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Form 1

Computer Organization and Microprocessor- ENCS2380

Quiz#2 (10 pts.), Date: Wednesday, Nov. 06, 2024

Q1. A microprocessor has the following instruction format and the memory is byte addressable:

Opcode [5 bits]	Addressing mode [1 bit] 0: immediate 1: memory address	Operand [26 bits]
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Answer the following questions:

a. (1 pt.) What is the total length of the instruction (in bytes)?

$$5 + 1 + 26 = 32 \text{ bits} = 4 \text{ Bytes.}$$

b. (1 pt.) How many operations can be implemented using this instruction?

$$2^5 = 32 \text{ operations.}$$

c. (1 pt.) What is the range of memory addresses (in hexadecimal) that the processor can access directly?

$$2^{26} = 64M \left\{ \begin{array}{l} 0000000 \\ 3FFFFFF \end{array} \right.$$

d. (1 pt.) What is the maximum unsigned integer (in decimal) that can be included as an immediate value?

$$0 - 2^{26} - 1$$

e. (1 pt.) What is the range of signed integers (in decimal) supported by the immediate addressing mode?

$$-2^{26-1} - + (2^{26-1} - 1)$$

f. (1 pt.) Given that the number of instructions of a program is 15 and the size of each instruction is 2 bytes, how many cells from the memory we need in order to store this program?

$$15 \times 2 = 30 \text{ cells.}$$

g. (2 pts.) If the opcode of the ADD operation is 8 (in decimal), find the machine code (in binary and in hexadecimal) for: ADD [13].

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10100010000000000000000000000000
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0x4400000D

h. (2 pts.) If the opcode of the SUB operation is 5 (in decimal), find the instruction corresponding to this machine code: 0010101100000000000000000000000011001.

SUB 33554457

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Form 2

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Q1. A microprocessor has the following instruction format and the memory is byte addressable:

Opcode [7 bits]	Addressing mode [1 bit] 1: immediate 0: memory address	Operand [24 bits]
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Answer the following questions:

a. (1 pt.) What is the total length of the instruction (in bytes)?

$7 + 1 + 24 = 32 \text{ bits} = 4 \text{ Bytes.}$

b. (1 pt.) How many operations can be implemented using this instruction?

$2^7 = 128 \text{ operations}$

c. (1 pt.) What is the range of memory addresses (in hexadecimal) that the processor can access directly?

$2^{24} = 16M \left\{ \begin{array}{l} 000\ 000 \\ FFF\ FFF \end{array} \right.$

d. (1 pt.) What is the maximum unsigned integer (in decimal) that can be included as an immediate value?

$0 - 2^{24} - 1$

e. (1 pt.) What is the range of signed integers (in decimal) supported by the immediate addressing mode?

$-2^{24-1} - 2^{24-1} - 1$

f. (1 pt.) Given that the number of instructions of a program is 17 and the size of each instruction is 2 bytes, how many cells from the memory we need in order to store this program?

$17 \times 2 = 34 \text{ cells}$

g. (2 pts.) If the opcode of the ADD operation is 9 (in decimal), find the machine code (in binary and in hexadecimal) for: ADD [11].

$00010010000000000000000000000011$

$0x1200000B$

h. (2 pts.) If the opcode of the SUB operation is 25 (in decimal), find the instruction corresponding to this machine code: 001100100000000000000000000011001.

SUB [25]