

## CS-301 Computer Architecture Assignment 10

Name: \_\_\_\_\_

1. More registers appear to be a good thing, in terms of reducing the total number of memory accesses a program might require. Give an arithmetic example to support this statement. First, determine the number of memory accesses necessary using MARIE and the two registers for holding memory values (AC and MBR). Then perform the same arithmetic computation for a processor that has more than three registers to hold memory data values.

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2. MARIE saves the return address for a subroutine in memory, at a location designated by the jump-and-store (JnS) instruction. In some architectures, this address is stored in a register, and in many it is stored on a stack. Which of these methods would best handle recursion? Explain your answer. (Hint: Recursion implies many subroutine calls.)

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3. The first two bytes of a  $2M \times 16$  main memory have the following hex values:

Byte 0 is FE

Byte 1 is 01

If these bytes hold a 16-bit two's complement integer, what is its actual decimal value if:

- a) Memory is big endian?

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- b) Memory is little endian?

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4. The memory unit of a computer has 256K words of 32 bits each. The computer has an instruction format with 4 fields: an opCode field; a mode field to specify 1 of 7 addressing modes; a register address field to specify one of 60 registers; and a memory address field. Assume an instruction is 32 bits long. Answer the following questions.

- a) How large must the mode field be?

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- b) How large must the register field be?

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- c) How large must the address field be?

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- d) How large is the opCode field?

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