Course Name: Comp Arch Lab 1

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

Experiment: [Experiment # [1] – Introduction, GitHub tutorial, Number Representation]

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GRADE: _______________

COMMENTS:

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ECE Lab Report Structure

1. Purpose / Introduction / Overview – describe the problem and provide background information
2. Approach / Method – the approach took, how problems were solved
3. Results – present your data and analysis, experimental results, etc.
4. Conclusion / Summary – what was done and how it was done

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Introduction/Approach

In order to re-familiarize ourselves with number representations in different languages, exercises will be done. Github, a vital tool for the class, will also be setup for future use and lab submission. Overall, the concepts of the first lab are basic refreshers in preparation for the complexities ahead. The following pages contain the answers to asked questions, which were done utilizing previously learned techniques from DLD.

Number Representation:

1.1 Conversions

Table Used

Binary	Hex	Decimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15

a)

1. 0b10001110

Binary to Hexadecimal: 1000 = 8, 1110 = E ; **Answer:8E**

Binary to Decimal: 1*2^7+0*2^6+0*2^5+0*2^4+1*2^3+1*2^2+1*2^1+0*2^0 = **142**

2. 0xC3BA

Hexadecimal to Decimal: 12*16^3+3*16^2+11*16^1+10*16^0 = **50106**

Hexadecimal to Binary: C = 1100, 3 = 0011, B = 1011, A=1010 ; **Answer: 1100001110111010**

3. 81
Decimal to Binary:
81/2=40 R(Remainder)=1
40/2=20 R=0
20/2=10 R=0
10/2=5 R=0
5/2=2 R=1
2/2=1 R=0
½=0 R=1
Answer: 1010001
Decimal to Hexadecimal:
81/16=5 R=1
5/16=0 R=5
Answer: 51 (Hex)

4.0b100100100
Binary to Hex: 1=1, 0010=2, 0100=4 ; **Answer:124**
Binaty to Dec:1*2^8+0*2^7+0*2^6+1*2^5+0*2^4+)*2^3+1*2^2+0*2^1+0*2^0 = **292**

5.0xBCA1
Hex to Dec: 11*16^3+12*16^2+10*16^1+1*16^0 = **48289**
Hex to Binary:B=1011,C=1101,A=1010,1=0001 ; **Answer: 1011110110100001**

6.0
Decimal to Binary: 0/2=0 R=0 ; **Answer: 0000**
Decimal to Hex: 0/16=0 R=0 ; **Answer: 0**

7.42
Decimal to Binary:
42/2=21 R=0
21/2=10 R=1
10/2=5 R=0
5/2=2 R=1
2/2=1 R=0
½=0 R=1
Answer: 101010
Decimal to Hex:
42/16=2 R=10
2/16=0 R=2
Answer:20A
8.0xBAC4
Hex to Dec: 11*16^3+10*16^2+12*16^1+4*16^0 = **47812**
Hex to Binary: B=1011, A=1010, C=1101, 4=0100 ; **Answer = 1011101011010100**

b)
2^14 = 2^10*2^4 or 16Ki
2^43 = 2^40*2^3 or 8Ti
2^23 = 2^20*2^3 or 8Mi
2^58 =2^50*2^8 or 256Pi
2^64 =2^60*2^4 or 16Ei
2^42 =2^40*2^2 or 4Ti
c)
2Ki = 2^1*2^10=2^11
512Pi = 2^9*2^50=2^59
256Ki = 2^8*2^10=2^18
32Gi = 2^5*2^30=2^35
64Mi = 2^6*2^20=2^26
8Ei = 2^3*2^60=2^63

Signed Integers
2.2 Exercises

1. The largest integer that can be represent is 255 with 8 bits. Alongside 00000000 this creates a total possible of 256 integers that can be represented by 8 bits.

2. 0 = 00000000 Two's Complement = 11111111+1 = 00000000
   3 = 00000011 Two's Complement = 11111100+1 = 11111101
   -3 = 10000011 Two's Complement = 01111100+1 = 01111101

3.
42 =
42/2=21 R=0
21/2=10 R=1
10/2=5 R=0
5/2=2 R=1
2/2=1 R=0
½=0 R=1
42 = 00101010 Two's Complement = 11010101 + 1 = 11010110
-42 = 10101010 Two's Complement = 01010101 + 1 = 01010110

4. Largest 8-bit integer = 11111111(Binary) = 255(Decimal)
   Two's Complement of largest: First Flip -> 00000000 Then add 1 -> 00000001
   Largest 8-bit plus 1 overflow occurs but if we only see the 8 bit we get 00000000 when actually it is 100000000.

5. We will add 3 + -3 since we already solved their complements. We use the regular 3 for 3 and two's complement of 3 for the negative 3 representation.

3=00000011
Two's complement of 3=11111101

00000011+11111101 = 100000000 -> Two's complement = 011111111 + 1 = 100000000 the 1 is a sign plus an overflow. We only focus on the 8 bits so we get 0 as the answer which is true as -3+3=0.

6. Decimal is used to count in everyday life and based off of base ten. Computers instead use binary which is base two where only the numbers 0 and 1 are used to represent all else. This is used cause computer circuits exist in two states, on or off. Hexadecimal uses base 16 and the letters A through F to represent 10 to 15. Hexadecimal is used because it is convenient since a single value represents four bits. It's easier to read then a long string of 1s and 0s while also taking up less space.

Counting
3.1 Exercises
1)How many bits to represent:

a) 0
1 bit can be used

b) pi
We need floating point format to represent pi with half precision being the least bits which means we need 11 significant bits.
c) e
To find this we need to perform the same task as we did with pi and use half precision thus requiring 11 significant bits.

2)2 TiB = 2 x 1024 x 1024 x 1024 x 1024 bytes (in order to represent the KiB, then MiB, then GiB, then TiB). Each multiple of 1024 requires the use of 10 bits. Thus, the minimum address length required would be 41 bits.

3) This is the same question as part c of question 1 thus 11 significant bits.

Conclusion:

Overall, the lab presented an opportunity to refresh material learned in DLD, while also providing a gateway into what's to come. By solidifying the fundamentals, future endeavours become less taxing. Github introduction was also done, a vital asset for submission in the months to come. Although, the first lab can be concluded to be simple, it was a necessary step towards logical progression of expanding computer knowledge.