

Altering the Code to Perform Many Tosses

Coding enables us to simulate activities that would take a long time in real life. For example, if you wanted to toss a real coin 1000 times, it could take more than an hour and it would be challenging to keep track of the results!

Let's alter the code that you created in Masters 10 and 11 to include repeats and to calculate experimental probability. You will also use **Turbo Mode** in Scratch to speed up the calculations.

Open your code from Master 11, or go to this link for the completed application:

<https://scratch.mit.edu/projects/806733522/editor/>

Part 1: Tossing the Coin Many Times

Add a **repeat** block to simulate tossing a coin many times. You will be able to adjust the code to simulate 100 tosses, 1000 tosses, or any number of tosses that you choose!

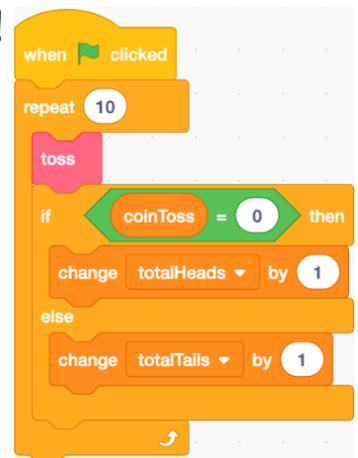
1. Under **Control**, select a **repeat** block.

Drag and drop it so it appears around the code below the **when green flag clicked** block, as shown here.

2. Click on the green flag and watch as 10 tosses are automated. This means that, rather than having to click on the flag 10 times to simulate 10 coin tosses, you click once and the repeat does the rest! Click on the space bar to reset the variables.

Alter the number of repeats from **10** to **100**.

How many heads are tossed? How many tails?



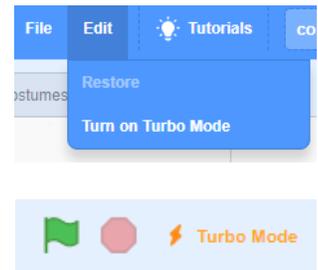
Altering the Code to Perform Many Tosses (cont'd)

3. If you change the repeat value to a larger number such as 1000, you'll have to wait a while to see the results.

In Scratch, you can use **Turbo Mode**.

It will execute the code super fast when you click on the green flag.

To turn on **Turbo Mode**, click **Edit** and then select **Turn on Turbo Mode**. You can later turn **Turbo Mode** off in the same way.



You will know that you are in **Turbo Mode**, when it says **Turbo Mode** next to the green flag above the stage.

Set the **repeat** to **1000**.

Click the space bar to reset the variables, then click the green flag and watch how quickly your results appear!

How many heads were tossed? How many tails?

4. Reset the variables and adjust the **repeat** value to **10 000**.

Execute the program.

- How many tosses were heads? How many were tails?
- What was the experimental probability of tossing heads?

- The theoretical probability of tossing heads is $\frac{1}{2}$, or 0.5

How do you think the experimental probability of tossing heads will compare to the theoretical probability as you do more and more coin tosses?

- Reset the variables and adjust the repeat value to 100 000 or an even larger number of your choice.

Was your prediction in part c correct?

Altering the Code to Perform Many Tosses (cont'd)

Part 2: Calculating the Experimental Probability of Tossing Heads

1. Add a block to calculate the experimental probability of tossing heads. To begin, you need to make a new variable. Under **Variables**, select **Make a Variable** and name it **headsEP**.

2. Under **Variables**, select the **set** block and place it inside the bottom of the **repeat** block but below the **if-then-else** block. Ensure the **headsEP** variable is selected from the pulldown menu. For now, set your **repeat** back to **10**.

```

when green flag clicked
  repeat 10
    toss
    if coinToss = 0 then
      change totalHeads by 1
    else
      change totalTails by 1
    set headsEP to 0
  
```

3. a) From under **Operators**, select the **division** operator () and place it inside the **set** block.

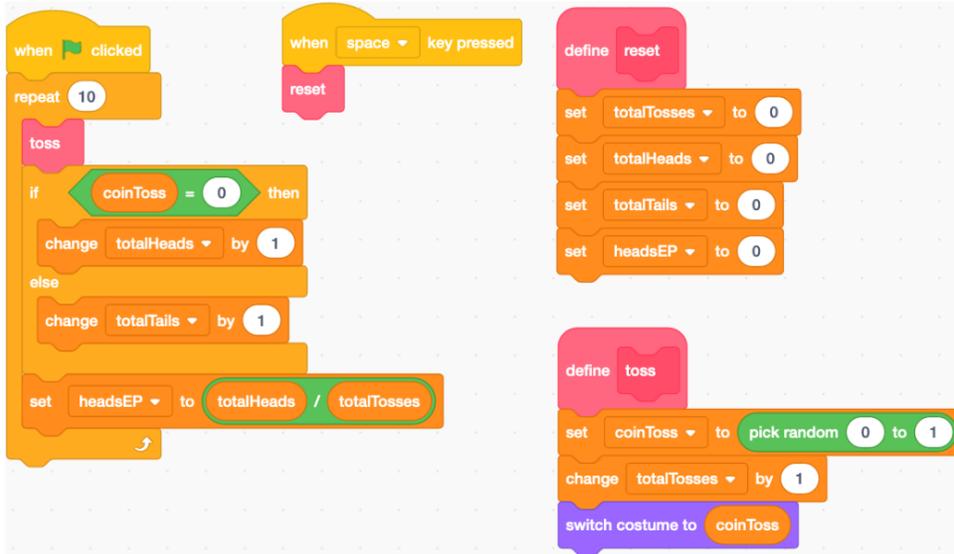
b) To determine the experimental probability of tossing heads, you need to divide the **totalHeads** variable by the **totalTosses** variable. From under **Variables**, drag the **totalHeads** variable into the first oval of the **division** operator and the **totalTosses** variable into the second oval.

```

when green flag clicked
  repeat 10
    toss
    if coinToss = 0 then
      change totalHeads by 1
    else
      change totalTails by 1
    set headsEP to totalHeads / totalTosses
  
```

Altering the Code to Perform Many Tosses (cont'd)

4. Add a **set** block to the **reset** subprogram for **headsEP** and ensure it is set to **0**. Your program should look similar to this:



5. a) Click the space bar to ensure the variables are reset.

Execute the code with the **repeat** set to **10**.

You will see the experimental probability for heads displayed on the stage along with the values of the other variables.

Is the experimental probability calculated correctly?

If not, check for errors in your code.

If it is, move on to part b.

b) Reset the variables again.

While in **Turbo Mode**, adjust the **repeat** to **1 000 000** and click on the green flag.

What is the experimental probability of tossing heads for your 1 000 000 tosses?

Is this what you would expect?

Additional Challenge

Add a block to your code to calculate and display the experimental probability of tossing tails.