

**Reading:** Barr, §§ 2.6, 2.7

**Exercises:** Write your solutions clearly, remembering that they will be graded for presentation as well as correctness.

**A1.** A bowl contains 100 Scrabble tiles: 36 A's, 30 B's, 24 C's, and 10 D's.

- (a) In the first experiment, we choose a tile at random, make a note of the letter on it, and return it to the bowl. We repeat this process two more times. What is the probability that the tiles we have drawn all show the same letter of the alphabet?
- (b) In the second experiment, we randomly draw three tiles from the bowl without replacement. What is the probability that the three tiles we have drawn all show the same letter of the alphabet?
- (c) Which of the answers in (A1a) and (A1b) is larger? Can you think of a simple explanation why this should be so?
- (d) In the third experiment, we randomly draw three tiles and lay them out on the table in the order in which they were drawn. What is the probability that the three tiles are in alphabetical order?

**A2.** Repeat parts (A1a) through (A1d) of problem A1, assuming now that the bowl contains 25 A's, 25 B's, 25 C's, and 25 D's.

**A3.** A five-card poker hand counts as *two pair* if two of the cards have equal ranks, two of the remaining cards have equal ranks (but not equal to the rank of the first two) and the fifth card has a rank different from the ranks of the other four. Got that?

How many different two-pair poker hands are there? What is the probability of being dealt two pair?

**A4.** A five-card poker hand counts as *three of a kind* if three of the cards have the same rank and the remaining cards have ranks that are different from each other and different from the first.

How many different three-of-a-kind poker hands are there? What is the probability of being dealt three of a kind?

Choose one of the cryptograms on the handout **Cryptograms #8 – Vigenère ciphers**.

- B1.** Calculate the index of coincidence for your cryptogram. You will probably want to use an Excel spreadsheet to do this. Print out your spreadsheet and hand it in. If you entered formulas in any of the Excel cells, write them on the printout.

Also, write a paragraph or so explaining how you carried out the calculation.

- B2.** Use the index of coincidence to estimate the keyword length (using the Friedman test).

- B3.** Now apply the Kasiski test to your cryptogram. Identify all repeated strings of four characters or more and find out how many characters separate the repetitions. Make a list of possible keyword lengths. (If you don't find enough repeated strings of four characters, try throwing in a few three-character strings.)

- B4.** Guess the length of your keyword, and use the techniques from the last problem set to decrypt your cryptogram.