ENEL 353 Tutorial T02

Tue Sept 17 2019

Quiz #1 Tue Sept 24

- closed-book
- bring: pencil, eraser, Schulich calculator
- topics: numbers and codes (not logic gates)

Slide 2: Important Correction

There are 4, not 5 quizzes in Fall 2019.

Exercise 1

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

ENEL 353
T02
Sept 17 2019
2 of 5

Exercise 2

N	2^N
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
10	1024
11	2048
12	4096

Exercise 3

$$2D.8_{16} = 2\times16^{1} + 13\times16^{0} + 8\times16^{-1}$$

$$= 32 + 13 + 0.5 = 45.5_{10}$$

Exercise 4

$$2102_3 = 2\times3^3 + 1\times3^2 + 0\times3^1 + 2\times3^0$$

$$= 54 + 9 + 0 + 2 = 65_{10}$$

Exercise 5

division	quotient	remainder
26/2	13	0
13/2	6	1
6/2	3	0
3/2	1	1
1/2	0	1

↑ read up

Answer

11010_2

Exercise 6

$253_8 = 2 \times 8^2 + 5 \times 8^1 + 3 \times 8^0$

$= 128 + 40 + 3 = 171_{10}$

$10B_{16} = 1 \times 16^2 + 0 \times 16^1 + 11 \times 16^0$

$= 256 + 0 + 11 = 267_{10}$

Exercise 7 Let's convert to octal first. (Other choices would also work).

division	quotient	remainder
75/8	9	3
9/8	1	1
1/8	0	1

↑ read up

$75_{10} = 113_8$

Convert octal to binary ...

1	1	3
001	001	011

$75_{10} = 1001011_2$

(It's okay to leave out leading zeros in unsigned binary. That's not okay for signed binary.)

Convert binary to hex ...

0100	1011
4	B

$75_{10} = 4B_{16}$

Exercise 8

carry in	0100	carry in	1000
	1011		0101
+	0010	+	1110
sum	1101	sum	0011

The carry out of the MSB is not part of the 4-bit sum

Exercise 9

rep. of $+5_{10}$ 0101

invert bits 1010

add 1 **1011** ← answer

Exercise 10 (Algorithm works to negate negative numbers)

rep. of -4_{10} 1100

invert bits 0011

add 1 **0100** ← answer

Exercise 11

unsigned

$$1\times2^5 + 0\times2^4 + 1\times2^3 + 0\times2^2 + 0\times2^1 + 0\times2^0$$

$$= 32 + 8 + 4 = \boxed{44_{10}}$$

Sign/magnitude A sign bit of 1 means that the number is negative. The magnitude is

$$0\times2^4 + 1\times2^3 + 1\times2^2 + 0\times2^1 + 0\times2^0 = 12$$

answer: $\boxed{-12_{10}}$

ENEL 353
T02
Sept 17 2019
5 of 5

two's complement

Let's negate 101100

Invert bits 010011

Add 1 010100

So the negation of 101100 is $2^4 + 2^2 = 20_{10}$

So 101100 must represent $\boxed{-20_{10}}$