Due: Monday October 20, beginning of tutorial.

This assignment is worth 10% of final grade

1. Here are the total scores from the vote on the list of possible course topics (in alphabetical order).

   - Artificial Intelligence (AI) 31
   - Computing as a Commodity (COMMODITY) 29
   - Cryptography (CRYPT) 15
   - Fortran (and programming languages) (FORTRAN) 6
   - Human Computer Interaction (HCI) 16
   - Linear Programming (LP) 17
   - Model Checking (MC) 3
   - Relational Data Bases (RDB) 22
   - Search Engines (SEARCH) 44
   - Social Networks (SN) 49
   - TCP/IP (TCP) 8
   - Turing machines (TM) 10

   (a) Draw a "balanced" binary search tree T for this list of topics using the abbreviated topic name as the key. By balanced we want the depth of any node in the tree T to be k or $k+1$ for some positive integer k.

   (b) Convert each total vote into a probability p_i of being accessed. That is, let v_i be the total vote for topic i and let $V = \sum_i v_i$. Then the probability of accessing the i^{th} topic is $p_i = \frac{v_i}{V}$. Compute the expected search time of an access to a topic for your binary search tree T. The expected length of a search (when we are assuming all searches are successful) is $\sum_i[(d_i+1)\cdot p_i]$ where d_i is the depth of the node representing the i^{th} keyword.

   (c) Can you construct another binary search tree T' (perhaps not balanced) that has a smaller expected search time?

2. Design a Turing machine that will decide membership in the following set of strings: Let $\Sigma = \{a, b\}$ and then define $bE2a = \{w \in \Sigma^* | w = a^n b^{2n}$ for some integer $n \geq 0\}$. Desribe your Turing machine by the kind of state diagram provided for the example of palindromes.