Basics of Probability

When we toss a fair coin the two outcomes in the sample space S = {H, T} are equally likely, so the probability of each outcome is 1/2.

This is a THEORETICAL PROBABILITY based on the sample space having equally likely outcomes.

In general, this is the way we will find probability, by using a sample space of EQUALLY LIKELY OUTCOMES.

The probability of an event, P(E) is a number between 0 and 1,

We can also calculate the EMPIRICAL PROBABILITY of an event by doing an experiment many times.

For example, you could toss a coin and note how many times it comes up heads (shown in book)

or you could roll a die and count how many times a 1 is rolled.

number of tosses (m)	number of 1's rolled (n)	relative frequency (n/m)

(SUBJECTIVE PROBABILITY)

UNIFORM SAMPLE SPACE $S=\{s_1,s_2, ...,s_n\}$,

$\{s_1\}, \{s_2\} \ldots \{s_n\}$ are called SIMPLE events

Notice these simple events are MUTUALLY EXCLUSIVE as only one can occur.

PROBABILITY DISTRIBUTION TABLE:

Event	probability

Properties of probability distribution tables:

Toss a coin three times. There are 8 equally likely outcomes:

Event	Probability

Find the probability distribution table for the number of heads when a coin is tossed 3 times.

S = {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}

What is the probability of 2 or more heads?

Suppose the instructor of a class polled the students about the number of hours spent per week studying math during the previous week. The results were 69 students studied two hours or less, 128 students studied more than two hours but 4 or less hours, 68 students studied more than 4 hours but less than or equal to 6 hours, 30 students studied more than 6 hours but less than or equal to 8 hours and 14 students studied more than 8 hours.

Arrange this information into a PDT and find the probability that a student studied more than 4 hours per week

What is the probability of rolling a sum 2 or a sum of 12 using two fair die?

1~1	2~1	3~1	4~1	5~1	6~1
1~2	2~2	3~2	4~2	5~2	6~2
1~3	2~3	3~3	4~3	5~3	6~3
1~4	2~4	3~4	4~4	5~4	6~4
1~5	2~5	3~5	4~5	5~5	6~5
1~6	2~6	3~6	4~6	5~6	6~6

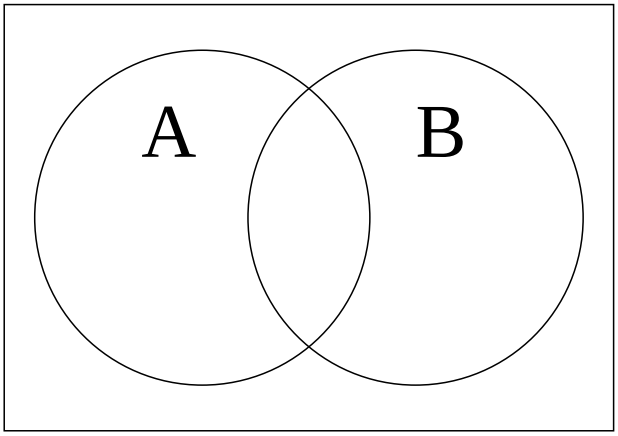
What is the probability of rolling a sum of 7?

1~1	2~1	3~1	4~1	5~1	6~1
1~2	2~2	3~2	4~2	5~2	6~2
1~3	2~3	3~3	4~3	5~3	6~3
1~4	2~4	3~4	4~4	5~4	6~4
1~5	2~5	3~5	4~5	5~5	6~5
1~6	2~6	3~6	4~6	5~6	6~6

Rules for Probability

If event A and event B are mutually exclusive then

In general, A and B have some outcomes in common so we have the union rule for probability:

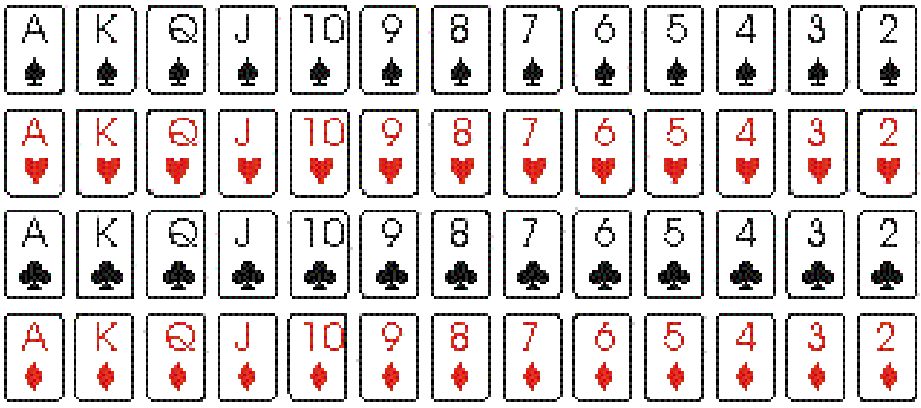


Example: Let
E={x|x is a sum of 7} =
and
F={x|x is a 6 on the green die} =

1~1	2~1	3~1	4~1	5~1	6~1
1~2	2~2	3~2	4~2	5~2	6~2
1~3	2~3	3~3	4~3	5~3	6~3
1~4	2~4	3~4	4~4	5~4	6~4
1~5	2~5	3~5	4~5	5~5	6~5
1~6	2~6	3~6	4~6	5~6	6~6

What is the probability that you have a sum of 7 OR a 6 on the green die?

A standard deck of 52 cards has 4 suits, each with 13 cards. The suits are spades, ♠, hearts, ♥, clubs, ♣ ,and diamonds, ♦. The cards in each suit are numbered from Ace, King, Queen, Jack, ten down to 2.



Example - If a single card is drawn from a standard deck of cards, what are the probabilities of

a) a 9 or a 10? Let

b) a black card or a 3?

Example - a survey gave the following results: 45% of the people surveyed drank diet drinks (D) and 25% drank diet drinks and exercised ($D \cap E$) and 24% did not exercise and did not drink diet drinks ($D^c \cap E^c$). Find the probability that:

a) a person does not drink diet drinks (D^c).

b) does not exercise and drinks diet drinks ($E^c \cap D$).

c) exercises and does not drink diet drinks ($E \cap D^c$).

Draw the diagram.