

## Solutions to Assign 1 questions 4 and 8

NOTE: handwritten numbers are incorrect.

Question 4.

a)  $10000111 - 1011001$  ( $135 - 89 = 46$ )

0101 1001 2's complement -> 1010 0111

$$\begin{array}{r} 1000\ 0111 \\ + 1010\ 0111 \\ \hline 1\ 0010\ 1110 \end{array} \text{ (46) - note carry out so value is positive}$$

b)  $1011001 - 10000111$  ( $89 - 135 = -46$ )

10000111 2's complement -> 01111001

$$\begin{array}{r} 0101\ 1001 \\ + 0111\ 1001 \\ \hline 11010010 \end{array} \text{ - note no carry out so value is negative and in 2's complement}$$

11010010 2's complement -> -00101110 (-46)

c)  $0.1001 - 0.0101$  ( $0.5625 - 0.3125 = 0.25$ )

0.0101 2's complement -> 1.1011

$$\begin{array}{r} 0.1001 \\ + 1.1011 \\ \hline 10.0100 \end{array} \text{ (0.25)- carry out so value is positive}$$

d)  $.0101 - 0.1001$  ( $0.3125 - 0.5625 = -0.25$ )

0.1001 2's complement -> 1.0111

$$\begin{array}{r} 0.0101 \\ + 1.0111 \\ \hline 0\ 1.1100 \end{array} \text{ - no carry out so value is negative}$$

1.1100 2s complement -> -0.0100 (-0.25)

Question 8. 3 input NAND gate  $F = (ABC)'$  ; cascade of two NAND gates  $G = ((AB)'C)'$   
 $F = (ABC)' = A' + B' + C'$  (deMorgans)  
 $G = ((AB)'C)' = ((A' + B')C)' = (A'C + B'C)' = (A'C)'(B'C)' = (A + C')(B + C')$   
 $= AB + AC' + BC' + C' = AB + AC' + C' = AB + C' \neq F$

using deMorgan's, distribution and identity above

Truth table just to confirm

A	B	C	$(ABC)'$	$(AB)'$	$((AB)'C)'$
0	0	0	1	1	1
0	0	1	1	1	0
0	1	0	1	1	1
0	1	1	1	1	0
1	0	0	1	1	1
1	0	1	1	1	0
1	1	0	1	0	1
1	1	1	0	0	1