

## EECS 122: Introduction to Communication Networks Homework 11 Solutions

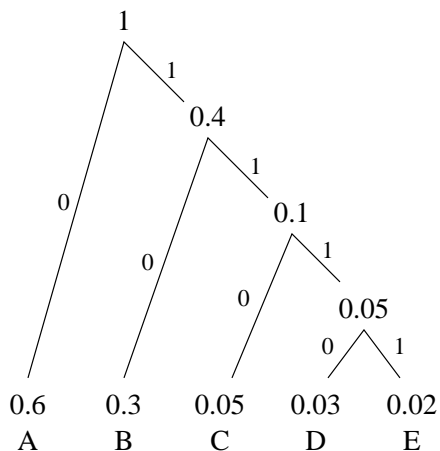
### Solution 1.

a) The entropy is

$$-0.6 \log_2 0.6 - 0.3 \log_2 0.3 - 0.05 \log_2 0.05 - 0.03 \log_2 0.03 - 0.02 \log_2 0.02 \doteq 1.444$$

A typical 1000-symbol message, at 1.444 bits per symbol, would require 1444 bits.

b) The tree must have this structure, though the “0” and “1” labels can be swapped for any pair of sibling edges:



$A = 0, B = 10, C = 110, D = 1110, E = 1111.$

c) Average bits per symbol for our Huffman code is

$$0.6 \cdot 1 + 0.3 \cdot 2 + 0.05 \cdot 3 + 0.03 \cdot 4 + 0.02 \cdot 4 = 1.55$$

A fixed-length binary code would use 3 bits per symbol, so our compression factor is  $3/1.55 \doteq 1.94.$

**Solution 2.** Packet  $P1$  is arriving along the shortest path from the source, so it will be forwarded onto all links other than the one on which it arrived (links 2, 3, and 4). But packet  $P2$  is not arriving along the shortest path from the source, so it does not get forwarded onto any links.