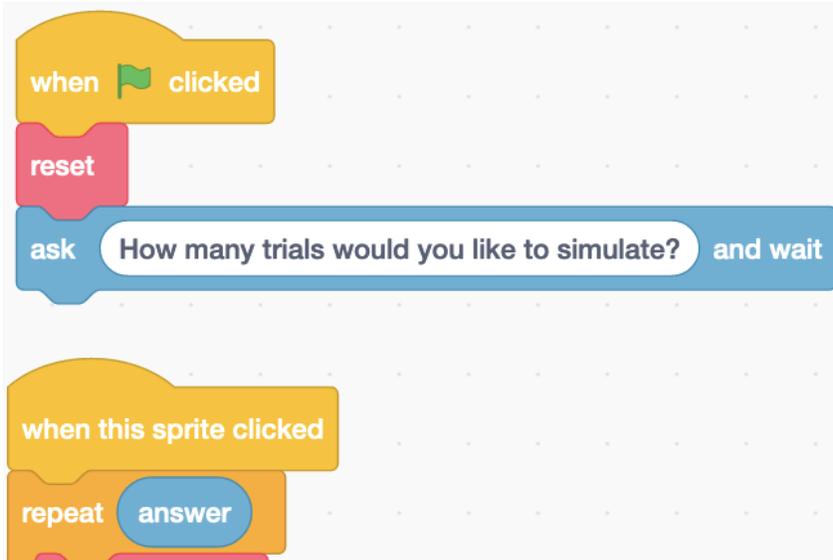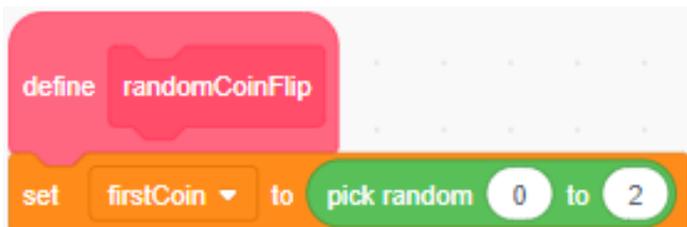# Answers

Challenge 1: Obtaining Input from the User

As described in the hint, add a block that asks the user how many trials they would like to simulate. Use the answer to set the number of repeats.
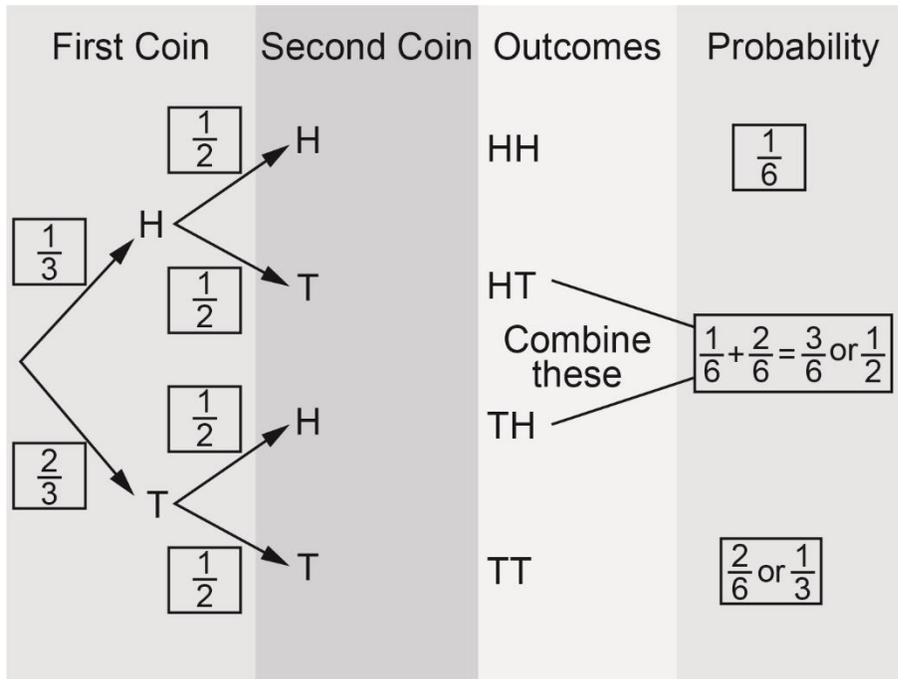
when [flag] clicked
reset
ask (How many trials would you like to simulate?) and wait

when this sprite clicked
repeat (answer)

Challenge 2: Simulating an Unfair Coin

Alter the code as described in the hint.

define randomCoinFlip
set firstCoin ▾ to (pick random (0) to (2))

For a large number of trials, the experimental probabilities

should approach HH: $\frac{1}{6}$, TT: $\frac{2}{6}$ or $\frac{1}{3}$, HT or TH: $\frac{1}{6}$ + $\frac{2}{6}$ = $\frac{3}{6}$ or $\frac{1}{2}$

Answers (cont'd)

First Coin	Second Coin	Outcomes	Probability
$\frac{1}{3}$ H	$\frac{1}{2}$ H	HH	$\frac{1}{6}$
	$\frac{1}{2}$ T	HT	
		Combine these	$\frac{1}{6}+\frac{2}{6}=\frac{3}{6}$ or $\frac{1}{2}$
$\frac{2}{3}$ T	$\frac{1}{2}$ H	TH	
	$\frac{1}{2}$ T	TT	$\frac{2}{6}$ or $\frac{1}{3}$

To simulate an unfair coin that has a $\frac{1}{4}$ probability of landing

heads, change the **pick random** range for the **firstCoin** variable to include four possibilities (0 to 3).

```
define randomCoinFlip

set firstCoin ▼ to pick random 0 to 3
```

For a large number of trials, the experimental probabilities

should approach HH: $\frac{1}{8}$, TT: $\frac{3}{8}$, HT or TH: $\frac{1}{8}$ + $\frac{3}{8}$ = $\frac{4}{8}$, or $\frac{1}{2}$

Answers (cont'd)

Challenge 3: Considering HT and TH as Separate Outcomes

New variables should be created for HT, TH, experimentalProbability-HT, and experimentalProbability-TH. Four of the subprograms need to be altered as shown below to reflect the fact that HT and TH are no longer treated as the same outcome.

The reset subprogram:

The subprogram calculating the probabilities:

```
define  reset
    set  HH ▾  to  0
    set  HT ▾  to  0
    set  TH ▾  to  0
    set  TT ▾  to  0
    set  totalTosses ▾  to  0
    set  experimentalProbability-HH ▾  to  0
    set  experimentalProbability-HT ▾  to  0
    set  experimentalProbability-TH ▾  to  0
    set  experimentalProbability-TT ▾  to  0
    delete all of  TossCombo ▾
```

```
define  calculateExperimentalProbability
    set  experimentalProbability-HH ▾  to  HH / totalTosses
    set  experimentalProbability-HT ▾  to  HT / totalTosses
    set  experimentalProbability-TH ▾  to  TH / totalTosses
    set  experimentalProbability-TT ▾  to  TT / totalTosses
```

Answers (cont'd)

The subprograms called **firstTossHeads** and **firstTossTails**:

The theoretical probabilities are HH: $\frac{1}{4}$, HT: $\frac{1}{4}$, TH: $\frac{1}{4}$, TT: $\frac{1}{4}$;

for a large number of trials, the experimental probabilities should approach these numbers. Here is a sample result for 1000 trials:

experimentalProbability-HH 0.245

experimentalProbability-HT 0.252

experimentalProbability-TH 0.22

experimentalProbability-TT 0.283