PROBLEM SET 09

YOUR NAME

(1) Using Huffman's algorithm, how many bits would it take to encode the string:

`AN_ANT_NEST_TENANT_SET_TEN_ANTENNA_TENTS`

(Not including the number of bits to encode the encoding tree itself.) Note that "_" is also a character.

(2) Write a logical expression that's equivalent to the following but uses only $\bar{\wedge}$s (NAND).

(a) $\sim A$ **Answer:** $\sim A = A \bar{\wedge} A$

(b) $A \wedge B$

(c) $A \vee B$

(3) A universal Boolean operator is one (such as NAND) that can be used to define any other Boolean operator. Prove or disprove the following (you can assume that NAND is universal, since we just showed that you can use it to make AND, OR, and NOT):

(a) NOR ($\bar{\vee}$) is universal (hint, the computer that was used to guide the Apollo space mission was built using only NOR gates).

(b) (BONUS) XOR is universal.

(4) (This is exercise 11.14) A palindrome is a string that reads the same backward as it does forward. Find a context-free grammar that generates the set of all palindromes over the alphabet $\{A, D\}$.

(5) On a scale from 0 to 1, what do you think your attendance/participation grade ought to be? Please briefly justify your answer.