Homework 7

(Answer in this sheet)

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| 1 | | **[10 pts]** How do you have to set up the control signals to transfer a numeric value from the main memory (RAM) to the Accumulator register on the Brainless Microprocessor?   |  |  | | --- | --- | | Control Signal | Value | | Use PC |  | | Load MAR |  | | Arith |  | | Invert |  | | pass |  | | Load ACC |  | | ACC to Data Bus |  | | Read |  | | Write |  | | Load IR |  | | |
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| 2 | | **[10 pts]** How do you have to set up the control lines to ADD a numeric value from the main memory (RAM) to the value held in the Accumulator register on the Brainless Microprocessor?   |  |  | | --- | --- | | Control Signal | Value | | Use PC |  | | Load MAR |  | | Arith |  | | Invert |  | | pass |  | | Load ACC |  | | ACC to Data Bus |  | | Read |  | | Write |  | | Load IR |  | | |
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| 3 | **[10 pts]** Use the following circuit to build a similar ALU-Accumulator circuit but with 8 bits word size instead of 4? (Hint: Use two of these circuits. Show the needed connections, the input data bits and the output data bits) | | |

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| 4 | **[Extra credit: 5 pts]** Is the following Microchip PIC CPU based on Harvard or Princeton architecture? |
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| 5 | **[10 pts]** Design an instruction that subtracts an operand held in the main memory from a value stored in the accumulator register.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | **Instruction** | Subtract | | | | |  | **Opcode** | 3 | | | | |  | **Present State** | 0 | 1 | 2 | 3 | | **Description** | **Pin number** |  |  |  |  | | Next\_step[1:0] | 13:12 |  |  |  |  | | - | 11:10 |  |  |  |  | | Use\_pc | 9 |  |  |  |  | | Load\_mar | 8 |  |  |  |  | | arith | 7 |  |  |  |  | | invert | 6 |  |  |  |  | | pass | 5 |  |  |  |  | | load\_acc | 4 |  |  |  |  | | acc\_to\_\_db | 3 |  |  |  |  | | read | 2 |  |  |  |  | | write | 1 |  |  |  |  | | load\_ir | 0 |  |  |  |  | |  | HEX Equivalent |  |  |  |  | |
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| 6 | **[10 pts]** Design an instruction that zeros the content of the accumulator register.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | **Instruction** | Subtract | | | | |  | **Opcode** | 3 | | | | |  | **Present State** | 0 | 1 | 2 | 3 | | **Description** | **Pin number** |  |  |  |  | | Next\_step[1:0] | 13:12 |  |  |  |  | | - | 11:10 |  |  |  |  | | Use\_pc | 9 |  |  |  |  | | Load\_mar | 8 |  |  |  |  | | arith | 7 |  |  |  |  | | invert | 6 |  |  |  |  | | pass | 5 |  |  |  |  | | load\_acc | 4 |  |  |  |  | | acc\_to\_\_db | 3 |  |  |  |  | | read | 2 |  |  |  |  | | write | 1 |  |  |  |  | | load\_ir | 0 |  |  |  |  | |  | HEX Equivalent |  |  |  |  | |
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| 7 | **[Extra credit: 10 pts]** Write a program that subtracts 5 from 3. Show how the program will be stored in memory. What result do you expect to see on a hex display?   |  |  |  | | --- | --- | --- | | **Address** | **Contents** | **Comment** | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |