CS 3101 Computer Organization

Homework 5

**Due Date: Wednesday, November 7, 2018 at beginning of class**

Type your answers in a word processor, print and submit hardcopy in class. Do not handwrite.

1. Show how the decimal value 2017041210 would be stored by byte-addressable machines with 32-bit words, using little endian format and then big endian format. Assume the value starts at address 201816. Draw a diagram of memory and place the appropriate values in the correct (and labeled) memory locations.

2017041210 = 133C6AC16

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Address | 0010000000011000 | 0010000000011001 | 0010000000011010 | 0010000000011011 |
| Big Endian | 01 | 33 | C6 | AC |
| Little Endian | AC | C6 | 33 | 01 |

1. Suppose we have the instruction **Load 100**. Given memory and register R1 contain the decimal values below:

|  |  |
| --- | --- |
| ***Memory Address*** | ***Content*** |
| 100 | 500 |
| 300 | 700 |
| 500 | 900 |
| 700 | 100 |
| 900 | 300 |

|  |  |
| --- | --- |
| R1 | 200 |

Assuming R1 is implied in the indexed addressing mode, determine the actual value loaded into the accumulator and fill in the table below:

|  |  |
| --- | --- |
| ***Mode*** | ***Value Loaded into AC*** |
| Immediate | 100 |
| Direct | 500 |
| Indirect | 900 |
| Indexed | 700 |

1. A certain computer has a memory of 1M words, and each word is 32 bits long. Each instruction is 32 bits long and is consisted of an opcode field, a register address field to specify one of 32 registers, and a memory address field.

a. How large must the register field be?

5

b. How large must the address field be?

20

c. How many different opcodes can be supported by this format?

256

1. (**bonus question, 5 points**) In a computer instruction format, the instruction length is 12 bits and the size of an address field is 4 bits. Is it possible to design a coding method to support 13 2-address instructions, 46 1-address instructions, and 30 0-address instructions using the specified format? Show your design or argument to justify your answer to get credit.

**It is possible:**

0000 R1 R2

1100 R1 R2 13, 2-address codes

1101 0000 R1

1111 1101 R1 46, 1-address codes

1111 1110 0000

1111 1111 1101 30, 0-address codes