CPSC 2610

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Assignment 1

1.

a. $(37)_{10} = (100101)_2$

b. $(65)_{10} = (1000001)_2$

c. $(138)_{10} = (10001010)_2$

	Quotient	Remainder	a
138/2	69	0	0
69/2	34	1	1
34/2	17	0	2
17/2	8	1	3
8/2	4	0	4
4/2	2	0	5
2/2	1	0	6
½	0	1	7

2.

a. $(101101)_2 = (45)_{10}$

b. $(111001)_2 = (57)_{10}$

c. $(1100111)_2 = (103)_{10}$

$(1100111)_2$

$= (1 X 2^6) + (1 X 2^5) + (0 X 2^4) + (0 X 2^3) + (1 X 2^2) + (1 X 2^1) + (1 X 2^0)$

$= 64 + 32 + 0 + 0 + 4 + 2 + 1$

$= 103$

3.

a. $(123)_{10} = (173)_8$

b. $(249)_{10} = (371)_8$

	Quotient	Remainder	a
249/8	31	1	0
31/8	3	7	1
⅜	0	3	2

4.

a. $(58)_{10} = (3A)_{16}$

b. $(249)_{10} = (F9)_{16}$

	Quotient	Remainder	a
249/16	15	9	0
15/16	0	15 (F)	1

5.

a. $(673)_8 = (1AA)_{16}$

$(673)_8 = (110\ 111\ 011)_2 = (1\ 1011\ 1011)_2 = (0001\ 1011\ 1011)_2 = (1AA)_{16}$

b. $(23EF9)_{16} = (0437371)_8 = (437371)_8$

$(23EF9)_{16} = (0010\ 0011\ 1110\ 1111\ 1001)_2$

$= (00\ 100\ 011\ 111\ 011\ 111\ 001)_2$

$= (000\ 100\ 011\ 111\ 011\ 111\ 001)_2$

$= (0437371)_8$

6.

a. $(36.375)_{10} = (100011.011)_2$

	Quotient	Reminder	a
35/2	17	1	0
17/2	8	1	1
8/2	4	0	2
4/2	2	0	3
2/2	1	0	4
½	0	1	5

$= (100011)_2$

	Integer	Fraction	a
0.375 X2	0	0.75	-1
0.75 X2	1	0.5	-2
0.5 X2	1	0	

= (.011)

=> $(100011.011)_2$

b. $(10110.0101)_2 = (22.3125)_{10}$

$(10110.0101)_2$

$= (1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + (0 \times 2^0) + (0 \times 2^{-1}) + (1 \times 2^{-2})$

$+ (0 \times 2^{-3}) + (1 \times 2^{-4})$

$= 16 + 0 + 4 + 2 + 0 + 0 + 0.25 + 0 + 0.0625$

$= 22.3125$

7.

a. $10011 - 10001 = (00010)_2 = (2)_{10}$

2's complement of :		10001
	flip	01110
	add +	1
		01111
	add +	10011
		100010
	rule 1:	00010

$(00010)_2 = (2)_{10}$

b. $100010 - 101011 = (\underline{0}001001)_2 = -9$

2's complement of :		101011
	flip	010100
	add +	1
		010101
	add +	100010
		110111
	=	$\underline{0}110111$
Rule 2: 2's complement of :		110111
filp:		001000
add:	+	1
		001001

Result = $(\underline{0}001001)_2 = (-9)_{10}$

8.

a. $(+29)_{10} + (-49)_{10}$

$(29)_{10} = (0011101)_2$

$(49)_{10} = (0110001)_2$

In 8 bit CPU:

(+29) = $\underline{0}$ 0011101

(-49) = $\underline{1}$ 1001111 (2’s complement of 0110001 = 1001110 + 1 = 1001111)

$\underline{0}$0011101 + $\underline{1}$1100111 = $\underline{1}$1101100 = -1101100

2’s complement of: 1101100 = 0010011 + 1 = 0010100

Result: $(-0010100)_2 = (-20)_{10}$

b. $(-29)_{10} + (-49)_{10}$

In 8-bit CPU:

(-29) = $\underline{1}$ 1100011 (2’s complement of 0011101 = 1100010 + 1 = 1100011)

(-49) = $\underline{1}$ 1001111 (from 8(a))

$\underline{1}$1100011 + $\underline{1}$1001111 = 1$\underline{1}$0110010 = $\underline{1}$0110010 = -0110010

2’s complement of : 0110010 = 1001101 + 1 = 1001110

Result: $(-1001110)_2 = (-79)_{10}$

9.

a. Unsigned binary format

$10110110 = (1 \times 2^7) + (0 \times 2^6) + (1 \times 2^5) + (1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2)$

$+ (1 \times 2^1) + (0 \times 2^0)$

$= 128 + 0 + 32 + 16 + 0 + 4 + 2 + 0$

$= 182$

$(10110110)_2 = (182)_{10}$

b. Signed 1’s complement format

10110110 in 8 bit CPU

= $\underline{1}$ 0110110 = -0110110

1’s complement of: 0110110 = 1001001

$(1001001)_2 = 2^6 + 0 + 0 + 2^3 + 0 + 0 + 2^0 = 64 + 8 + 1 = (73)_{10}$

Result = $(-1001001)_2 = (-73)_{10}$

c. Signed 2’s complement format

10110110 in 8 bit CPU

= $\underline{1}$ 0110110 = -0110110

2’s complement of: 0110110 = 1001001 + 1 = 1001010

$(1001010)_2 = 2^6 + 0 + 0 + 2^3 + 0 + 2^1 + 0 = 64 + 8 + 2 = (74)_{10}$

Result = $(-1001010)_2 = (-74)_{10}$

d. BCD format

$(10110110)_2 = (182)_{10}$ (from 9.a)= $(0001\ 1000\ 0010)_{BCD}$

In 8-bit CPU: $(000110000010)_{BCD} = (1000\ 0010)_{BCD} = (82)_{10}$