CSE202 Logic Design I – Tutorial 02

#	Student ID	Student Name	Grade (10)
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Q1	Add and multiply the following numbers without converting them to decimal. (a) Binary numbers 1011 and 101. (b) Hexadecimal numbers 2E and 34.
Sol 1	**(a)** 10000 and 110111 $\begin{array}{r} 1011 \\ +101 \\ \hline 10000 = 16_{10} \end{array}$ $\qquad$ $\begin{array}{r} 1011 \\ \times 101 \\ \hline 1011 \\ 1011 \\ \hline 110111 = 55_{10} \end{array}$ **(b)** 62_h and 958_h $\begin{array}{rr} 2E_h & 0010\_1110 \\ +34_h & 0011\_0100 \\ \hline 62_h & 0110\_0010 = 98_{10} \end{array}$ $\qquad$ $\begin{array}{r} 2E_h \\ \times 34_h \\ \hline B^3 8 \\ 8^2 A \\ \hline 9\ 5\ 8_h = 2392_{10} \end{array}$

Q2	Obtain the 1's and 2's complements of the following binary numbers: (a) 10000000 (c) 11011010 (e) 10000101 Obtain the 1's and 2's complements of the following binary numbers: (b) 00000000 (d) 01110110 (f) 11111111.
Sol 2	**(a)** 1000_0000 1s comp: 0111_1111 2s comp: 1000_0000

	(c) 1101_1010 1s comp: 0010_0101 2s comp: 0010_0110 **(e)** 1000_0101 1s comp: 0111_1010 2s comp: 0111_1011 **(b)** 0000_0000 1s comp: 1111_1111 2s comp: 0000_0000 **(d)** 0111_0110 1s comp: 1000_1001 2s comp: 1000_1010 **(f)** 1111_1111 1s comp: 0000_0000 2s comp: 0000_0001

Q3	Find the 9's and the 10's complement of the following decimal numbers: (c) 25,000,000 (d) 00,000,000. Find the 9's and the 10's complement of the following decimal numbers: (a) 52,784,630 (b) 63,325,600
Sol 3	**(c)** 25,000,000 9s comp: 74,999,999 10s comp: 75,000,000 **(d)** 00,000,000 9s comp: 99,999,999 10s comp: 00,000,000

	(a) 52,784,630 9s comp: 47,215,369 10s comp: 47,215,370 **(b)** 63,325,600 9s comp: 36,674,399 10s comp: 36,674,400

Q4	Perform subtraction on the given unsigned numbers using the 10's complement of the subtrahend. Where the result should be negative, find its 10's complement and affix a minus sign. Verify your answers. (c) 2,043 − 6,152 (d) 1,631 − 745 Perform subtraction on the given unsigned numbers using the 10's complement of the subtrahend. Where the result should be negative, find its 10's complement and affix a minus sign. Verify your answers. (a) 6,428 − 3,409 (b) 125 − 1,800
Sol 4	**(c)** 6152 → 06152 → 93847 (9s comp) → 93848 (10s comp) 2043 – 6152 = 02043 + 93848 = 95891 (Negative) Magnitude: 4109 Result: 2043 – 6152 = -4109 (d) 745 → 00745 → 99254 (9s comp) → 99255 (10s comp) 1631 -745 = 01631 + 99255 = 0886 (Positive) Result: 1631 – 745 = 886 **(a)** 3409 → 03409 →96590 (9s comp) → 96591 (10s comp) **0**6428 – 03409 = 06428 + 96591 = 03019 **(b)** 1800 → 01800 → 98199 (9s comp) → 98200 (10 comp) 125 – 1800 = 00125 + 98200 = 98325 (negative) Magnitude: 1675 Result: 125 – 1800 = 1675

Q5

Perform subtraction on the given unsigned binary numbers using the 2's complement of the subtrahend. Where the result should be negative, find its 2's complement and affix a minus sign.

