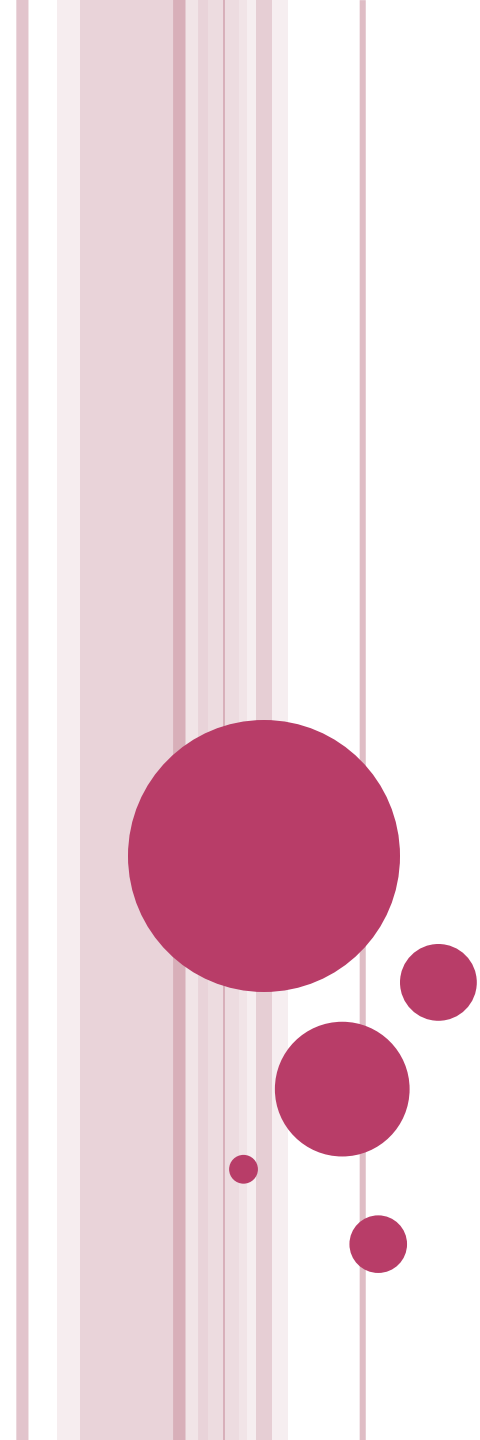


The left side of the slide features a series of vertical stripes in various shades of pink and purple. To the right of these stripes, there are several solid-colored circles of different sizes, also in shades of pink and purple, arranged in a descending, staggered pattern.

PROBABILITY

VOCABULARY

- **Outcome** - one possible result of a probability.
- **Sample Space** - the list of possible outcomes for a probability event.
- **Random** - outcomes that occur at random if each outcome is equally likely to occur.
- **Simple Event** - a specific outcome or type of outcome.
- **Complementary Events** - the events of one outcome happening and that outcomes not happening are complimentary; the sum of the probabilities of complementary events is 1.



REAL WORLD EXAMPLE:

Best Buy is having an IPOD giveaway. They put all the IPOD Shuffles in a bag. Customers may choose an IPOD without looking at the color. Inside the bag are 4 orange, 5 blue, 6 green, and 5 pink IPODS. If Maria chooses one IPOD at random, what is the probability she will choose an orange IPOD?

$$P(\text{orange}) = 4/20 = 2/10 = 1/5 \text{ or } 20\%$$



WHAT IS A PROBABILITY?

- Probability is the chance that some event will happen
- It is the ratio of the number of ways a certain event can occur to the number of possible outcomes

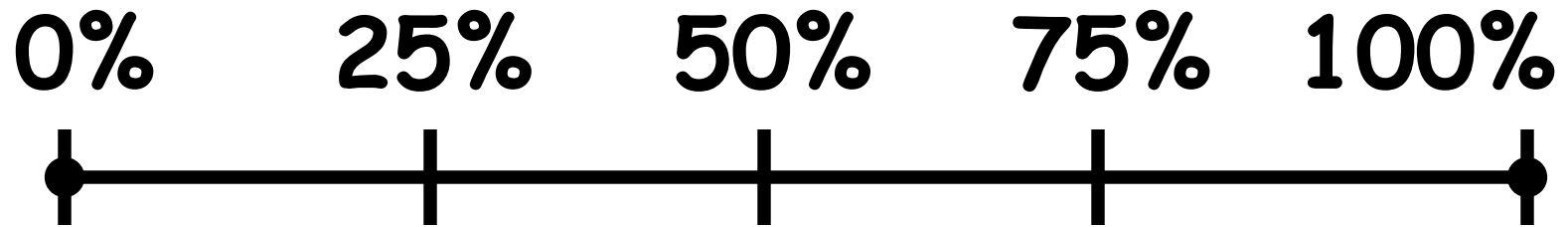
$$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

