CHAPTER 3 Probability

Section 3.1: Exploring Probability / Section 3.2: Probability and Odds

Statements of probability and odds are referenced often in various media in many fields including political polls, sports and social statistics.

Have you noticed?!

But do you know the difference between probability and odds?

Review of Probability

Event: collection of outcomes that satisfy a specific condition.

Ex: When throwing a standard die, the event "throwing an odd #" is the collection of outcomes 1, 3, 5 or 3 ways.

Probability of an event: the ratio of favourable outcomes to the total possible outcomes. (part:whole)

$$P(event) = \frac{favourable}{total} = \frac{part}{whole}$$

For example, the probability of throwing an odd number on a standard die is:

$$P(odd) = \frac{favourable}{total} = \frac{3}{6} = \frac{1}{2}$$

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Probability can be expressed as a fraction, a ratio, a decimal, or a percent.

$P(odd) = \frac{1}{2}$ or $P(odd) = 1:2$ or $P(odd) = 0.5$ or $P(odd) = 50\%$

NOTE:

The probability of an event can range from 0 (impossible) to 1 (certain) or 0 to 100%.

Experimental Probability VS. Theoretical Probability

Experimental probability of event A: $P(A) = \frac{n(A)}{n(T)}$

where $n(A)$ is the number of times event A occurred

and $n(T)$ is the total number of trials, T, in the experiment

Theoretical probability of event A: $P(A) = \frac{n(A)}{n(S)} = \frac{fav}{total} = \frac{part}{whole}$

where $n(A)$ is the number of favourable outcomes for event A

and $n(S)$ is the total number of outcomes in the sample space, S, where all outcomes are equally likely

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Probability VS. Odds

Consider choosing a heart from a deck of cards.

P(heart) = $\frac{13}{52} = \frac{1}{4}$ or $1:4$

When discussing odds, we need to be specific!

It is not enough to ask, "what are the odds?" We need to ask:

"What are the *odds in favour*?" or "What are the *odds against*?"

Odds in favour: the ratio of favourable outcomes to unfavourable outcomes. (fav:unfav) (part:part)

Odds in favour of choosing a heart from a deck of cards is:

$\frac{13}{39} = \frac{1}{3}$ or $1:3$

Odds against: the ratio of unfavourable outcomes to favourable outcomes. (unfav:fav) (part:part)

Odds against choosing a heart from a deck of cards is:

$\frac{39}{13} = \frac{3}{1}$ or $3:1$

NOTE:

The formula for the odds against is the reciprocal of the formula for finding odds in favour of an event.

Example 1:

Identify the following as odds or probability.

a) The chances of rolling a 1 on a fair six-sided die is $\frac{1}{6}$

b) The chances of drawing a 4 from a standard 52-card deck is 1:12.

Example 2:

a) The odds of winning a contest are 5:9. What is the probability of winning the contest?

b) The probability of you passing the next math test is 75%. What are the odds of you passing?

c) A jar contains 3 red marbles and some green marbles. The odds are 3:1 that a randomly chosen marble is green. How many green marbles are in the jar?

NOTE:

All odds and probability calculations begin with 2 of 3 values:

total possibilities, favourable outcomes and non-favourable outcomes,

and we have to determine the third.

In general,

- If the odds in favour of an event is a:b,
  then the total number of possibilities is a+b.
- Therefore, the probability of an event occurring is a:a+b.
- The odds against an event is b:a.
- The probability of an event not happening is b:a+b. (complement)

Example 3: (ex.1, p. 143)

Bailey holds all the hearts from a standard deck of 52 playing cards. He asks Morgan to choose a single card without looking.

Determine the odds in favour of Morgan choosing a face card.

Example 4: (ex. 2, p. 144)

Research shows that the probability of an expectant mother, selected at random, have twins is $\frac{1}{32}$.

a) What are the odds in favour of an expectant mother having twins?

b) What are the odds against an expectant mother have twins?

Example 5: (ex. 3, p. 144)

A computer randomly selects a university student's name from the university database to award a $100 gift certificate for the bookstore. The odds against the selected student being male are 57:43. Determine the probability that the randomly selected university student will be male.

Example 6: (ex. 4, p. 145)

A hockey game has ended in a tie after a 5 min overtime period, so the winner will be decided by a shootout. The coach must decide whether Ellen or Brittany should go first in the shootout. The coach would prefer to use her best scorer first, so she will base her decision on the players' shootout records. Who should go first?

Player	Attempts	Goals Scored
Ellen	13	8
Brittany	17	10

Example 7: (ex. 5, p. 146)

A group of Grade 12 students are holding a charity carnival to support a local animal shelter. The students have created a dice game that they call Bim and a card game that they call Zap. The odds against winning Bim are 5:2, and the odds against winning Zap are 7:3. Which game should Madison play?

Practice Questions:

p. 148-150, # 1, 2, 3, 5, 6, 7, 9, 10,12, 14, 17