Test 4 Topics
MCS115 - Fall 2004

Section 7.1:

- You should be familiar with the Let's Make a Deal scenario.
- You should be familiar with the Reunion Scenario ("I have two children ...."). What are the odds of having two boys in each case? You should understand how tossing two pennies, ignoring two tails, and counting two heads relates to the Reunion Scenario.
- You should understand the Birthday Question. How many people do you need in order to have the probability of having two people with the same birthday greater than 50%?

Section 7.2:

- You should know that $P(E) = \frac{N}{T}$, i.e the probability of an event occurring is equal to the number of different outcomes giving E divided by the total number of equally likely outcomes. You should know that the set of equally likely outcomes is called the sample space and that an event is a subset of the sample space.
- You should be able to compute probabilities in the context of rolling dice, flipping coins, dealing cards etc. In other words, in any situation where it is reasonable that you can count equally likely outcomes, you should be able to compute probabilities.
- You should know what relative frequency is and how it relates to probability (via Law of Large Numbers).
- You should understand the Law of Large Numbers.
- You should know that if the probability of an event happening is P, then $0 \leq P \leq 1$. The probability that the event does not happen is $1 - P$.
- You should understand the solution to the birthday problem. Given n people, you should be able to compute the probability that no two of them have the same birthday and the probability that at least two of them have the same birthday. You should be able to generalize your understanding of the birthday problem to other scenarios.
- You should know how to compute "conditional probabilities." For example, if you toss a penny, a nickel and dime, and there is at least one head, what is the probability that all three are heads. See also 7.2 I 10, II 5.

Section 7.3:

- You should understand the difference between a single event being rare and the likelihood that some rare event will occur sometime. You should understand that outcomes with a low probability are almost certain to occur if the experiment is repeated often enough.
- You should understand the Infinite Monkey Theorem. You should understand that within the purely random we will occasionally see familiar patterns.
- You should understand Buffon's Needle experiment, the probability of a needle crossing a line, and how to estimate π using this experiment.
- You should understand what a random walk is. You should know that in a one-dimensional random walk, the probability of visiting any one spot is 1.

Section 7.6:

- You should know how to use the one coin method and the two coin method for asking embarrassing questions. Given the results of a one coin or two coin method survey, you should be able to estimate how many people would actually answer an embarrassing question yes if they were telling the truth.
- You should know how to compute the mean, median and mode for a collection of data. You should know have to determine what effect additional data points will have on the mean, median and mode. You should know, in general, what causes the mean to be higher than median and what causes the median to be higher than the mean.
- You should know that a randomly selected sample will have statistics, e.g. mean, that are close to the true parameters for the population. You should understand what sample bias is and a few examples of causes of sample and survey bias.

Section 7.7:

- You should understand the HIV/AIDs testing example and be able to compute various probabilities given different assumptions about infection rates and accuracies of tests.
- You should be able to generalize your understanding of the HIV/AIDs test to other testing scenarios, e.g. blondes, scholarships, taxis, and be able to compute probabilities given assumptions about test accuracy and fraction of the population with the characteristic of interest.