Math 186, Winter 2016, Prof. Tesler
Homework #1, Due Thursday January 14, 2016

Larsen & Marx Fifth Edition:
2.2# 2, 3, 4, 6, 12, 26, 28, 31, 32
2.3# 1, 5, 6, 10, 18
2.4# 1, 9, 22, 29, 34, 45
2.5# 1, 19
and the problems below: H-1 and H-2.

Notes:
• In problems such as 2.3.18, 2.4.9, and others, the problem describes a scenario in words, which you convert into event notation. You should not simply start out by saying “P(A) = ⋯, P(B) = ⋯” or “N(S) = ⋯”; you first need to define what each event A, B, S, ⋯ means in that instance.
• 2.2.12: Assume a, b, c are real and a ≠ 0.

Problem H-1. DNA sequences can be specified as strings in the alphabet of nucleotides, A, C, G, T; for example, AACGTC is a DNA sequence of length 6. (DNA is double-stranded; note that we are only specifying the sequence on one strand.)

(a) What is the number of DNA sequences of length 12?

(b) What is the number of DNA sequences of length 12 that contain at least one C? (This restriction only refers to the one strand, not to the complementary strand.)

(c) What is the number of DNA sequences of length 12 that contain at least one C but do not contain any G’s? (This restriction only refers to the one strand, not to the complementary strand.)

Problem H-2. Staphylococcus aureus (the bacteria that causes staph infections) has been sequenced and is available at


The sequence consists of 960324 A’s, 470753 C’s, 470308 G’s, and 971530 T’s, in a particular order.

(a) Mathematically define the sample space consisting of all positions in this sequence.

(b) What are the empirical probabilities of each nucleotide?

(c) What is the empirical probability that a nucleotide is a purine (A or G)?

(d) What is the empirical probability that a nucleotide is a pyrimidine (C or T)?

(e) Determine the “GC content” (the percentage of nucleotides that are G or C).