**Wk3D**

|  |  |
| --- | --- |
| **MARIE Assembly Language**  Part I  Write a short program of five to ten lines in MARIE assembly language to accomplish something.  For example: Write a program in MARIE assembly language to evaluate the expression: A=B+C-D  We suppose that the program start at address 100 hexadecimal in the main memory and the content of the variables A,B,C,D are at the addresses 200,201,202,203 hexadecimal  You can implement any another example if you want.  For this I used the example provided in the prompt: A = B + C - D  Hexadecimal Addresses:  A 200  B 201  C 202  D 203  Instructions:  100 Load 201 Load contents of 201 (B) into AC  101 Add 202 Adds contents of address 202 (C) to contents in AC (B) and stores the result in AC (C+B)  102 Subt 203 Subtracts contents of address 203 (D) from contents in AC (C+B) and stores the result in AC (C+B-D)  103 Store 200 Stores value in AC (C+B-D) to address 200 (A)  104 Halt Terminates Program  Part II  Suppose you wanted to implement a control unit for a computer that you are designing.  Would you use a hardwired implementation or a micro-programmed control unit?  Why?  What factors in the computer design would affect your decision?  As a programmer, I would have to go with the micro-programmed control unit over the hardwired control unit because it’s less costly to implement, it’s easier to handle complex instructions, and is less difficult to perform instruction decoding. Most importantly, modifications can be made by changing microinstruction in the control as opposed to have to redesign the whole control unit.  Part III   1. A digital computer has a memory unit with 32 bits per word. The instruction set consists of 132 different operations. All instructions have an operation code part (opcode), and an address part (allowing for only one address).   Each instruction is stored in one word of memory.   1. How many bits are needed for the opcode? \_\_\_8 bits\_\_\_\_\_ 2. How many bits are left for the address part of the instruction? \_\_\_24 bits\_\_\_ 3. What is the maximum allowable size for memory? \_\_16,777,216 words\_\_ 4. Suppose that a 4 M x 32 bits main memory is built using 512 K x 8 bits RAM chips and memory is word addressable. 5. How many RAM chips are necessary? \_\_ 32 RAM chips\_\_\_ 6. How many RAM chips are needed for each memory word? \_\_\_4 RAM chips\_\_\_ 7. How many address bits are needed for each RAM chip? \_\_\_19 bits\_\_\_ 8. How many address bits are needed for all memory? \_\_\_22 bits\_\_\_ |  |