Chapter 3
Probability

Events, Sample Spaces and Probability

Example 3.7 Using the Combinations Rule – Selecting 5 Movies from 20

Problem: Suppose a movie reviewer for a newspaper reviews 5 movies each month. This month the reviewer has 20 new movies from which to make the selection. How many different samples of 5 movies can be selected from the 20?

A ***combination*** of r objects from a collection of n objects is any unordered arrangement of r of the n objects. In other words, a combination is any subset of r objects from the collection of n objects. Note that order does not matter for combinations. The number of possible combinations of *r* objects from a collection of *n* objects is given by the formula

$$ {}_nC_r = \frac{n!}{r!(n-r)!} \quad . $$

The TI-83/84 Plus will compute combinations for us. It uses the symbol ${}_nC_r$ to represent a combination.

Solution: We need to find ${}_{20}C_5$ on the TI-83/84 Plus.

1. On the home screen, enter the total number of objects, here 20.

2. Press [MATH] and arrow over to the PRB menu. See Figure 3 – 1.

3. Press [3] or arrow down to **3:nCr** and press [ENTER]. The calculator will return to the home screen.

4. Enter the number of objects selected, here 5 and press [ENTER]. Your calculator will compute the answer and your screen will appear as in Figure 3 – 2.

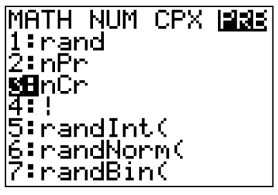

Figure 3 – 1

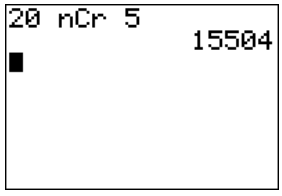

Figure 3 – 2

From Figure 3 – 2 we see there are 15,504 combinations of 5 objects from 20 objects. Thus there 15,504 different samples of 5 movies selected from 20 movies.

Some Additional Counting Rules (Optional)

Example 3.27 Applying the Permutations Rule – Driving Routes

Problem: Suppose you wish to drive, in sequence, from a starting point to each of five cities and you wish to compare the distances – and ultimately, the costs – of the different routes. How many different routes would you have to compare?

A ***permutation*** of r objects from a collection of n objects is any ordered arrangement of r of the n objects. The number of possible permutations of r objects from a collection of *n* objects is given by the formula

$$ {}_n\mathrm{P}_r = \frac{n!}{(n-r)!} $$

The TI-83/84 Plus will compute permutations for us.

Solution: Because order matters, this is a permutation problem. We will need to find ${}_5\mathrm{P}_5$.

1. On the home screen, enter the total number of objects, here 5.

2. Press [MATH] and arrow over to the PRB menu. See Figure 3 – 3.

3. Press [2] or arrow down to **2:nPr** and press [ENTER]. The calculator will return to the home screen.

4. Enter the number of objects selected, here 5 and press [ENTER]. Your calculator will compute the answer and your screen will appear as in Figure 3 – 4.

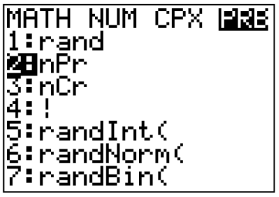

Figure 3 – 3

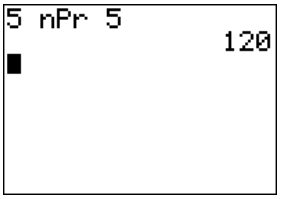

Figure 3 – 4

As seen in Figure 3 – 4 there are 120 permutations of 5 objects taken 5 at a time. Thus, there are 120 different driving routes that would need to be compared.

Example 3.30 Applying the Combinations Rule – Selecting Soldiers for a Mission

Problem: Five soldiers from a squadron of 100 are to be chosen for a dangerous mission. In how many ways can groups of 5 be formed?

Solution: We need to find ${}_{100}C_5$ on the TI-83/84 Plus.

1. On the home screen, enter the total number of objects, here 100.

2. Press [MATH] and arrow over to the PRB menu. See Figure 3 – 5.

3. Press [3] or arrow down to **3:nCr** and press [ENTER]. The calculator will return to the home screen.

4. Enter the number of objects selected, here 5 and press [ENTER]. Your calculator will compute the answer and your screen will appear as in Figure 3 – 6.

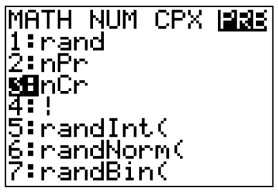

Figure 3 – 5

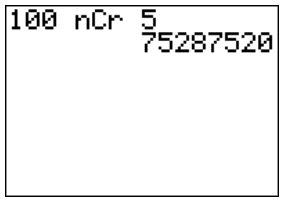

Figure 3 – 6

As seen in Figure 3 – 6 there are 75,287,520 combinations of 5 objects from 100 objects. Thus, there are 75,287,520 ways to select 5 soldiers from a squadron of 100.