(c) 1001 − 101000 (d) 110000 − 10101

Perform subtraction on the given unsigned binary numbers using the 2's complement of the subtrahend. Where the result should be negative, find its 2's complement and affix a minus sign.

(a) 10011 − 10001 (b) 100010 − 100011

Sol 5

(c)

	101000	
1s comp:	1010111	
2s comp:	1011000	
	001001	
Diff:	1100001	(negative)
	0011111	(2s comp)
	-011111	(diff is -31)

(d)

	10101	
1s comp:	1101010	with sign extension
2s comp:	1101011	
	110000	
	0011011	sign bit indicates that the result is positive

Check: 48 -21 = 27

(a)

	10001	
1s comp:	01110	
2s comp:	01111	
	10011	
Diff:	00010	

(b)

	100011	
1s comp:	1011100	with sign extension
2s comp:	1011101	
	0100010	
	1111111	sign bit indicates that the result is negative
	0000001	2s complement
	-000001	result

Q6

Add the following numbers in binary using 2's complement to represent negative numbers. Use a word length of 6 bits (including sign) and indicate if an overflow occurs.

(d) (−12) + 13 (e) (−11) + (−21) (c) (−25) + 18

Repeat (a), (c), (d), and (e) using 1's complement to represent negative numbers.

Sol 6

(c)
$$\begin{array}{r} 100111 \\ +\ 010010 \\ \hline 111001 \end{array}$$

(d)
$$\begin{array}{r} 110100 \\ +\ 001101 \\ \hline (1)\ 000001 \end{array}$$

(e)
$$\begin{array}{r} 110101 \\ +\ 101011 \\ \hline (1)\ 100000 \end{array}$$

(c)
$$\begin{array}{r} 100110 \\ +\ 010010 \\ \hline 111000 \end{array}$$

(d)
$$\begin{array}{r} 110011 \\ +\ 001101 \\ \hline (1)\ 000000 \\ +\ \quad 1 \\ \hline 000001 \end{array}$$

(e)
$$\begin{array}{r} 110100 \\ +\ 101010 \\ \hline (1)\ 011110 \\ +\ \quad 1 \\ \hline 011111 \end{array}$$

OVERFLOW!

Q7	Add, subtract, and multiply in binary: (a) 1111 and 1001
Sol 7	(a) 111 111 1111 (Add) 1111 (Subtract) 1001 1001 11000 0110 1111 (Multiply) 1001 1111 0000 01111 0000 001111 1111 10000111

Q8	Construct a table for 4-3-2-1 weighted code and write 9154 using this code.
Sol 8	

	4 3 2 1
0	0 0 0 0
1	0 0 0 1
2	0 0 1 0
3	0 1 0 0
4	1 0 0 0
5	1 0 0 1
6	1 0 1 0
7	1 1 0 0
8	1 1 0 1
9	1 1 1 0

9154 = 1110 0001 1001 1000

Q9	Is it possible to construct a 5-4-1-1 weighted code? A 6-3-2-1 weighte code? Justify your answers.
Sol 9	5-4-1-1 is not possible, because there is no way to represent 3 or 8. 6-3-2-1 is possible: 6 3 2 1 0 0 0 0 1 0 0 1 2 0 0 1 0 3 0 1 0 0 4 0 1 0 1 5 0 1 1 0 6 1 0 0 0 7 1 0 0 1 8 1 0 1 0 9 1 1 0 0

Q10	Convert to hexadecimal, and then give the ASCII code for the resulting hexadecimal number (including the code for the hexadecimal point): (b) 183.81_{10}
Sol 10	**(b)** 183.81_{10} 16 | 183 — 0.81 16 | 11 r7 — 16 0 r11 — (12).96 16 (15).36 $\therefore 183.81_{10} = B7.CF_{16}$ $= \underline{1000010}\ \underline{0110111}\ \underline{0101110}\ \underline{1000011}\ \underline{1000110}$ B 7 . C F