CSEE-5110: HW quiz 4, Oct 8, 2015

1. (10 points total)
   Let $p = 0.6$ be the fraction of machines in a network that are big endian; the remaining $1 - p$ fraction are little-endian. Suppose we choose two machines at random and send an `int` from one to the other.

   (a) (5 points) Give the average number of byte-order conversions needed for big-endian network byte order.

   $$0 \times 0.6^2 + 1 \times 2(0.6 \times 0.4) + 2 \times 0.4^2 = 0 + 0.48 + 0.32 = 0.8$$

   (b) (5 points) Give the average number of byte-order conversions needed for receiver-makes-right network byte order.

   $$0 \times 0.6^2 + 1 \times 2(0.6 \times 0.4) + 0 \times 0.4^2 = 0 + 0.48 + 0 = 0.48$$

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2. (10 points total)
   Suppose you have the following IPv4 address 31.22.2.11

   (a) (5 points) Give the big-endian binary representation of this address.
   be 0001111 00010110 00000010 00001011

   (b) (5 points) Give the little-endian binary representation of this address.
   le 00001011 00000010 00010110 0001111

3. (10 points total)

(a) (5 points) Assume the letter a occurs 50% of the time, b occurs 30% of the time , and c and d each occurs 10% of the time. Give an encoding of each letter as a bit string that provides optimal compression. (Hint: construct a Huffman code)

$a = 1$, $b = 01$, $c = 001$, $d = 000$
or $a = 0$, $b = 10$, $c = 110$, $d = 111$
or $a = 1$, $b = 00$, $c = 011$, $d = 010$
or $a = 0$, $b = 11$, $c = 100$, $d = 101$
Depending on how you connect the tree and how the leaves are labeled, the code may be different. However, if constructed correctly, the code will be a prefix code and the mean length of the code will always be the same in each case.

(b) (5 points) What is the percentage of compression you achieve above?

0.5*1 + 0.3*2 + 0.1*3 + 0.1*3 = 1.7
(1 - (1.7/2))*100 = 15%

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4. (10 points total)

(a) (5 points) Suppose you want to implement fast-forward and reverse for MPEG streams.What problems do you run into if you limit your mechanism to displaying I frames only?

You are limited to arrival rate of the I frames

(b) (5 points) Which combination of MPEG frames is best for interactive videoconferencing:

A. IBBBBPBBBBI . . . or **B.** IPPPPIPPPI . . .

Answer is B.