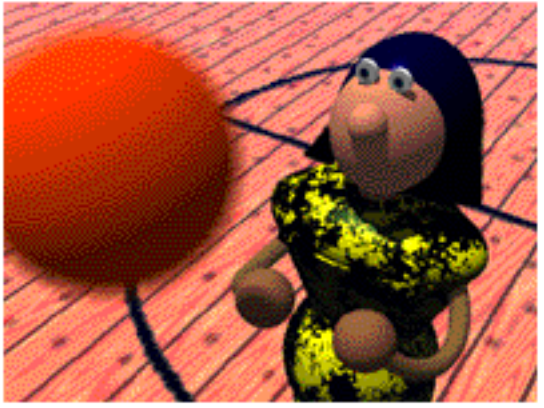
Warm-Up

Troy is on his school's basketball team. He is a good player, but not a very consistent free-throw shooter. Suppose Troy is about to shoot. Do you think he will score or miss?

It is impossible to predict the outcome. This is a chance event.

ACTIVITY CENTRAL SCREEN 1 OF 3



SCORE!!!
MISS
MISS
SCORE!!!
SCORE!!!
SCORE!!!
SCORE!!!
MISS
SCORE!!!
SCORE!!!

Warm-Up

Suppose that the result of each animation represents whether Hellish Troy makes or misses a free throw. Run the animation as many times as necessary to answer the following question:

Based on his current performance, is Troy more likely to score or to miss during his professional career? Explain your answer.

It is more likely that Troy will make a shot, because after many shots, Troy made a shot about 75% of the time.

Values	A	B	C
a	Freq.		
SCORE!!!	7		
MISS	3		
Sum:	10		

SCORE!!!
MISS
MISS
SCORE!!!
SCORE!!!
SCORE!!!
SCORE!!!
MISS
SCORE!!!
SCORE!!!

Warm-Up

You have completed this activity.
Now you can choose another activity from this subsection:

Exploration
Problem

You may click the Activity Central icon below to return to Activity Central.

SCREEN 3 OF 3

Exploration

Suppose a friend challenges you to a betting game. You are to flip a coin, and if the coin comes up heads, she will pay you $1.00. If the coin comes up tails, you will pay her $1.00. Does this sound like a fair game?

The game seems fair because there are only two outcomes when flipping a coin and either outcome is possible.

ACTIVITY CENTRAL

SCREEN 1 OF 15

Exploration

If you play the game many times, can you say for certain whether you'd be a winner or loser? Explain your answer.

Answers may vary.

ACTIVITY CENTRAL

SCREEN 2 OF 15

Exploration

In order to make a prediction about the long-term results of playing this game, what assumption must you make about the coin?

Whether or not the coin is weighted to favor one side or the other. If it's a fair coin, the number of wins is about equal to the number of losses. If the coin is weighted, then one outcome will be greater than the other.

ACTIVITY CENTRAL

SCREEN 3 OF 15

Exploration

Suppose you are suspicious about playing the game. What if the coin is not fair, that is, what if it's weighted to favor one side more than the other?

The coin in this model is identical to the coin in the game. Play once. Note the relative frequency of heads reported in the spreadsheet and record the fraction in the white box in the table on the right.

ACTIVITY CENTRAL

SCREEN 4 OF 15

Number of Tries	Relative Frequency of Heads
1	1/1

Relative Frequency

The relative frequency f/n of an outcome is a fraction whose numerator f is the frequency of the outcome, and whose denominator n is the number of tries in the experiment.

Close

	A	B
	Rel. Freq.	
H	1/1	
T	0/1	
Sum:	1	

Exploration

Can you decide if the coin is fair after tossing it just once?

No.

What could you do to find out whether or not the coin is fair?

Toss the coin many more times

ACTIVITY CENTRAL

SCREEN 5 OF 15

Exploration

Since you have access to a model of the coin, you can study how it's weighted without taking any risks (and losing any money). Toss the coin 10 times. Look at the spreadsheet and record the relative frequency of the outcome in the table. Is there any reason to believe that the coin may not be fair?

ACTIVITY CENTRAL

SCREEN 6 OF 15

Number of Tries	Relative Frequency of Heads
1	1/1
10	3/10

The coin...

The number of tries is relatively small and It's not enough to know for certain.

