DIGITAL CIRCUITS

HOMEWORK 1 SOLUTION

1. a) 0111 1100(124)
   ✚ 1101 0101(213) ⟸ unsigned
   10101 0001(337)
   ↑
   Carry

   0111 1100(124)
   ✚ 1101 0101(-43) ⟸ signed
   10101 0001(81)
   ↑
   Carry, ignore, no overflow

   b) 1100 0110
   ➖ 0000 1101 —2's complement→ 1100 0110(198)
   ✚ 1111 0011(-13) ⟸ unsigned
   11011 1001(185)
   ↑
   Carry, no borrow

   1100 0110
   ➖ 1111 1101 —2's complement→ 1100 0110(-58)
   ✚ 0000 0011(-3) ⟸ signed
   1100 1001(-55)
   No overflow

2. **a)** a'b'd'+ab'd'+abc'+abcd' (distributive)
   b'd'(a'+a)+abc'+abcd' (inverse, distributive)
   b'd'+ab(c'+cd'+**d'**)(consensus)
   b'd'+ab(c'+ (cd'+d'))(absorption)
   b'd'+abc'+abd' +**ad'**(consensus)
   b'd'+abc'+ad'(b+1)(distributive,dominance)
   b'd'+abc'+ad'

   b) a'b'c+ec'+a'b'e+a'c+a'e'+a'bcd+cd+ed +**a'cd** (consensus)
   a'b'c+ec'+a'b'e+a'c+a'e'+a'cd(1+b)+cd+ed (distributive,dominance)
   a'b'c+ec'+a'b'e+a'c+a'e'+a'cd+cd+ed+**a'e** (consensus)
   a'b'c+ec'+a'e(1+b)+a'c+a'e'+a'cd+cd+ed (distributive,dominance)
   a'c(b'+1+d)+ec'+a'e+a'e'+cd+ed (distributive,dominance)
   a'(c+e+e')+ec'+cd+ed
   a'+ec'+cd+ed (consensus)
   a'+ec'+cd