7. Vermont Hot Lotto Winning the jackpot in the Vermont Hot Lotto game requires that you select five numbers between 1 and 39 and another number between 1 and 19. The first five numbers must match (in any order) the same five numbers that are later drawn, and the sixth number must also match the sixth number that is later drawn.

a. What is the probability that the first five selected numbers match the five numbers that are later drawn?

b. What is the probability that the sixth selected number matches the sixth number that is later drawn?

c. What is the probability of winning the jackpot?

Technology Project

Simulations

Calculating probabilities can often be painfully difficult, but *simulations* provide us with a very practical alternative to calculations based on formal rules. A **simulation** of a procedure is a process that behaves the same way as the procedure so that similar results are produced. Instead of calculating the probability of getting exactly 5 boys in 10 births, you could repeatedly toss 10 coins and count the number of times that 5 heads (or simulated "boys") occur. Better yet, you could do the simulation with a random number generator on a computer or calculator to randomly generate 1s (or simulated "boys") and 0s (or simulated "girls").

Let's consider this probability exercise:

Classic Birthday Problem

Find the probability that among 25 randomly selected people, at least 2 have the same birthday.

For the above classic birthday problem, a simulation begins by representing birthdays by integers from 1 through 365, where 1 represents a birthday of January 1, and 2 represents January 2, and so on. We can simulate 25 birthdays by using a calculator or computer to generate 25 random numbers (with repetition allowed) between 1 and 365. Those numbers can then be sorted, so it becomes easy to examine the list to determine whether any 2 of the simulated birth dates are the same. (After sorting, equal numbers are adjacent.) We can repeat the process as many times as we like, until we are satisfied that we have a good estimate of the probability. There are several ways of obtaining randomly generated numbers from 1 through 365, including the following:

STATDISK: Select **Data**, then select **Uniform Generator.** Enter a sample size of 25, a minimum of 1, and a maximum of 365, and enter 0 for the number of decimal places. The resulting STATDISK display will consist of 25 simulated birthdays. Use copy/paste to copy the data set to the **Sample Editor,** where the values can be sorted. To sort a column of data, click on Data, then select the first menu item of Sort Data. Make selections at the top and click on Sort.

Minitab: Click on **Calc,** select **Random Data,** then select **Integer.** In the dialog box, enter 25 for the number of rows, store the results in column C1, and enter a minimum of 1 and a maximum of 365. To sort the 25 simulated birthdays, click on **Data** and select **Sort** to arrange the data in increasing order.