Examples that use Probability:

(1) Dice, (2) Spinners, (3) Coins, (4) Deck of Cards, (5) Evens/Odds, (6) Alphabet, etc.



What is a PROBABILITY?



0	$\frac{1}{4}$ or .25	$\frac{1}{2}$ Or .5	$\frac{3}{4}$ or .75	1
Impossible	Not Very Likely	Somewhat Likely	Equally Likely	Certain

EXAMPLE 2: ROLL A DICE.

What is the probability of rolling an even number?

$$P(\text{event}) = \frac{\# \text{ favorable outcomes}}{\# \text{ possible outcomes}}$$

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

The probability of rolling an even number is 3 out of 6 or .5 or 50%



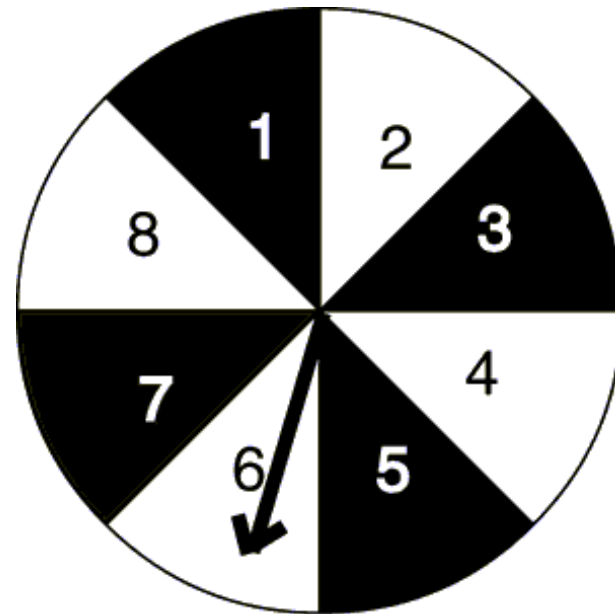
CALCULATE THE PROBABILITY OF EACH INDEPENDENT EVENT.

1) $P(\text{black}) =$

2) $P(1) =$

3) $P(\text{odd}) =$

4) $P(\text{prime}) =$



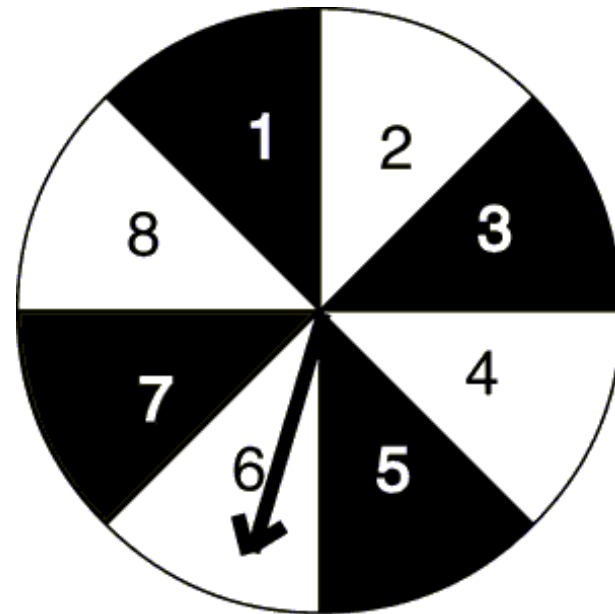
ANSWERS.

