Written Problems

Problem 1

(1) What is the binary for the decimal numeral 255, using 8 bits?

$255 = 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 2^7 + 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$

   = **1111 1111**

(2) What is the binary for the decimal numeral 127, using 8 bits?

$127 = 64 + 32 + 16 + 8 + 4 + 2 + 1 = 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$

   = **0111 1111**

(3) What is the binary for the decimal numeral 126, using 8 bits?

$127 = 64 + 32 + 16 + 8 + 4 + 2 = 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1$

   = **0111 1110**

(4) What is the most significant bit in the binary numeral 1001 0000?

1

(5) What is the least significant bit in the binary numeral 1001 0000?

0

(6) What decimal numeral is represented by the binary numeral 1001 0000?

$1001\ 0000 = 2^7 + 2^4 = 128 + 16 =$ **144**

Problem 2: Consider 01101000 01101001 00100001 01100001 01101100 01101100 11110100 00100001.

(1) Suppose each byte above is the ISO-88591 encoding of a character. What do the characters spell out?

0110 1000 = 64 + 32 + 8 = 104 --> h

0110 1001 = 64 + 32 + 8 + 1 = 105 --> i

0010 0001 = 32 + 1 = 33 --> !

0110 0001 = 64 + 32 + 1 = 97 --> a

0110 1100 = 64 + 32 + 8 + 4 = 108 --> l

0110 1100 = 64 + 32 + 8 + 4 = 108 --> l

1111 0100 = 128 + 64 + 32 + 16 + 4 = 244 --> ô

0010 0001 = 32 + 1 = 33 --> !

hi!allô!

(2) Suppose the seventh byte is the 8-bit signed base-2 representation of the integer x. What is the signed base-10 representation of x? Now suppose the seventh byte is the 8-bit unsigned base-2 representation of x? What is the signed base-10 representation of x?

1111 0100 = -(64 + 32 + 16 + 4) = **-116**

1111 0100 = 128 + 64 + 32 + 16 + 4 = **244**

(3) Suppose the seventh byte is the 8-bit twos-complement representation of the integer x. What is the signed base-10 representation of x? Explain your calculation.

decrement: 1111 0100 - 1 = 1111 0011

complement: 1111 0011 --> 0000 1100

positive decimal value: 0000 1100 = 8 + 4 = 12

-12

check: 256 – 12 = 244 = 1111 0100