Binary and C Intro Assignment (Learning)

CSCI 389: Computer Systems

Fall 2022

This assignment is an opportunity to test your understanding of binary and C and receive feedback. Point values are assigned so that you can differentiate between large and small mistakes, but this assignment does not affect your grade.

Due Date: Monday, September 19th at 12:00 pm.

1. (12 points) **Converting Bases.** Convert the following numbers to the specified base.

   (a) (2 points) Convert 209_{10} to binary.

   (b) (2 points) Convert 192_{10} to hexadecimal.

   (c) (2 points) Convert 10110001_2 to decimal.

   (d) (2 points) Convert 1001101_2 to hexadecimal.

   (e) (2 points) Convert $D3A7_{16}$ to decimal.

   (f) (2 points) Convert $83EF_{16}$ to binary.

2. (4 points) **Binary Addition.** Show how to add 10001111_2 and 01100101_2 using binary arithmetic.

3. (4 points) **Binary Multiplication.** Show how to multiply 100110 and 11001 using binary arithmetic.

4. (4 points) **Circuits.** Create the truth table for the following circuit:
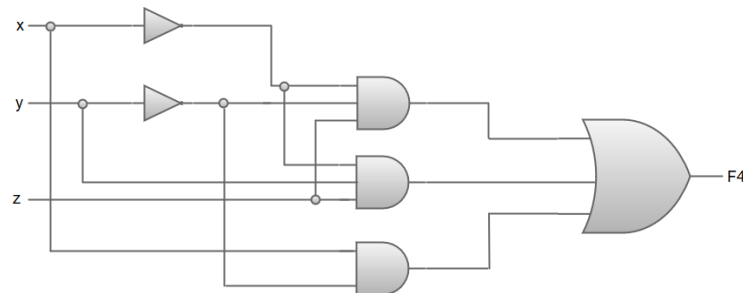
5. (16 points) **C.** Write C code that generates a list of random integers and computes the mean (as a real number). Your program should take as input two parameters, the length of the list, and a seed to generate the random numbers. It should print out the list of integers and the calculated mean. Submit your code, as well as the makefile you used to compile it.

A 10   B 11   C 12
D 13   E 14   F 15

C
256   16   1
16^2 16^1 16

1	1	0	1	0	0	0	1
256	128	64	32	16	8	4	2	1

1   2^8 2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0

1.

a) 209_{10} to bin = 11010001

128 | 32 16 | | | 1

10110001

b) 192_{10} to hex = 0xC0

c) 10110001 to dec = 177

d) $\overset{4}{100}\overset{13}{\boxed{11D1}}$ to hex = 0x4D

84 1

e) D3A7 to dec

53,248 + 768 + 160 + 7 = 54183

f) $83EF_{16}$ to binary

1 digit hex ~ 4 digits bin

$\underbrace{1\ 0\ 0\ 0}_{8}$ $\underbrace{0\ 0\ 1\ 1}_{3}$ $\underbrace{1\ 1\ 1\ 0}_{E}$ $\underbrace{1\ 1\ 1\ 1}_{F}$

2.

```
     1 1 1 1
  1 0 0 0 1 1 1 1
+ 0 1 1 0 0 1 0 1
 ----------------
  1 1 1 1 0 1 0 0
```

3.

```
      1 0 0 1 1 0        38
   ×    1 1 0 0 1        25
   -----------------
        1 0 0 1 1 0
               0
              0 0
   1 0 0 1 1 0 0 0 0
 1 0 0 1 1 0 0 0 0 0
 -------------------
 1 1 1 0 1 1 0 1 1 0     950
```

4.

X	y	z	F4
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0