CS 1511 Homework 14

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Tues, Mar 5

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27 Lemma 7.12 says that A coin with Pr[Heads] = can be simulated by a PTM in expected time O(1) provided the ith bit of is computable in poly(i) time.

We can construct this p such that a random coin that comes up with this probability will make a Turing Machine able to decide a language in undecidable time.

Assume that this is possible to make a PTM that simulates a coin flip with probability p. The ith bit of p can be computed in constant time.

The p is comprised of 1s and 0s. The turing machine in question (say TM T) generates a random "x". This x is a random variable. Then we compare x to that probability p. We do this by comparing bit by bit. If p is 0.0101010 and x is 0.0101011, we know that x has a greater probability than p.

We make each bit of this p represent whether a Turing Machine will halt on a particular language. So, order every Turing Machine and input w like (M,w) and correspond it with a integer. The ith integer in p will be a 1 if M halts on w and 0 if not.

Then, the Turing Machine T could solve the halting problem. To figure out if M halts on w, it would first correspond that M,w pair to an integer. Call this integer i. The ith digit of p would tell us what the answer to this question is. So we flip We flip a coin i times. We count the distribution of heads and tails. We can say with p confidence whether or not M halts w.

28 First we show NP $\in$ PP. Then we show coNP $\in$ PP.