Comp 200 Exercises

Chapters 4-5

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Chapter 4

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1. Given our discussion of positional number systems. Determine the decimal value of the following numbers

a. 133 (base 4):

(1 * 4^2) + (3 * 4^1) + (3 * 4^0) = 16 + 12 + 3 = **31**

b. 367 (base 8)

(3 * 8^2) + (6 * 8^1) + (7 * 8^0) = 192 + 48 + 7 = **247**

c. 1BA (base 16)

(1 * 16^2) + (11 * 16^1) + (10 * 16^0) = 256 + 176 + 10 = **442**

Chapter 5

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19. Consider the following structure of the instruction register:

op code: 6 bits
address-1: 18 bits
address-2: 18 bits

a. What is the maximum number of distinct operation codes that can be recognized and executed on this machine?

"If the operation code field contains k bits, then the maximum number of unique machine language operations is 2^k"

64 is the maximum number of operating codes. 2^6 = 64

b. What is the maximum memory size of this machine?

All memory addresses in RAM have the same length of bits. Since the address sizes are 18 bits, we can assume the maximum memory size is 2^18 or 262,144 memory cell addresses. Assuming each cell is 8 bits, our maximum memory size would be 8 * 262,144 = 2,097,152 bits or 262.14 kilobytes.

c. How many bytes are required for each operation
The total number of bits in the instruction register is 42. To determine the amount of bytes required, we would divide the 42 bits by 8 (8 bits in a byte) 42 / 8 = 5.25 bytes

20. If the size of the op code field in exercise 19 were increased from 6 bits to 8 bits, what would now be the theoretical maximum size of the instruction set?

The total number of unique language operations for a op code with 8 bits of memory would be 2^8 = 256