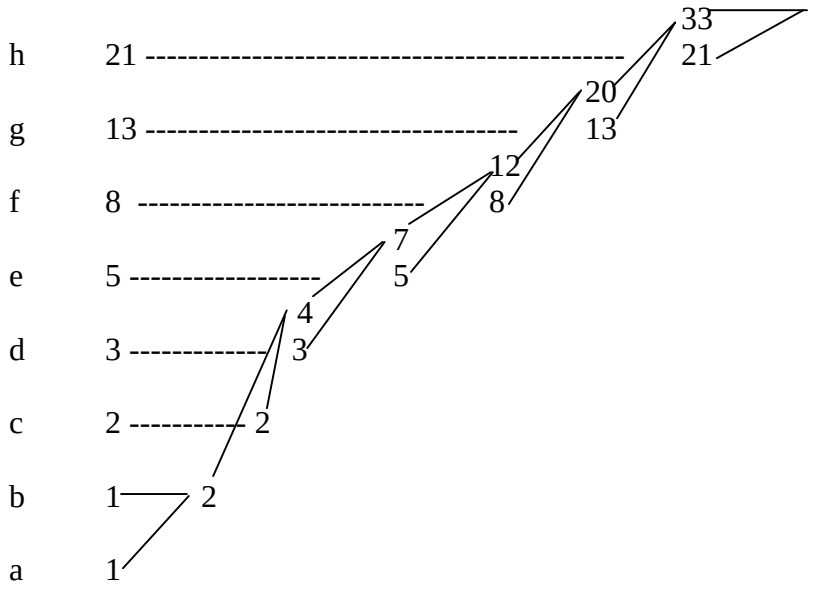
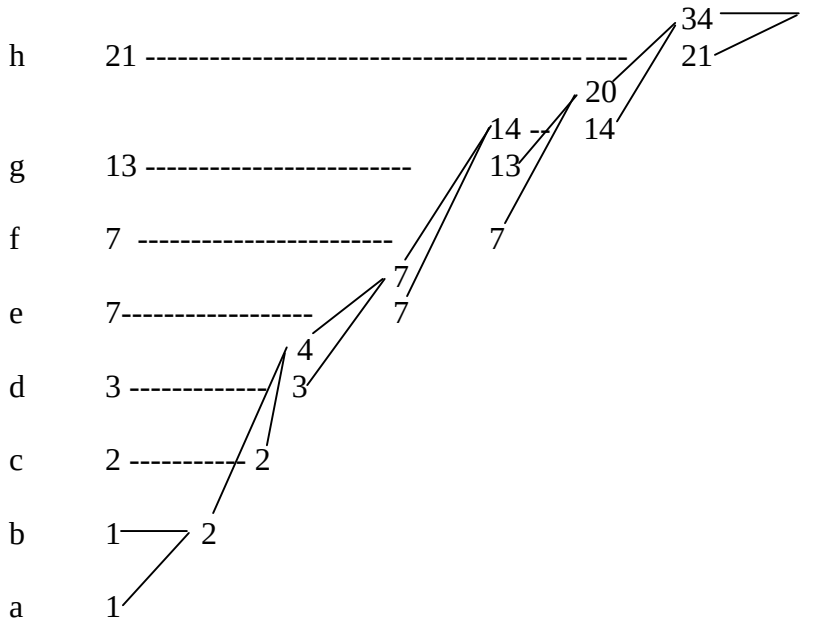
2.993: Principles of Internet Computing
Homework #8 Solutions

1. *Huffman Code* What is the optimal Huffman code for the following set of frequencies:

a) a: 1 b: 1 c:2 d:3 e: 5 f:8 g:13 h:21



b) a: 1 b: 1 c:2 d:3 e: 7 f:7 g:13 h:21



c) In each case, is your code unique? Explain.

Yes, they are unique in each case. What we mean by "unique" is that the code lengths of all codewords are unique: [1 2 3 4 5 6 7 7] and [1 3 3 3 4 5 6 6] . This, however, is not true in general. Consider the following case: a:2, b:2, c:1, d:1. Convince yourself that there is more than one unique Huffman code.

2. *Prefix Code* Suppose you are given a set of possible codeword lengths for characters a_1, a_2, ..., a_5: $l_1 = 2$, $1_2 = 4$, $1_3 = 6$, $1_4 = 7$, $1_5 = 9$. Is there a (binary) prefix code with such codeword lengths? If so, give one. If not, explain why it is not possible.

a1: 00
a2: 0100
a3: 010100
a4: 0101010
a5: 010101100

Of course, there are many other valid code patterns.