

Due Mon Feb 4 at the beginning of class.

Show all your work and please try to be neat. Refer to Handouts as necessary.

1. Which component of microcontroller architecture best fits the blanks below.
  - a. Accumulators A and B and index registers X and Y compose the \_\_\_\_\_ in the 68HC12 microcontroller CPU.
  - b. Data and instruction bytes are stored in \_\_\_\_\_.
  - c. Instruction bytes loaded from memory to the CPU are stored in the \_\_\_\_\_.
  - d. Data exchanged between Memory and the CPU must pass through \_\_\_\_\_.
  - e. The memory address of the next instruction to be executed is stored in the \_\_\_\_\_.
  - f. When accessing memory outside the CPU, the \_\_\_\_\_ defines the location of the memory value to be read or written.
  - g. After decoding the instruction bytes, operation control bits are sent to the \_\_\_\_\_.
  - h. Data bytes loaded into the Register File must first pass through the \_\_\_\_\_.
  - i. A microcontroller interfaces with the outside world through \_\_\_\_\_.
  
2. Data Transfer/Manipulation Instructions
  - a) What is the difference between a logical shift right and an arithmetic shift right?
  - b) If accA holds \$16 and accB holds \$2A, what memory locations will change value after executing the STD \$637F instruction? Identify the new value in any changed memory locations.
  
3. Arithmetic Instructions
  - b) What series of instructions would achieve the 16-bit subtraction of \$7234 from \$ABCD (i.e., \$ABCD-\$7234)? Write the instructions and state what the result would be and where it would be stored.
  - a) If accA holds \$A4 and accB holds \$28, what values will be in each accumulator after executing the ABA instruction?
  
4. Logic and Bit Operations  
Assuming Accumulator A holds \$FF:
  - a) What values is in accA after the instruction ORAA #\$00?
  - b) What value is in accA after the instruction BITA #\$00?
  - c) What CCR flags are set or cleared by the instructions in a) and b)?Assuming accD holds \$A5A5, IX holds \$E200, and memory location \$E200 holds \$F0:
  - d) What is the result of the instruction BSET \$E200 %01100110? Specify the resulting value in hex and the location it is stored.
  - e) Write an instruction that will force to one (high) the 7<sup>th</sup> and 0<sup>th</sup> bits of memory location \$2ED3.
  
5. Data Test Instructions  
Using a data test instruction, how could you determine if an 8-bit values stored in memory address \$01F0 had a zero value. Write the required assembly code and explain what happens after the code is executed to let you know if the value is zero or not.

6. Identify the address mode associated with each of the following statements:
  - a. Contains all necessary data within its op-code and operand bytes.
  - b. Allows the fastest execution of instructions using data stored in memory.
  - c. Does not require any operands.
  - d. Permits access to all data within the complete memory structure.
  - e. Instruction data is stored in memory at an address relative to a value in a CPU register.
  
7. For each of the following ASM instructions, specify the hexadecimal memory address of the value affected and the hexadecimal value in that address after the instruction is executed. Assume the initial value in all memory addresses is \$C3
  - a. BSET \$9D %10101010
  - b. BSET \$67B3 %11100111
  - c. BCLR %10011110 %10000001
  - d. BCLR \$859C \$C3