

Date Assigned: 22 September 2004.

Date Due: 29 September 2004. There is no class on 29th September due to the annual conference at Allerton. This is the premier conference in the field; you can get to meet and hear the top researchers just 40 miles from campus. Further, there are shared rides from the campus to Allerton and back. Please turn in the solutions to the TA Zhijun Zhao's mailbox in Everitt Lab by 5 pm.

Suggested Reading: Chapter 5 of the text, the LZ coding scheme from Section 12.10 and the Lempel-Ziv scheme with the sliding window from the reading material posted on the course website.

1. Problems 5.15, 5,16, 5.22, 5.24 and 5.26 of the text book.
2. Consider the following sequence of symbols of length 35 from the alphabet $\{a, b, c, d\}$:

abcdabacccccdddccabaabbbbaacdbcac

- (a) Encode the sequence using the LZ algorithm described in Section 12.10 of your text. Just give the final dictionary and the index of the entry from the dictionary that is transmitted at each stage.
 - (b) Assuming a fixed window size of 5, encode the sequence using the LZ sliding-window algorithm. Just indicate the evolution of the window stage by stage.
3. Suppose you want to test a coin for its bias $p \in (0, 1)$, i.e., the coin has probability p of falling heads and $1 - p$ for falling tails. You are given the results of a sequence of independent tosses from the same coin (so you are seeing a sequence of i.i.d. random variables). Can you devise a test to figure out the bias p based on the results of the sequence of independent tosses? *Bonus:* Can you figure out the accuracy to which you can estimate p from a sequence of n tosses, for large n ? *Commentary:* There are several different ways to solve this problem. Generating "good" random numbers is a very interesting area, both theoretically and practically (think how much care casinos must take to ensure that their slot machines are actually biased in their favor). Interested students might want to check out www.random.org.