	A	B
a	Rel. Freq.	
H	3/10	
T	7/10	
Sum:	1	

Exploration

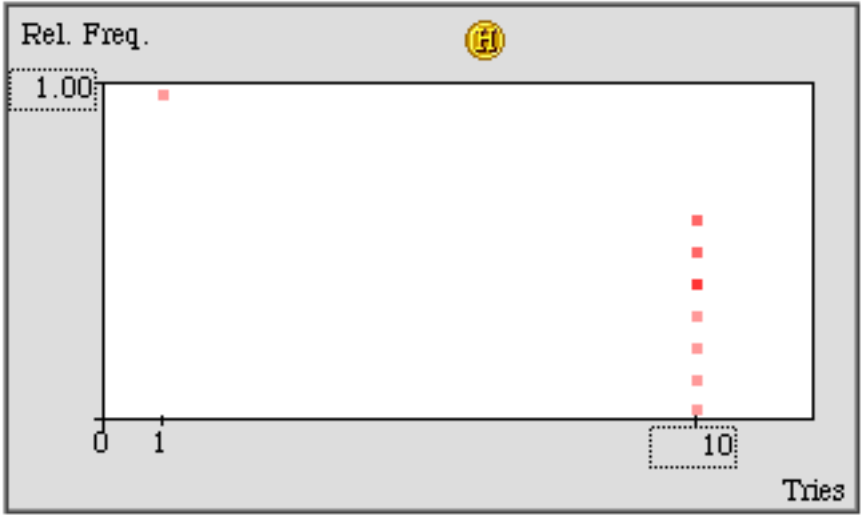
The model window has been closed to speed up the experiment. Repeat the experiment 9 more times, tossing the coin 10 times in each experiment.

Click each square in the relative frequency graph.

What can you conclude about the coin now?

The coin does not appear to be fair because the relative frequency of heads is less than 0.50 in most cases. This means that heads turn up less frequently than tails.

ACTIVITY CENTRAL SCREEN 7 OF 15



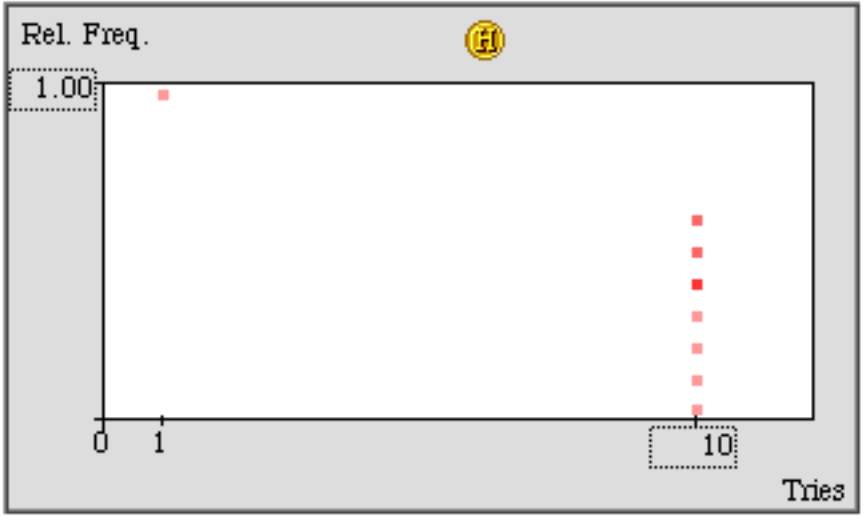
Exploration

Examine the data in the relative frequency graph. What appears to be the relative frequency of heads turning up when the coin is tossed many times? Express your answer in percentage terms.

About 30-40% of the time.

ACTIVITY CENTRAL

SCREEN 8 OF 15



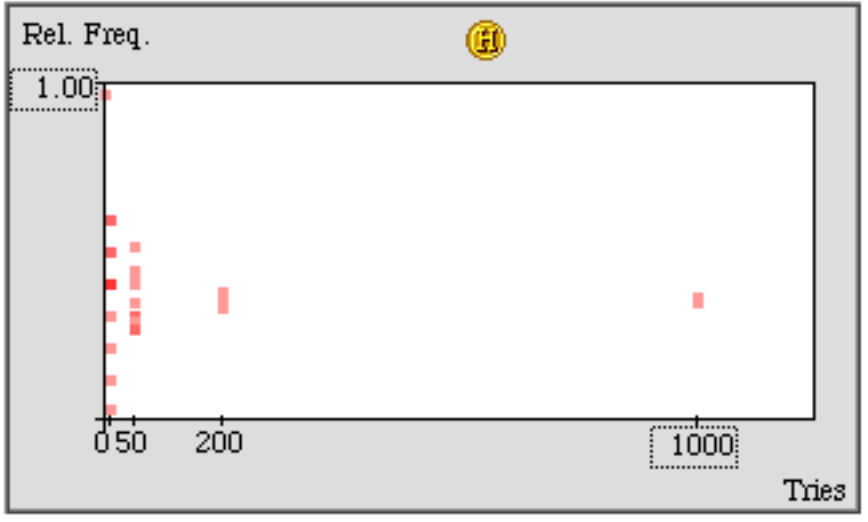
Exploration

To obtain a better approximation of the probability, you need to toss the coin many more times. Perform the following experiments. The results of each experiment will appear in the graph.

