Homework 9

CMPSC 465

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Problem 1:

I worked with Sahil Kuwadia and Ethan Yeung
I did not consult without anyone my group member
I did not consult any non-class materials

Problem 2: *Suppose we have an optimal prefix code on a set* $C = \{0, 1, ..., n-1\}$ *of characters and we wish to transmit this code using as few bits as possible. Show how to represent any optimal prefix code on* C *using only* $2n - 1 + n\lceil \log n \rceil$ *bits.*

Since there are n characters, there are n leaves in the tree. Thus, there will be $n-1$ vertices within the graph, so the entire graph will contain $2n-1$ total vertices, thus $2n-1$ bits. The height of a full binary tree for n characters is $\lceil \log n \rceil$.

We can say that to associate the members of C with the leaves of the tree, $\lceil \log n \rceil$ bits will be enough to represent all members. We know that no delimiters are required if each character is represented by a unique prefix. So, with n leaves, it requires $n\lceil \log n \rceil$ bits to represent all characters.

Thus, we can say that the total number of bits required to represent the optimal prefix code is $2n - 1 + n\lceil \log n \rceil$.

Problem 3: *Generalize Huffman's algorithm to ternary codewords (i.e., codewords using the symbols 0, 1, and 2), and prove that it yields optimal ternary codes.*

Problem 4: