1. **Are the probabilities legitimate?**: In each of the following situations, state whether or not the given assignment of probabilities to individual outcomes is legitimate, that is, satisfies the rules of probability. If not, give specific reasons for your answer.
   a. Choose a college student at random and record class year and enrollment status:
      i. Pr(senior full-time) = 0.44
      ii. Pr(junior part-time) = 0.56
      iii. Pr(sophomore full-time) = 0.46
      iv. Pr(sophomore part-time) = 0.54

   b. Deal a card from a shuffled deck: $\Pr(\clubsuit) = 16/52, \Pr(\diamondsuit) = 12/52, \Pr(\heartsuit) = 12/52, \Pr(\spadesuit) = 12/52$.

   c. Roll a die and record the count of spots on the up-face: $\Pr(\boxdot) = 1/3, \Pr(\boxdot) = 0, \Pr(\boxdot) = 1/6, \Pr(\boxdot) = 1/3, \Pr(\boxdot) = 1/6, \Pr(\boxdot) = 0$.

2. **Loaded dice**: There are many ways to produce crooked dice. To *load* a die so that 6 comes up too often and 1 (which is opposite 6) comes up too seldom, add a bit of lead to the filling of the spot on the 1 face. Because the spot is solid plastic, this works even with transparent dice. If a die is loaded so that 6 comes up with probability 0.21 and the probabilities of the 2,3,4, and 5 faces are not affected, what is the assignment of probabilities to faces?

3. A state lottery's Pick 3 games asks players to choose a three-digit number between 000 and 999. The state chooses the winning three-digit number at random, so that each number has probability 1/1000. You win if the winning number contains the digits in your number, in any order.
   a. Your number is 491. What is your probability of winning?

   b. Your number is 222. What is your probability of winning?

4. **Is this calculation correct?**: Government data show that 6% of the American population are at least 75 years of age and that about 51% are women. Explain why it is wrong to conclude that because $(0.06)(0.51) = 0.0306$ about 3% of the population are women aged 75 or over.

5. **Colored dice**: Here's more evidence that our intuition about chance behavior is not very accurate. A six-sided die has four green and two red faces, all equally probable. Psychologists asked students to say which of these color sequences is most likely to come up at the beginning of a long set of rolls of this die:

   RGRRR RGRRRG GRRRRR

   More than 60% chose the second sequence. What is the correct probability of each sequence?