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COMP 3350 – Project 1

1. A.) 0110 0001 1111
   - First step is to convert to decimal
   - 0x2^11+1x2^10+1*2^9+…….+1x2^0
   - Decimal representation is 1567
   - Now we convert to hexadecimal
   - 61F

   B.) 1000 1111 1100
   - First step is always to convert to decimal using the same method as A
   - Decimal representation is 2300
   - Convert to hexadecimal
   - 8FC

   C.) 0001 0110 0100 0101
   - Convert to decimal
   - Decimal representation is 5701
   - Convert to hexadecimal
   - 1645

2. A.) 1100 1010
   - Signed: -54 (Same steps as question 1 but leading digit is sign)
   - 1s complement: -53 (always 1 more than decimal)
   - 2s complement: -54 (2s is same)

   B.) 1111 0010
   - Signed: -14 (Same steps as question 1 but leading digit is sign)
   - 1s complement: -13 (always 1 more than decimal
   - 2s complement: -14 (2s is same)

   C.) 1000 0111
   - Signed: -121 (Same steps as question 1 but leading digit is sign)
   - 1s complement: -120 (always 1 more than decimal)
   - 2s complement: -121 (2s is same)

3. A.) $-100_{(10)}$
   - Take -100 and divide by two keeping the remainder
   - Assuming signed 8 bit: 1001 1100
   - 1s complement: 0110 0011 (invert digits)
   - 2s complement: 0110 00100 (add 1 to end of 1s complement)

   B.) $-16_{(10)}$
   - Take -16 and divide by two, keeping the remainder

- Assuming signed 8 bit: 1111 0000
- 1s complement: 0000 1111
- 2s complement: 0001 0000

C.) $-21_{(10)}$

- Take -21 and divide by two, keeping the remainder
- Assuming signed 8 bit: 1110 1011
- 1s complement: 0001 0100
- 2s complement: 0001 0101

D.) $-0_{(10)}$

- 0000 0000
- 1s complement: 1111 1111
- 2s complement: 0001 0000 0000

4. A.) Range of an unsigned 7-bit number?
   - Range is typically 0 to (2^n-1), so it is 0 to (2^7-1)
   - 0 to 127

   B.) Range of a signed 7-bit number?
   - Range with signed is (2^{n-1}-1) to (2^{n-1}-1); signed on both
   - (2^6-1) to (2^6-1); -63 to 63

5. A.) 1000 AND 1110
   - Check each bit (if both are 1, then the result is 1)
   - 1000

   B.) 1000 OR 1110
   - Check each bit (if either is 1, then result is 1)
   - 1110

   C.) (1000 AND 1110) OR (1001 AND 1110)
   - AND operations first – (1000) OR (1000)
   - OR operation second: 1000

6. 25 – 65 = -40
   a. Not sure how to show work on word, but I will describe in words as best as I can
   b. Take the 1s place and subtract (5 – 5) = 0; We are left with 20 – 60 (since this operation would be invalid for positive math, we will need to go into the negative)
   c. Flip the equation and do 60 – 20 and add the sign back; -40
7. Verify the answer from Q6 using conversion of 2s and decimal numbers
   a. 25 in binary is 0001 1001
   b. -64 in 2s complement is 1011 1111
   c. Subtraction in 2s complement would follow the same steps, but carry from larger bit and add
   d. 0001 1001 + 1011 1111 = 1101 1000
   e. 1101 1000 converted to decimal is -40