CS174 Sp2001 **Homework 7** **due: Mar 15, 2001**

This homework is due by 5pm on Thursday March 15th. Please hand it to the CS174 homework box on the second floor of Soda Hall.

1. Here is a different definition of a data-punctuated token tree. Let level 0 be the leaves of the tree, level 1 be their parents etc. Nodes are partitioned as follows: Assume every leaf is assigned a zero or one by a pseudo-random parity function. All tree nodes are defined non-recursively from the binary parity data at the leaves. i.e. there are no parity values at internal nodes.

   At level k, draw boundaries at every transition from a sequence of exactly k zeros to a one. The nodes at level k represent the fingerprint of all leaves in between two boundaries at level k.

   (a) What is the minimum degree of an internal node in this tree?

   (b) Show that the expected number of transitions at level k in a sequence of n characters is $n/2^{(k+1)}$.

   (c) What is the expected number of nodes in an entire tree on n nodes?

   (d) Suppose one leaf node is changed or deleted. How many ancestor nodes at each level might change? Give an upper bound.

   (e) Now suppose that a contiguous sequence of m nodes is inserted in a tree with n nodes. How many nodes of the DPTT will change?