

Worksheet – Sections 5.1-5.2

Theoretical probability: probability calculated based on reasoning and all possible outcomes

Empirical probability: probability calculated based on actual data collected from experiments

Outcome: the most basic result of an observation or experiment

Sample space: list of all outcomes

Event: collection of outcomes sharing a certain common property

Probability of event A: $P(A) = \frac{\text{number of outcomes in } A}{\text{number of all possible outcomes}}$

Events A and B are **mutually exclusive** if $P(A \text{ and } B) = 0$

$$P(A^c) = 1 - P(A)$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

1) The following exercise is an example of simulating coin tossing using a table of random numbers.

4 5 5 0 6	4 4 7 1 6	0 2 4 9 8	1 5 3 2 7	7 9 1 4 9	2 8 4 0 9
5 5 1 8 5	7 4 8 3 4	8 1 1 7 2	8 9 2 8 1	4 8 1 3 4	7 1 1 8 5
8 7 9 6 4	4 3 7 5 1	8 0 9 7 1	5 0 6 1 3	8 1 4 4 1	3 0 5 0 5
0 9 1 0 6	7 3 1 1 7	5 7 9 5 2	0 4 3 9 3	9 3 4 0 2	5 0 7 5 3
8 8 7 9 7	0 7 4 4 0	6 9 2 1 3	3 3 5 9 3	4 2 1 3 4	2 4 1 6 8

(a) Begin with the first digit in the second row, going from left to right, write the sequence of 10 random digits.

(b) Change the sequence of 10 random digits to a sequence of heads and tails. Let the digits 0, 1, 2, 3, 4 represent heads (H) and the digits 5, 6, 7, 8, 9 represent tails (T).

(c) What percentage of the flips were heads?

2) Repeat Problem 1, but now begin with the first digit in the third row and second column, going from left to right.

3) A bag contains 5 red marbles, 3 blue marbles, and 2 green marbles. One marble is chosen at random. An observer concludes that the probability that the marble is blue is $3/10$ because there are 3 blue marbles among a total of 10 marbles. Is this an example of an empirical probability or a theoretical probability?

4) A factory produces light bulbs. Out of 200 bulbs tested, 18 were defective. An observer concludes that the probability that a randomly selected bulb is defective based on this data is $18/200$. Is this an example of an empirical probability or a theoretical probability?

5) Roll a fair six-sided die.

(a) Find the sample space. (In other words, list all possible outcomes).

(b) What is the probability that the die shows an even number or a number less than 4?

(c) What is the probability the die shows an odd number or a number greater than 4?

6) Assume that the only grades possible in a history course are A, B, C, and lower than C. The probability that a randomly selected student will get an A in a certain history course is 0.18, the probability that a student will get a B in the course is 0.25, and the probability that a student will get a C in the course is 0.37.

(a) What is the probability that a student will get an A or a B?

(b) What is the probability that a student will get an A or a B or a C?

(c) What is the probability that a student will get a grade lower than a C?

7) Flip a fair coin 4 times.

(a) Find the sample space. (In other words, list all possible outcomes).

(b) Find the probability of getting exactly two heads among 4 flips.