110 (22 in dec) in the accumulator. Carry, Overflow, Neg and Zero flasg are 0. |
| 1C-1D | LDA [250] | 01 100 | 000 1111 1010 | 0110000011111010 | Load Accumulator with contents of keyboard (address 250 which is FA in hex). The contents are unknown until user presses the key. The accumulator will contain the ascii code of the letter or character pressed. |
| 1E-1F | STA r1 | 01 011 | 001 0000 0000 | 0101100100000000 | Register 1 gest a ???. Note: the number on register 1 is unknown. |
| 20-21 | NEG | 00 110 | 000 0000 0000 | 0011000000000000 | Twos complement of the contents of the accumulator. Carry and overflow flags are 0 but we do not know contents of Zero and Neg flags since they depend on what ascii character was selected. |
| 22-23 | ADDC r1 | 00 011 | 001 0000 0000 | 0001100100000000 | Add a number and its complement. Accumulator will have a zero. Zero flag and carry flags are set. All other flags are zero. |
| 24-25 | BRZ | 10 000 | 000 0000 0000 | 1000000000000000 | Jump if zero to instruction located in address 40 (28 in hex). |
| 26-27 | STA r2 | 01 011 | 010 0000 0000 | 0101101000000000 | This instruction should not be executed. If executed, register 2 gets a 0. |
| 28-29 | LDI 78 | 01 110 | 000 01001110 | 0111000001001110 | Load Accumulator with 01001110. Zero flag is cleared and all other flags remain the same. |
| 2A-2B | STA [FC] | 01 101 | 000 1111 1100 | 0110100011111100 | Display a N in first display location, as well as in location 252 in memory ($FC_{hex} = 252_{10}$). Note; the ascii code for a capital N is 78. |
| 2C-2D | STOP | 11 111 | 000 0000 0000 | 1111100000000000 | Cease operation. No changes to anything. |

| IR (bin) | IR (hex) |
|---|---|
| 0111000000110010 | 7032 |
| 0101100100000000 | 5900 |
| 0111000011110110 | 70F6 |
| 0101101000000000 | 5A00 |
| 0001100100000000 | 1900 |
| 0101111100000000 | 5F00 |
| 0111000000000010 | 7002 |
| 0101101100000000 | 5B00 |
| 0110100010000000 | 6880 |
| 0100000000000000 | 4000 |
| 0110100010000001 | 6881 |
| 0001101000000000 | 1A00 |
| 0110100010000010 | 6882 |
| 0010101100000000 | 2B00 |
| 0110000011111010 | 60FA |
| 0101100100000000 | 5900 |
| 0011000000000000 | 3000 |
| 0001100100000000 | 1900 |
| 1000000000000000 | 8000 |
| 0101101000000000 | 5A00 |
| 0111000001001110 | 704E |
| 0110100011111100 | 68FC |
| 1111100000000000 | F800 |

| Code |
| --- |
| 7032 |
| 5900 |
| 70F6 |
| 5A00 |
| 1900 |
| 5F00 |
| 7002 |
| 5B00 |
| 6880 |
| 4000 |
| 6881 |
| 1A00 |
| 6882 |
| 2B00 |
| 60FA |
| 5900 |
| 3000 |
| 1900 |
| 8000 |
| 5A00 |
| 704E |
| 68FC |
| F800 |