

Probability Review-10

If an experiment (such as rolling a die or picking a card from a shuffled deck) consists of N trials, and a particular outcome occurs S times, then the **probability**, P , for that outcome, equals S/N . This assumes that all outcomes are equally likely.

In a proper experiment, N should be very large.

The **sample space** for the experiment is the set of all possible outcomes for that experiment.

An **event** is a subset of the sample space.

Probability Laws

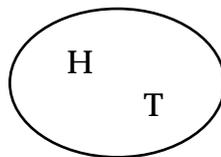
$$P(\text{event } A) = \frac{\text{number of outcomes favorable to event } A}{\text{total number of outcomes}}$$

$$P(\text{not } A) = P(\sim A) = 1 - P(A)$$

Example 1:

In a coin flip experiment, the sample space consists of the two outcomes, heads (H), or tails (T). The sample space $S = \{ H, T \}$

The possibilities may also be represented by a Venn diagram. The Venn diagram for this situation is shown below.

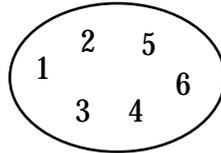


The probability of getting a head, $P(H)$, is $1/2$. The probability of getting a tail, $P(T)$, is $1/2$.

This means that if we flip a coin 100 times we are likely to get 50 heads and 50 tails. Although in practice, if we do the experiment, we may get 48 heads and 52 tails etc.

Example 2:

If we roll one die, the sample space is { 1, 2, 3, 4, 5, 6 }. The Venn diagram is shown below.



The probability, $P(3)$, of rolling a 3 is $1/6$. The probability of **NOT** rolling a three, $P(\sim 3)$, is equal to $1 - P(3) = 5/6$. The probability of rolling an even number equals $3/6 = 1/2$. The probability of rolling a number which begins with the letter of T is $2/6 = 1/3$.

Problems:

1) If you roll a die, find the probability of rolling a:

a) a six b) a number less than 5 c) a seven

2) A bag contains two white marbles and five black marbles.

a) Find the probability of drawing a black marble.

b) Find the probability of drawing a white marble.

c) Find the probability of NOT drawing a white marble.

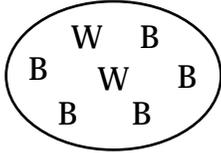
d) Sketch the sample space (Venn diagram).

3) Suppose that you have a standard deck of cards. The deck contains 52 cards. Half are red, and half are black. There are four suits, diamonds (red), hearts (red), clubs (black) and spades (black). Each suit has thirteen cards, two to ten, plus a jack, queen, king and an ace. The "face" cards are the jack, queen and king. Answer the following questions.

The deck is shuffled and one card is drawn. Give the probabilities:

a) P (red card), b) P (8), c) P (king), d) P (black face card), e) P (red or black face card), f) P (a card with a value of less than eight. ace = 1), g) P (NOT an ace).

Answers: 1)a) $1/6$, b) $2/3$, c) 0 , 2)a) $5/7$, b) $2/7$, c) $1 - 2/7 = 5/7$,



3)a) $1/2$, b) $1/13$, c) $1/13$, d) $3/26$, e) $3/13$, f) $7/13$, g) $12/13$.