CS 303 Logic and Digital System Design
HW2

Q1)

a) (10 pt) Do the following conversions. Show your work clearly.

Decimal	Binary	Hexadecimal
546		
128		
27.375		

Decimal	Signed 8-bit binary in 2's complement form
-6.375	

Signed 8-bit binary in 2's complement form	Decimal
00000011.1101	
11111111.1111	
10100110.0111	

b) (10 pt) Calculate the binary equivalent of 127/64. If we use only 4 bits in the fraction, what is the error in the binary representation? How many bits are needed to fully represent 127/64 in signed 2's complement binary number system? Show your work clearly.

Q2)

Assume a 5-bit, 2's complement scheme to represent signed integers.

a) (3 pt) Show the range of integers that can be represented.

b) (12 pt) Do the following arithmetic operations and detect overflows. Show your work clearly.

14 + 9
14 + (-9)
(-5) + (-9)
(-7) + (-10)

Q3)

a) (5 pt) Express the following function as a sum of minterms.

$$F(x,y,z,t) = (x \oplus y)(z+t)$$

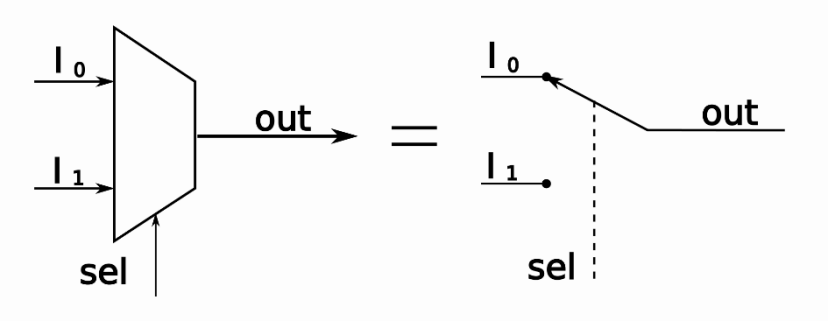
Hint: Example minterm: $m_{12} = xyz't'$ ($12 = 1100_2$ in binary)

b) (10 pt) Optimize F <u>using</u> Karnaugh map.

c) (5 pt) Assume we guarantee that $xyzt_2$ will never be larger than 12. Add necessary don't care conditions and optimize F further using K-map.

Q4) (20 pt)

Multiplexer is a logical unit that selects between several input signals.



For a 2-to-1 multiplexer, if the sel input is 0, out output is equal to I_0. If the sel input is 1, out output is equal to I_1. Design this 2-to-1 multiplexer and draw its circuit.

Q5) (25 pt)

You are asked to design a 2-bit comparator circuit. Operation of this circuit is defined as follows:

Inputs: A=$(A1,A0)_2$ and B=$(B1,B0)_2$, 2-bit signed numbers in 2's complement form
Outputs: EQ, G, L

if (A==B)
EQ=1
else
EQ=0
	if (A<B)
	L=1
	else
	L=0
		if (A>B)
		G=1
		else
		G=0

Design circuit for this comparator, however you would like to design it and draw its circuit. You can use deductions as we used in class. For example, if you have a circuit for EQ output, and a circuit for L output, you can use those two outputs to derive G output. Show your work clearly.