

**Tossing Coins**

Adapted from ID: 17178

**Time required**

30 minutes

**Activity Overview**

*In this activity, students will use a simulation to find the experimental probability of independent events, tossing two coins. They will find the sample space and then compare the experimental and theoretical probabilities.*

**Topic: Probability**

- Simulations
- Experimental and theoretical probabilities

**Teacher Preparation and Notes**

- *This activity is intended to be an introduction to finding the theoretical probability for independent events. Specific directions and inquiry questions are part of the student worksheet, so this can be an independent or group activity. The last questions ask students to combine their results with those of the rest of the class. The teacher should be ready to collect and display the combined results.*
- *Students will need to work in groups to compile data.*

**Associated Materials**

- *Tossing\_Coins\_Student.doc*
- *Tossing\_Coins\_Student.pdf*
- *Tossing\_Coins.tns*
- *Tossing\_Coins\_Soln.tns*

**Problem 1 – Simulating Tossing Two Coins**

To ensure that all students do not have the same results when using the random integer command, have them move to Page 1.3 and type RandSeed # where # is any number unique to them, such as the last four digits of their phone number. They should then press **enter**.

Have students move to page 1.4.

Review with students how to use the **Random Integer** generator to simulate the tossing of a coin. The command **randint(0,1)** will generate one toss, where 0 represents heads and 1 represents tails. The command **randint (0,1,50)** will generate 50 tosses.

To start the activity, students are to predict what they think will be the probabilities of the outcomes of tossing a coin twice.

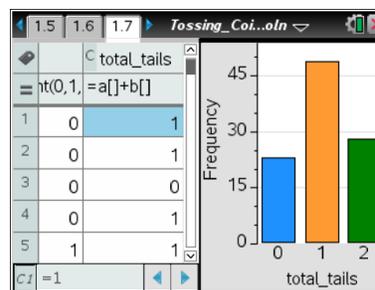
In the simulation, students will let 0 represent heads and 1 represent tails. On Page 1.7, in the formula rows of Columns A and B, students are to enter the command **=randint(0,1,100)**. Each row will represent one trial consisting of 2 tosses, for a total of 100 trials.

	A coin1	B coin2	C total_tails
1	=randint(0,1,	=randint(0,1,	=a[]+b[]
2	1	0	1
3	1	0	1
4	0	0	0
5	1	0	1
6	0	1	1

In Column C, students will enter **=a+b** to add Columns A and B, which calculates the number of tails for each trial. The possible numbers are 0, 1, and 2.

**Note:** Students can generate additional sets of data by choosing **MENU > Actions > Recalculate** (**ctrl** + **R**).

To quickly determine the sums of 0, 1, and 2 tails, students will use the **Quick Graph** feature. With the cursor in Column C, they select **MENU > Data > Quick Graph**. The list name **total\_tails** should be displayed in the lower part of the graph screen (x-axis). To display a bar graph, select **MENU > Plot Properties > Force Categorical X** and then **MENU > Plot Type > Bar Chart**. Students can move the cursor over each bar to see the number of successes and the percentages for each possible outcome.



Students then calculate the experimental probabilities of tossing 0, 1, and 2 tails.

If the recalculate command is used, the quick graph will change each time the command is executed.

Students should combine their results as a group, where the total number of trials is 100 multiplied by the number of students in the group. They should also combine their results as a class, where the total number of trials is 100 multiplied by the number of students in the class.

Students then compute the theoretical probabilities of tossing 0, 1, and 2 tails using the sample space. This is a good place to review the **Law of Large numbers**, where the experimental probability approaches the theoretical probability as the number of trials increases.