

Section 10.1 Basic Probability Concepts

An outcome is the result from a single trial of an experiment.

The set of all possible outcomes is called the sample space.

ex: rolling a 6 sided die has a sample space of $\{1, 2, 3, 4, 5, 6\}$

An event is any subset of the sample space.

ex: Events for rolling a 6 sided die
rolling an even # $\{2, 4, 6\}$
rolling a 4 $\{4\}$
rolling a 1 or 3 $\{1, 3\}$
etc

ex1 List the sample space for:

a) rolling a fair 8 sided die
 $\{1, 2, 3, 4, 5, 6, 7, 8\}$

b) flipping a fair coin
 $\{H, T\}$

2/8

c) flipping 2 fair coins at the same time
 $\{HH, HT, TT, TH\}$

There are 2 types of probabilities:

Theoretical - ideal probability that is found without doing any experiments

Experimental (Empirical) - found by conducting experiments and recording results

All of the prob in this chapter will be theoretical.

Theoretical Probability

$$P(E) = \frac{n(E)}{n(S)} = \frac{\text{\#outcomes in event}}{\text{\#outcomes in sample space}}$$

↑
probability of event E

^{3/8}

ex 2 A fair 6 sided die is rolled.

Find the probability the die lands on:

a) 2

$$P(2) = \frac{\text{\# ways to roll 2}}{\text{total \# outcomes}} =$$

$$\boxed{\frac{1}{6}}$$

b) an even #

2, 4, 6

$$P(\text{even \#}) = \frac{\text{\# even \#s}}{\text{total \# outcomes}} = \frac{3}{6} = \boxed{\frac{1}{2}}$$

c) a number less than 5

↖ don't include 5

1, 2, 3, 4

$$P(\text{less than 5}) = \frac{\text{\#s less than 5}}{\text{total \# outcomes}} = \frac{4}{6} = \boxed{\frac{2}{3}}$$

d) a number 5 or less

↖ include 5

1, 2, 3, 4, 5

$$\frac{\text{\#s 5 or less}}{\text{total \#}} = \boxed{\frac{5}{6}}$$

* Frac on calc: Alpha y= *

Some facts about Probabilities:

1. Probability is never negative.
2. Probabilities are always between 0 and 1.
3. Prob of 0 = impossible event
4. Prob of 1 = certain event
5. Sum of the probabilities for each outcome in a sample space is 1.

ex 3 Can the following numbers represent a probability?

a) $\frac{4}{7}$ Yes positive + bw 0 and 1

b) 0.63 Yes

c) $63\% = 63 \div 100 = 0.63$ Yes

d) $\frac{7}{4} = 1.75$ No bigger than 1

e) $(-)\frac{1}{2}$ No negative

f) $121\% = 121 \div 100 = 1.21$ No bigger than 1

g) 63 No bigger than 1

$\frac{5}{8}$

ex 4 You flip 2 fair coins at the same time. Find the probability the coins land on:

a) exactly 2 tails

Sample Space { HH, TT, HT, TH }

$$P(2T) = \frac{\text{\# ways TT}}{\text{total \# outcomes}} = \frac{1}{4}$$

b) exactly 1 tail

$$P(\text{exactly 1 T}) = \frac{\text{\# ways 1 T}}{\text{total \#}} = \frac{2}{4} = \frac{1}{2}$$

c) at least 1 tail $\leftarrow$ 1 or more

$$P(\text{at least 1 T}) = \frac{\text{\# 1 T or more}}{\text{total \#}} = \frac{3}{4}$$

What is the prob of rolling a 4 on a fair 6 sided die?

$$P(4) = \frac{1}{6}$$

What is the prob of NOT rolling a 4 on a fair 6 sided die?

$$P(\text{not } 4) = \frac{5}{6}$$

These are called complementary events.

$$P(E) + P(E') = 1$$

complement / Not

$$P(E') = 1 - P(E)$$

Formula for the prob of event E
not happening.

ex 5 There are 36 outcomes in the sample space for rolling 2 fair 6 sided dice. What is the prob of not rolling 2 ones?

$$P(\text{rolling 2 ones}) = \frac{1}{36} \leftarrow \text{only 1 outcome} \quad \square \square$$

$$P(\text{not rolling 2 ones}) = \frac{35}{36}$$

1 outcome is 2 ones
then the rest of the 36
outcomes are not

ex 6 What is the prob of rolling a pair of 6 sided dice and getting a sum of 7?

← add

* Google outcomes for rolling 2 dice *

$$\frac{\text{\# ways to get sum of 7}}{\text{total \# outcomes}} = \frac{6}{36} = \frac{1}{6}$$

6 outcomes:
from picture

1, 6	4, 3
2, 5	5, 2
3, 4	6, 1

ex 7 In a math class of 4 women and 7 men, one person is selected at random to go to the board. Find the prob^l the person selected is a man.

$$\frac{\text{\#men}}{\text{total \# people}} = \frac{7}{7+4} = \boxed{\frac{7}{11}}$$