- 10 experiments of 50 tosses per experiment
- 8 experiments of 200 tosses
- 5 experiments of 1000 tosses

ACTIVITY CENTRAL

SCREEN 9 OF 15



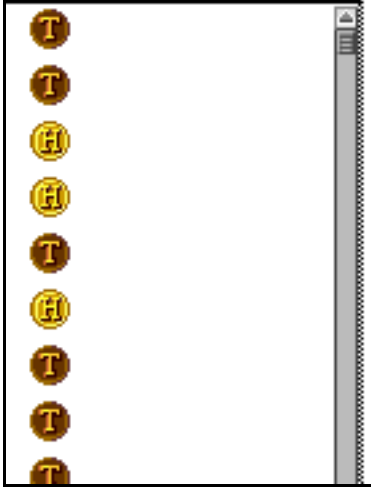
Exploration

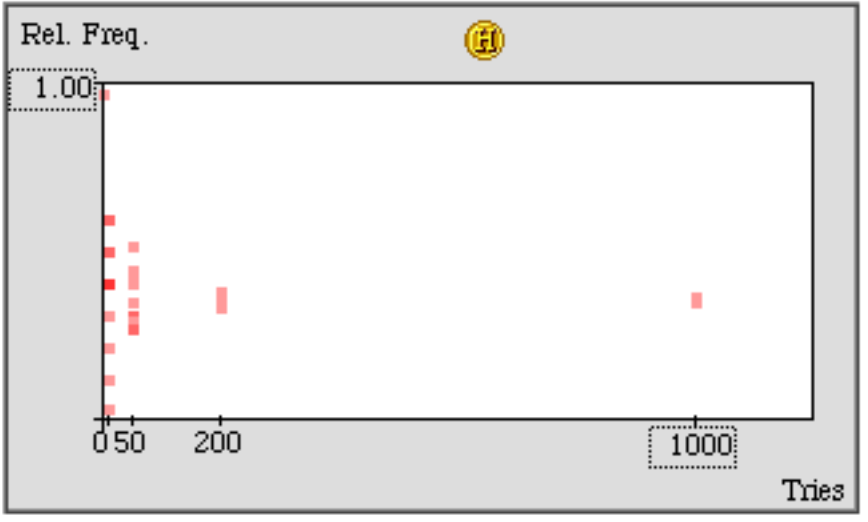
In the graph, the results of each experiment appear as a square above the number of tries (50, 200, 1000). Click the square that lies closest to the middle of each column to see the relative frequency it represents. Record the relative frequency of this midpoint in the corresponding row of the table on the right.

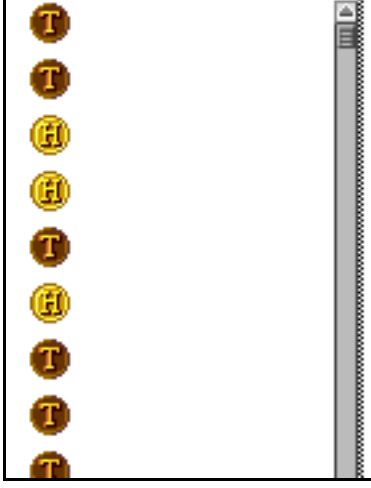
ACTIVITY CENTRAL

SCREEN 10 OF 15

Number of Tries	Relative Frequency of Heads
1	1/1
10	3/10
50	0.34
200	0.345
1000	0.354







Exploration

If the coin is tossed many times, what decimal number would best approximate the relative frequency of heads?

0.35

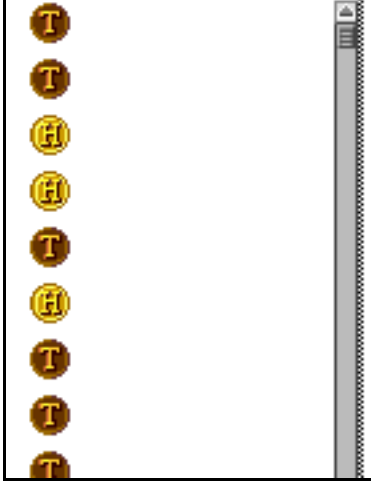
What decimal would represent the relative frequency of tails?

