1. (10 pts) Unicode is a standard for encoding text characters used in most of the world’s writing systems. There are 109,976 (printable) characters in Unicode (version 6.2).

(a) How many different strings of length 4 can be written using the characters in Unicode?
   Answer: There are $109,976^4$ Unicode strings of length 4.

(b) If you need to name $n$ things using fixed length strings written in Unicode, how long would the strings need to be?
   Answer: The strings would need to be $\lceil \log_{109,976} n \rceil$ characters long.

2. (5 pts) Write 43 as an unsigned binary number.
   Answer:

   \[
   \begin{array}{cccccc}
   \text{REPEATED REMAINDERING MOD } T \\
   \text{QUOTIENTS} & 43 & 21 & 10 & 5 & 2 & 1 \\
   \text{REMAINDERS} & 1 & 1 & 0 & 1 & 0 & 1 \\
   \end{array}
   \]

   Therefore $(43)_{10} = (101011)_2$.

3. (5 pts) Write $+43$ as a signed binary number in two’s complement notation.
   Answer: Since $(43)_{10} = (101011)_2$ as an unsigned binary, $(43)_{10} = (0101011)_{2c}$ as a two’s complement number.

4. (5 pts) Write $-43$ as a signed binary number in two’s complement notation.
   Answer: Since $(+43)_{10} = (0101011)_2$ as a two’s complement number, $(-43)_{10} = (1010101)_{2c}$.

5. (5 pts) Write $-43$ as a decimal number in biased notation with bias $b = 64$.
   Answer: $(-43)_{10} = (-43 + 64)_{b=64} = (21)_{b=64}$.

6. (5 pts) Use Horner’s rule to convert the unsigned binary $(1100 1000)_2$ to decimal notation.
   Answer:

   \[
   \begin{array}{ccccccc}
   \text{Horner’s Rule} \\
   1 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
   0 & 2 & 6 & 12 & 24 & 50 & 100 & 200 \\
   1 & 3 & 6 & 12 & 25 & 50 & 100 & 200 \\
   \end{array}
   \]

   Therefore $(1100 1000)_2 = (200)_{10}$.

Total Points: 35

Monday, November 19, 2012