

Exercise walk-through

4.2

Estimating Probabilities Using Simulation

AP Statistics

Randomness and probability

Probability is the long-run
relative frequency of an
outcome.

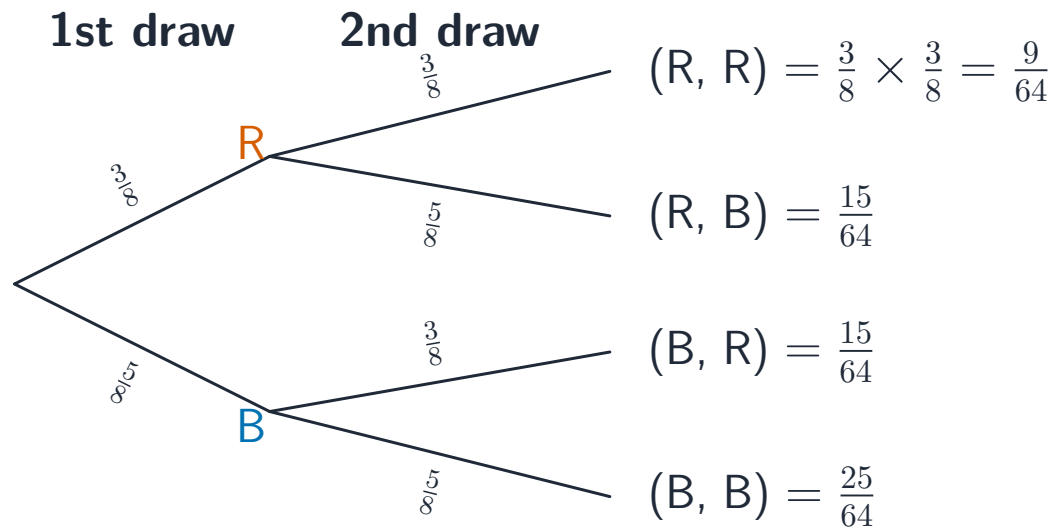
- short runs vary by
chance
- **simulation** estimates a
hard probability

Law of large numbers : more trials
 $\Rightarrow \hat{p}$ settles toward the true
 p .



Playing cards

On a tree diagram



On a tree diagram, multiply the probabilities along the branches

Independent Events and Unions of Events

		die 2					
+		1	2	3	4	5	6
die 1	1	2	3	4	5	6	7
	2	3	4	5	6	7	8
	3	4	5	6	7	8	9
	4	5	6	7	8	9	10
	5	6	7	8	9	10	11
	6	7	8	9	10	11	12

the six highlighted cells all give a total of 7

A sample space diagram lists every equally likely outcome

Exercises 2.1-2.3

2.1 State what a simulation uses to estimate a probability. [1]

2.2 State how the estimate improves. [1]

2.3 State what the relative frequency of an event approximates. [1]

Exercises 2.1-2.3

2.1 State what a simulation uses to estimate a probability. [1]

2.1

- many random trials (using a random number generator)
-

2.2 State how the estimate improves. [1]

2.2

- by running more trials
-

2.3 State what the relative frequency of an event approximates. [1]

2.3

- the true probability of the event

Exercises 3.1-3.2

3.1 A simulation estimates a probability using

[1]

☐

A a single trial

B many random trials

C a formula only

D a guess

3.2 As the number of simulated trials increases, the estimate

[1]

☐

A gets worse

B gets closer to the true probability

C stays fixed

D becomes 1

Exercises 3.1-3.2

3.1 A simulation estimates a probability using

[1]

☐

- A a single trial
- B many random trials
- C a formula only
- D a guess

3.1 B

- many random trials.

3.2 As the number of simulated trials increases, the estimate

[1]

☐

- A gets worse
- B gets closer to the true probability
- C stays fixed
- D becomes 1

3.2 B

- gets closer to the true probability.

Exercise 3.3 (a)

3.3 A student simulates rolling a die 1000 times to estimate $P(\text{six})$.

(a) State the tool that provides the randomness.

[1]

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(a) State the tool that provides the randomness.

[1]

(a)

- a random number generator

Exercise 3.3 (b)

3.3 A student simulates rolling a die 1000 times to estimate $P(\text{six})$.

(b) State what the relative frequency of sixes estimates.

[1]

Exercise 3.3 (b)

3.3 A student simulates rolling a die 1000 times to estimate $P(\text{six})$.

(b) State what the relative frequency of sixes estimates.

[1]

(b)

- the true probability of rolling a six

Exercise 3.3 (c)

3.3 A student simulates rolling a die 1000 times to estimate $P(\text{six})$.

(c) State how to improve the estimate.

[1]

Exercise 3.3 (c)

3.3 A student simulates rolling a die 1000 times to estimate $P(\text{six})$.

(c) State how to improve the estimate.

[1]

(c)

- run more trials