0.65

ACTIVITY CENTRAL

SCREEN 11 OF 15

Number of Tries	Relative Frequency of Heads
1	1/1
10	3/10
50	0.34
200	0.345
1000	0.354



Exploration

The probability of an outcome is its long-term relative frequency. The more tries in an experiment, the closer the relative frequency is to its probability.

In this game of chance, what is the probability of heads? What is the chance of tails?

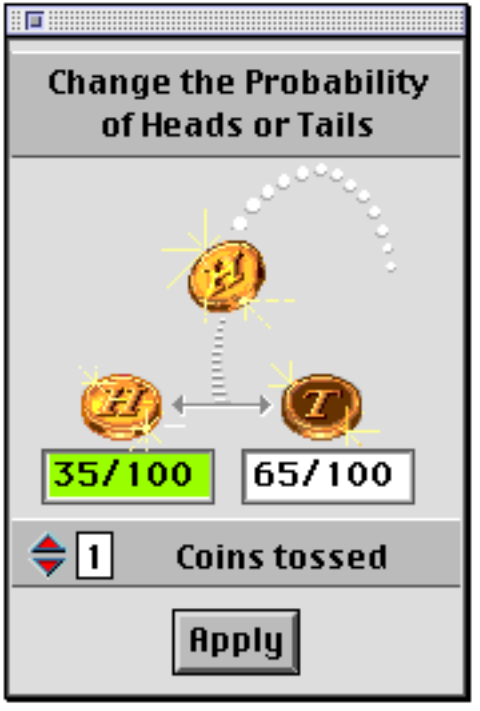
Open the modify Model dialog to see the setting.

Probability of heads: 0.35

Probability of tails: 0.65

ACTIVITY CENTRAL

SCREEN 12 OF 15



Exploration

Now that you've conducted this simulation and analyzed the results, should you accept your friend's challenge to play the game? Remember, the game was that you would win $1.00 if heads turn up, but you would lose $1.00 if tails turn up.

You would lose money in the long term since the probability of getting heads is less than getting tails.

ACTIVITY CENTRAL

SCREEN 13 OF 15

Exploration

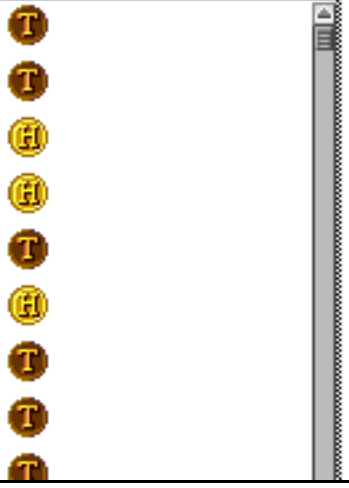
During World War II, John Kerrich, an English mathematician, tossed a coin 10,000 times while interned as a prisoner of war. He got 5,067 heads.

What can you say about the coin Kerrich used?

The coin seems to be a fair coin.

ACTIVITY CENTRAL

SCREEN 14 OF 15



Exploration

You have completed this activity.
Now you can choose another activity from this subsection:

Warm-Up
Problem

You may click the Activity Central icon below to return to Activity Central.

