

Chapter 5 Probability in our Daily Lives

Using the random binomial function on a TI-83

The TI-83 has the capability of giving different types of random numbers. One of these is the random binomial function. This function is used to simulate an experiment that has a fixed probability of success and repeat it a number of times. For example, suppose we want to simulate flipping 4 coins and count the number of heads. In this case, our number of trials is 4 and the probability of success is 0.5.

```
MATH NUM CPX PRB
1:rand
2:nPr
3:nCr
4:!
5:randInt(
6:randNorm(
7:randBin(
```

To do this on the calculator press **MATH** **▶** **▶** **▶** to go to the probability menu and toggle down to **7:randBin(**.

Press **ENTER** and type in the number of trials and the probability of success. In our coin example, we would type in **4,0.5)** after **randBin(**. On our screen we see that we had 2 heads in the four flips. If you want to repeat this experiment, just hit **ENTER** again as many times as you would like.

```
randBin(4,0.5) 2
```

You can also program your calculator to make repeated simulations of an experiment. Suppose we want to simulate flipping 4 coins 10 times and count the number of heads each time the 4 are flipped. To do this, go to the random binomial function as before, but this time type in **4,0.5,10)** after **randBin**. This will now perform 10 simulations of 4 coins being flipped. On our screen, you can see that the first two times we got 3 out of 4 heads, the next three times we got 2 out of 4 heads, and so on.

```
randBin(4,0.5,10)
)
(3 3 2 2 2 3 4 ...
```

Instead of the number of heads, we may be interested in the proportion of heads. To do this for our coin example, we just need to divide each of our results by 4. We can do this just as before, but divide by 4 before we hit **ENTER**. On our screen, you can see the first simulation had half heads, the second three-quarters heads, and so on.

```
randBin(4,0.5,10)
)/4
(.5 .75 .5 .25 ...
```

Understanding Randomness

According to a December 2003 Gallup poll, 33% of those polled said they often felt stress in their daily lives. Suppose this percentage was exactly true for all American adults.

1. Using your calculator, simulate drawing 10 people, then 50 people, then 250 people to determine what proportion often feel stress in their daily lives. Which proportion is closest of 0.33?
2. Using your calculator, simulate drawing 10 people 10 times to determine 10 proportions for those often feeling stress in their daily lives. Write down your proportions.
3. Using your calculator, simulate drawing 50 people 10 times to determine 10 proportions for those often feeling stress in their daily lives. Write down your proportions.
4. Using your calculator, simulate drawing 250 people 10 times to determine 10 proportions for those often feeling stress in their daily lives. Write down your proportions.
5. Which set of 10 results from questions 2, 3 and 4 had the smallest amount of variability?

General Probability Rules

The following is a list of the rules of probability from chapter 5.

1. $0 \leq P(A) \leq 1$
 2. $P(S) = 1$
 3. $P(A \text{ does not occur}) = 1 - P(A)$
 - Two events are **disjoint** if they have no outcomes in common.
 4. If A and B are disjoint $P(A \text{ or } B) = P(A) + P(B)$
 - Two events are **independent** if knowing that one occurs does not change the probability that the other occurs.
 5. If events A and B are independent then $P(A \text{ and } B) = P(A) \times P(B)$
 6. For any two events $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
 7. For any two events $P(A \text{ and } B) = P(A) \times P(B|A)$.
 This property can also be written as $P(B|A) = \frac{P(A \text{ and } B)}{P(A)}$
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6. What is the probability of getting 3 heads in a row when flipping a coin?
7. What is the probability of guessing correctly on a 10-question true/false test?
8. Lie detectors have a probability of 0.2 of showing that a truthful person is being deceptive. If 10 truthful people are applying for a job and are given a lie detector test, what is the probability that they will all found to be truthful? What is the probability that at least one is found deceptive?
9. What is the probability of rolling 4 dice and getting at least one 6?
10. If there were 5 men and 5 women trying for 2 jobs, and the jobs were chosen at random, what is the probability that both jobs would go to 2 men?

11. We will call a household prosperous if its income exceeds \$100,000 and educated if the householder completed college. Select an American household at random and let M be the event a household is prosperous and let E be the event a household is educated. According to the U.S. Census Bureau, $P(M) = 0.138$, $P(E) = 0.261$, and $P(M \text{ and } E) = 0.082$.
- Draw a Venn diagram that shows the relationship between M and E .
 - What is $P(M \text{ or } E)$?
 - What is the probability that a household is educated but not prosperous?
 - What is the probability that a household is neither educated nor prosperous?
 - Given a household is educated, what is the probability that it is prosperous?
 - Are the events M and E independent?
 - Draw a tree diagram for these events (including probabilities) with education first and then prosperity.