Note Title 1/30/2009

Quiz 4 correction including detailed work.

1.

$2\,\underline{|100}$

$2\,\underline{|50}$ rem $0 = a_0$

$2\,\underline{|25}$ rem $0 = a_1$

$2\,\underline{|12}$ rem $1 = a_2$

$2\,\underline{|6}$ rem $0 = a_3$

$2\,\underline{|3}$ rem $0 = a_4$

$2\,\underline{|1}$ rem $1 = a_5$

0 rem $1 = a_6$

$(96+4)_{10} = (6\ \ 4)_{16}$

So, $100_{10} = 1100100_2$; $a = \underbrace{0110}\,\underbrace{0100}$

Check: $4+32+64=100$ ✓

The 8-bit representation of this positive number is the same in any of the three systems we study (sign-magnitude, 1's complement, 2's complement): $01100100 = a$

2.

$2\,\underline{|30}$

$2\,\underline{|15}$ rem $0 = a_0$

$2\,\underline{|7}$ rem $1 = a_1$

$2\,\underline{|3}$ rem $1 = a_2$

$2\,\underline{|1}$ rem $1 = a_3$

0 rem $1 = a_4$

So, $30_{10} = 11110_2$, $b = 00011110$

Check: $\underbrace{0001}_{1}\,\underbrace{1110}_{E}\,{}_{16} = 16+14=30$ ✓

3. $b^* = 2^8 - b = \underbrace{\left[(2^8 - 1) - b\right]}_{\text{1's complement of } b,\ \bar{b}} + 1 = 11100001 + 1 = 11100010$

$=$ (quick method: complement bits to the left of the rightmost 1) $=$

$= 11100010$

Check: $b^* + b = 2^8_{10}$

$$\begin{array}{r} 11100010\ + \\ 00011110 \\ \hline 100000000_2 = 2^8_{10} \end{array}$$

$100000000_2 \overset{!}{=}$

4. $a - b = a + b^*$ (and check if you can ignore the carry bit; since the addends have different signs, the check will work out)

check result

$$\begin{array}{r} 01100100\ + \\ 11100010 \\ \hline 1\,01000110 \end{array} = 2+4+64 = 70 \checkmark$$

ignore carry bit

Answer: 01000110

5. $a+b$

$$\begin{array}{r} {\scriptstyle 1\,1\,1\,1} \\ 01100100\ + \\ \underline{00011110} \\ 10000010 \end{array}$$

overflow because sign of result is different from common sign of addends.

This was to be expected, because $130 > 127$, the largest (positive) number representable in the 2's complement system of bits.