MBF 3C Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

U2 D3 Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Experimental Probability and Simulations**

A few terms from last lesson:

Probability is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ an event will occur.

Experimental probability is found by doing an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the process of conducting a test to determine the probability of an event.

A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is one repetition of an experiment.

|  |
| --- |
| **Experimental Probability**  Determined using the results of an experiment or simulation  Experimental Probability = # of successful trials  total # of trials |

Simulations, or experiments that model an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are used to determine the likelihood, or probability, of an event occurring. We can simulate events using many different tools:

Example 1: A married couple plans to have three children. Use a simulation to estimate the likelihood that the family will have two boys and one girl (in no particular order).

Solution 1: Using a Coin

Since there are only two possible outcomes, using a coin is a great choice for simulating each birth. Let heads represent the birth of a \_\_\_\_\_\_\_\_, and let tails represent the birth of a \_\_\_\_\_\_\_\_.

(You could also use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

For each trial, flip the coin 3 times, recording the result after each flip.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Trial Number** | **Flip 1** | **Flip 2** | **Flip 3** | **Desired (2B, 1G)** | **Other** | **The probability of the couple having 2 boys and 1 girl is:** |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |
| Totals | | | |  |  |

Solution 2: Using a Graphing Calculator

We will use a random number generator on the TI 83+ calculator to determine the probability of having 2 boys and 1 girl. Let “1" represent the birth of a girl, and let “2" represent the birth of a boy.

To get to the random number generator, do the following:

Step 1: Press the “MATH” button

Step 2: Press the “>” to go over to “PRB”, then press “ENTER”

Step 3: Press “5" for “randInt(“

Step 4: Enter “1,2,3)”. This will produce three random numbers (either 1 or 2) to

simulate the birth of three children. {1 2 1} means 2 girls and 1 boy

Step 5: Record the result in the chart below.

Step 6: Press “Enter” to produce another result.

Step 7: Repeat steps 5 and 6 until you have done the required number of trials.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trial Number** | **Random Numbers Generated** | **Desired (2B, 1G)** | **Other** | **The probability of having 2 boys and 1 girl is:** |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |
| Totals | |  |  |

How do the results of the two methods compare?

Example 2: Suppose Barry Bonds has a batting average of 0.320. This indicates 320 hits out of every 1000 attempts (in lowest terms: 8 hits in 25 attempts). If Barry typically has 3 at bats in a game, use a simulation the estimate the likelihood that Barry has no hits in a game.

Solution 1: Drawing Slips of Paper From a Paper Bag

Materials: 1 paper bag, 17 slips of paper with an “M” for miss, 8 slips of paper with “HIT” for a hit.

To simulate Barry’s at bats for one game, draw one slip of paper, record the result and then put the slip of paper back in the bag. Repeat two more times (3 at bats per game).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Game Number** | **At Bat 1** | **At Bat 2** | **At Bat 3** | **Desired (M, M, M)** | **Other** | **The probability of Barry not getting any hits in a game is:** |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |
| Totals | | | |  |  |

Solution 2: Using a Graphing Calculator

Let values of 1 - 17 represent a miss and let values of 18 - 25 represent a hit.

Step 1: Press the “MATH” button.

Step 2: Press the “>” to go over to “PRB”, then press “ENTER”

Step 3: Press “5" for “randInt(“

Step 4: Enter “1,25,3)”. This will produce three random numbers. {16 2 21} means {M, M, H}

Step 5: Record the result in the chart below.

Step 6: Press “Enter” to produce another result.

Step 7: Repeat steps 5 and 6 until you have done the required number of trials.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trial Number** | **Random Numbers Generated** | **Desired Outcome** | **Other** | **The probability of Barry not getting any hits in a game is:**  **How do the results of the two methods compare?** |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |
| Totals | |  |  |

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**Experimental Probability and Simulations Assignment**

Design a bunch of simulations to estimate the probability of **one** of the following events. Execute one of your simulations 100 times. Record the results.

1. What is the probability of a family with four children having two boys and two girls?

2. What is the probability of getting every question correct on four question true or false quiz if a student is guessing the answer on every question?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category** | **Level 1** | **Level 2** | **Level 3** | **Level 4** |
| Application | Applies knowledge and skills in familiar contexts with limited effectiveness. | Applies knowledge and skills in familiar contexts with some effectiveness. | Applies knowledge and skills in familiar contexts with considerable effectiveness. | Applies knowledge and skills in familiar contexts with a high degree of effectiveness. |

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|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category** | **Level 1** | **Level 2** | **Level 3** | **Level 4** |
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