**CIS 350 – INFRASTRUCTURE TECHNOLOGIES**

**HOMEWORK # 4, PART I**

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(You may do this homework in groups of 2 students maximum.)

**Topics: Machine Cycle, Registers, and Memory (Chapter 7)**

Ex. Suppose that the following instructions are found at memory locations 01 and 02. Suppose that the following data are found at memory 15 and 16.

Address Instruction

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01 LDA 15

02 SUB 16 Addresses 01-02 represent the program area

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Data

15 20 Addresses 15-16 represent the data area

16 6

Show the contents of the PC, MAR, MDR, IR, and A registers as each step of the fetch-execute cycle is performed for instructions at addresses 01 and 02. Note that you have a sequence of two instructions. The 5 steps in the second instruction SUB 16 will gradually replace the contents of the registers set by the first instruction.

The machine cycle for the LDA instruction that is in the lecture notes for Chapter 7 and that we discussed on Panopto and MS Teams would be helpful. Also, look at the solution to Assignment One in Small Group Activity #4.

Instruction: 01 LDA 15

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| --- | --- | --- | --- | --- | --- |
| Steps in the machine cycle | PC | MAR | MDR | IR | A |
| 1. PC → MAR | 01 | 01 | LDA 15 | ? | ? |
| 2. MDR → IR | 01 | 01 | LDA 15 | LDA 15 | ? |
| 3. IR[addr] → MAR | 01 | 15 | 20 | LDA 15 | ? |
| 4. MDR → A | 01 | 15 | 20 | LDA 15 | 20 |
| 5. PC + 1 → PC | 02 | 15 | 20 | LDA 15 | 20 |

Instruction: 02 SUB 16

|  |  |  |  |  |  |
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| Steps in the machine cycle | PC | MAR | MDR | IR | A |
| 1. PC → MAR | 02 | 02 | SUB 16 | LDA 15 | 20 |
| 2. MDR → IR | 02 | 02 | SUB 16 | SUB 16 | 20 |
| 3. IR[addr] → MAR | 02 | 16 | 6 | SUB 16 | 20 |
| 4. A - MDR → A | 02 | 16 | 6 | SUB 16 | 14 |
| 5. PC + 1 → PC | 03 | 16 | 6 | SUB 16 | 14 |