Course Name: COMPUTER ARCHIT LAB

Course Number and Section: 14:332:333:02

Experiment: Lab 1 Report

Lab Instructor: Haolin Jiang

Date Performed: 2/12/25

Date Submitted: 2/19/25

Submitted by: Chance Reyes 225006531

Course Name: _____

Course Number and Section: **14:332:xxx:xx**

! Important: Please include this page in your report if the submission is a paper submission. For electronic submission (email or Canvas) please omit this page.

----------For Lab Instructor Use ONLY----------

GRADE: _____

COMMENTS:

Electrical and Computer Engineering Department
School of Engineering

1.1 Exercises

1. (24 pts) Convert the following from their initial radix to the other two radices:
0b1001, 0b10011011, 0x129, 0xFEBA, 129, 207

1. **Decimal: 9 Hex: 0x9**
2. **Decimal: 155 Hex: 0x9B**
3. **Decimal: 297 Binary: 0b100101001**
4. **Decimal: 65110 Binary: 0b1111111010111010**
5. **Binary: 0b10000001 Hex: 0x81**
6. **Binary: 0b11001111 Hex: 0xCF**

2. (4 pts) Write the following using IEC prefixes: 2^42, 2^67
4 Ti, 128 Ei

3. (4 pts) Write the following using SI prefixes: 10^12, 10^18
1 Tera, 1 Exa

4. (4 pts) Write the following with powers of 10: 10000 K, 10 P
10^7, 10^16

5. (4 pts) Write the following with powers of 2: 2048 Mi, 512 Ti
2^31, 2^49

2.2 Exercises

1. (10 pts) What is the largest integer that can be represented with 10 bits? How many bits do you need to represent the largest integer + 1? Please write down the answer in both two's complement and unsigned cases and explain your answer.
The largest unsigned integer a 10-bit binary number can represent is 2^10 – 1 = 1023. You need 11 bits to display 1023 + 1. The largest signed integer a 10-bit binary number can represent is the two's complement 2^9 – 1 = 511. You need 10 bits to display 511 + 1.

2. (10 pts) How do you represent the numbers 200, and -200 (assume the numbers are 9 bits)? Please answer in both two's complement and unsigned cases, and indicate if the number cannot be represented in either case.

	200	**-200**
Unsigned	**011001000**	**Impossible**
Two's complement	**011001000**	**100111000**

3. (10 pts) Is it possible to use 5 bits to represent the number -60? Is it possible to use 6 bits to represent the number 60? Please explain. Please answer in both two's complement and unsigned cases, and indicate if the number cannot be represented in either case.
You can't represent the number -60 with 5 bits since a signed 5-bit number can only go down to -16. You can represent the number 60 with an unsigned 6-bit number since it can go up to 63, but not a two's complement 6-bit number since it can only go up to 61.

4. (10 pts) What is the range of decimal values that an 5-bit two's complement representation can represent? Additionally, what is the range of decimal values that a 9-bit two's complement representation can represent? Please provide an explanation for each range.
The range of a 5-bit number in two's complement is -2^4 to 2^4 – 1 (-16 to 15)
The range of a 5-bit number in two's complement is -2^8 to 2^8 – 1 (-256 to 255)

3.1 Exercises

1. (5 pts) How many bits do we need to represent a variable that can only take on the 6 values 1, 3, 5, 7, 9, or 11 (i.e., we have 6 distinct numbers)?
We need to get $\log_2 6 = 2.58$ bits, which rounds up to 3 bits.

2. (5 pts) If the only value a variable can take on is 15C1.93hex, how many bits are needed to represent it?
We only need 1 bit to represent it.

3. (10 pts) If we need to address 4 Gi-Byte of memory and we want to address every byte of memory, how long does an address need to be?
We need $\log_2(4*2^{30}) = 32$ bits.