1) $P(\text{black}) = \frac{4}{8}$

2) $P(1) = \frac{1}{8}$

3) $P(\text{odd}) = \frac{1}{2}$

4) $P(\text{prime}) = \frac{1}{2}$



REAL WORLD EXAMPLE:

A computer company manufactures 2,500 computers each day. An average of 100 of these computers are returned with defects. What is the probability that the computer you purchased is not defective? (complementary event)

$$P(\text{not defective}) = \frac{\# \text{ not defective}}{\text{total \# manufactured}} = \frac{2,400}{2,500} = \frac{24}{25}$$



EXPERIMENTAL VS. THEORETICAL

Experimental probability:

$$P(\text{event}) = \frac{\text{number of times event occurs}}{\text{total number of trials}}$$

Theoretical probability:

$$P(E) = \frac{\text{number of favorable outcomes}}{\text{total number of possible outcomes}}$$



EXPERIMENTAL PROBABILITY

Experimental probability is found by repeating an **experiment** and observing the **outcomes**.

$P(\text{head}) = 3/10$

A head shows up 3 times out of 10 trials,

$P(\text{tail}) = 7/10$

A tail shows up 7 times out of 10 trials



THEORETICAL PROBABILITY

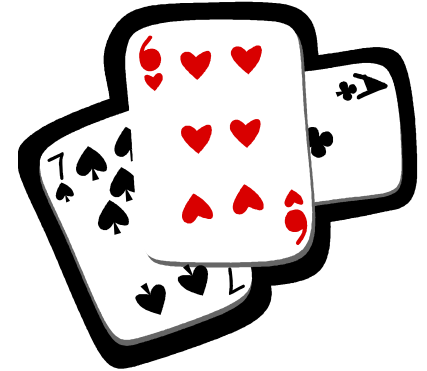
$$P(\text{head}) = 1/2$$

$$P(\text{tail}) = 1/2$$

Since there are
only two outcomes,
you have 50/50 chance to get
a head or a tail.



- 3. Select a card from an ordinary deck of playing cards (no jokers)
- The sample space would consist of the 52 cards, 13 of each suit. We have 13 clubs, 13 spades, 13 hearts and 13 diamonds.



- A **simple event**: the selected card is the two of clubs. A **compound event** is the selected card is red (there are 26 red cards and so there are 26 simple events comprising the compound event)
4. Select a driver randomly from all drivers in the age category of 18-25. (Identify the sample space, give an example of a simple event and a compound event)



SAMPLE SPACE OF ALL POSSIBLE OUTCOMES WHEN TWO DICE ARE TOSSED.

- (1,1), (1,2), (1,3), (1,4), (1,5) (1,6)
- (2,1), (2,2), (2,3), (2,4), (2,5), (2,6)
- (3,1), (3,2), (3,3), (3,4), (3,5), (3,6)
- (4,1), (4,2), (4,3), (4,4), (4,5), (4,6)
- (5,1), (5,2), (5,3), (5,4), (5,5), (5,6)
- (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)
- Quite a tedious project !!



EXAMPLE:

- Probability of a sum of 7 when two dice are rolled. First we must calculate the number of events of the sample space.
 - From our previous slide, we know that there are 36 possible sums that can occur when two dice are rolled.
 - Of these 36 possibilities, how many ways can a sum of seven occur?
 - Looking back at the slide that gives the sample space we find that we can obtain a sum of seven by the outcomes $\{ (1,6), (6,1), (2,5), (5,2), (4,3), (3,4) \}$
 - There are six ways to obtain a sum of seven. The outcome $(1,6)$ is different from $(6,1)$ in that $(1,6)$ means a one on the first die and a six on the second die, while a $(6,1)$ outcome represents a six on the first die and one on the second die.
- 

EXAMPLE:

- Toss two coins. Find the probability of at least one head appearing.
- Solution: At least one head is interpreted as one head or two heads.
- Step 1: Find the sample space: { HH, HT, TH, TT }
There are four possible outcomes.
- Step 2: How many outcomes of the event “at least one head” Answer: 3 : { HH, HT, TH }



SOME PROPERTIES OF PROBABILITY

- The first property states that the probability of any event will always be a decimal or fraction that is between 0 and 1 (inclusive). If $P(E)$ is 0, we say that event E is an **impossible event**. If $p(E) = 1$, we call event E a certain event. Some have said that there are two certainties in life: death and taxes.
- The second property states that the sum of all the individual probabilities of each event of the sample space must equal one.

