

TYPES OF PROBABILITY AND ODDS

Goal:

- to understand the difference in the terms subjective probability, theoretical probability and experimental probability.

- to understand how odds work

- to understand how odds are related to probability

The probability of an event can be determined in different ways.

First, we can think about the outcomes of an experiment and assign a probability.

For example, the probability of pulling an ace out of a deck of cards.

$$P(\text{ace}) = \frac{\text{favorable outcomes}}{\text{total \# outcomes}} = \frac{4}{52} = \frac{1}{13}$$

THIS IS CALLED
THEORETICAL
PROBABILITY.

Second, we can record data and use this information to assign a probability.

For example, the probability of a person making a free throw in basketball.

Using data and past statistics is EXPERIMENTAL PROB.
(EMPIRICAL)

Thirdly, an expert can use their judgement and training to determine the probability of an event.

For example, the probability of rain today.

Using judgement or opinions is SUBJECTIVE probability

Describe whether the following are examples of theoretical, subjective or experimental probability.

a) Las Vegas says the probability of the Habs winning the Cup next year is 2%.

SUBJECTIVE (judgement)

$$\text{Theoretical} = \frac{1}{31} \leftarrow \# \text{ of teams}$$

$$\text{Experimental} = \frac{24}{99} \leftarrow \begin{array}{l} \text{cups won} \\ \text{total} \end{array}$$

b) The probability of a bus being late is 15%.

EXPERIMENTAL (past data)

What are the odds of that?....

(chances)

Odds can be used instead of probability.

Ex:

The odds of Toronto winning the Stanley Cup are 1:12.

The odds of it raining tomorrow are 3:7.

Odds vs Probability

The following compare the odds with the probability.

	Odds for	Probability
Rain	3:7	3/10
Habs win	1:5	1/6
Pass test	4:1	4/5

How are the odds of an event connected to its probability?

ODDS
(ratio)

vs

PROB
(fraction, decimal, %)

favourable : un-favourable
outcomes outcomes

a : b

favourable outcomes
total outcomes

$\frac{a}{a+b}$

Ex: The odds of wining are 5:7.

a) What is the probability of winning?

$$\frac{5}{12}$$

b) What are the odds of losing?

$$7:5$$

c) What is the probability of losing?

$$\frac{7}{12}$$

One of the main uses of odds is for sports betting.

The amount won depends on the odds of a given team winning.

Ex: The odds of a team winning are 1:5.
A \$10 bet is placed. How much do you win?

WINNINGS (PROFIT) is proportional to the odds

$$\frac{\text{ODDS FOR WIN}}{\text{ODDS FOR LOSS}} = \frac{\text{BET}}{\text{WINNINGS}}$$

$$\frac{1}{5} = \frac{\$10}{x}$$

$$x = \$50$$

The odds of a team winning are 5:2.
A \$10 bet is placed. How much do you win?

$$\frac{5}{2} = \frac{\$10}{x}$$

$$5x = \$20$$

$$x = \$4$$

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