ACTIVITY CENTRAL

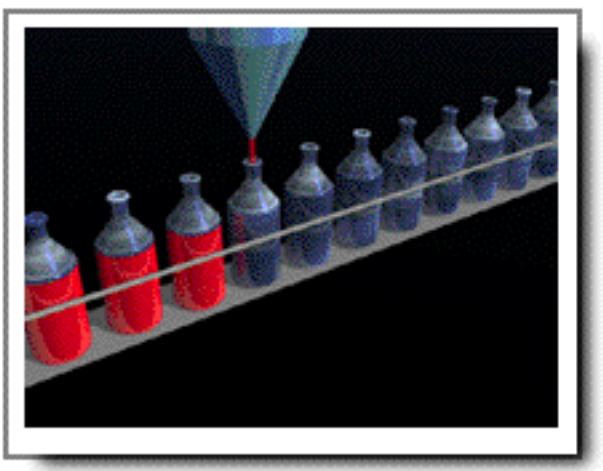
SCREEN 15 OF 15

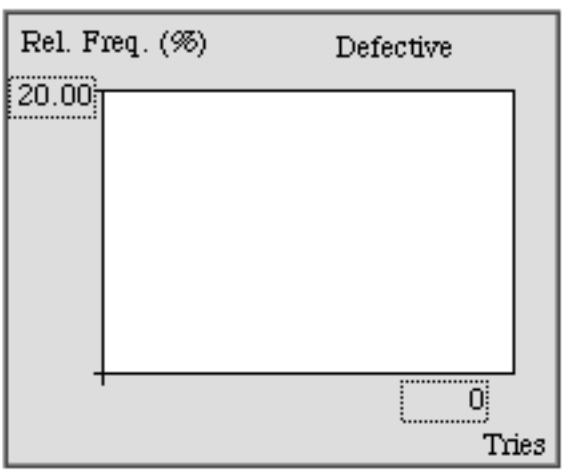
Problem

A medical equipment factory has a very rigorous quality control department. Its function is to detect any defective parts coming off the manufacturing line and to report their findings. This model simulates the relative frequency of finding defective parts.

ACTIVITY CENTRAL

SCREEN 1 OF 4





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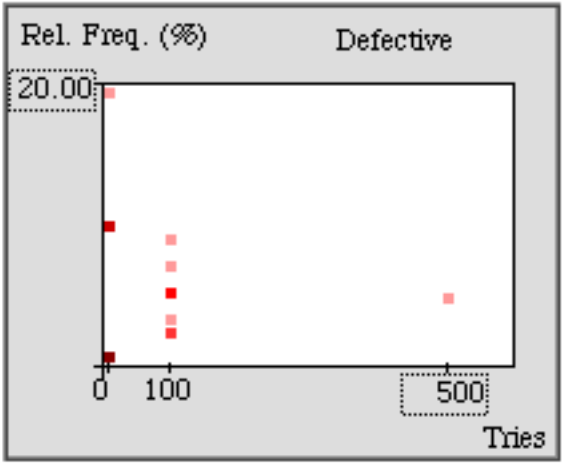
Problem

Run the model several times. Increase the number of tries to get the best results. The relative frequency for each try will be displayed as a percentage on the graph.

ACTIVITY CENTRAL

SCREEN 2 OF 4



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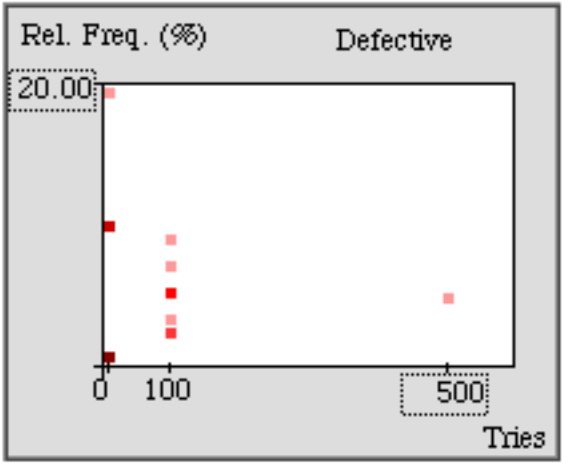
Problem

Examine the data in the relative frequency graph. What is the probability that a part will be defective? Explain.
Express your answer as a percentage.

The probability is 6%, because that is the middle value between the highest relative frequency and the lowest relative frequency observed.

ACTIVITY CENTRAL

SCREEN 3 OF 4



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Problem

You have completed this activity.
Now you can choose another activity from this subsection:

Warm-Up
Exploration

You may click the Activity Central icon below to return to Activity Central.

SCREEN 4 OF 4

Printing *Probability Constructor*

This CD includes material to help you prepare your use of *Probability Constructor* activities in the classroom.

You can access information about Installation, Logon, or the product itself by clicking the chapter name below.

For each activity listed at right there are: pictures of the on-screen activities including the text, the Model Window, any displays used in the activity, and the suggested answers.

- **To print a file,** click the chapter or activity name.

  Then choose Print from the File menu.

- **To reaccess this list,** click the "Last Page" icon  in the toolbar above.

Installation

Logon

About *Probability Constructor*

Frequency

Frequency of Heads and Tails
Frequency and Dice
Frequency of Colors in Turning Wheels

Relative Frequency

Exploring Relative Frequency with Marbles
Displaying Relative Frequency
Relative Frequency and Area

Probability

Calculating Probability
Properties of Probability
Geometric Probability
Probability Trees