PROBABILITY LESSON 1

RANDOM EVENT: an event whose result cannot be predicted with absolute certainty

Examples

Random	Not random
● getting stung by a bee ● winning the lottery ● tossing a coin or die	● getting older ● rolling a number BETWEEN 0 and 7 on a die

PROBABILITY is related to the likelihood that something will happen.
P(A) represents the probability that event "A" will occur, it can be represented as a fraction, decimal or percent.

Ex. What is the probability that the sun will rise in the east tomorrow?
Answer: P(sun will rise in the east tomorrow) = 100% or 1
(this is definitely NOT a random event)

Ex. What is the probability that you will roll a 5 on a regular die? (dice is plural)
Answer: P(5) = 1/6 or .17 or 17%

A **CERTAIN EVENT** has a 100% of happening.

Ex. There will be snow during the winter somewhere in Canada.
Getting burned if you touch a hot stove.
Rolling a number less than 7 on a regular die.

An **IMPOSSIBLE EVENT** has NO chance (0%) of happening.

Ex. A live shark flying through the class window in the next 15 seconds.
Rolling a number greater than 6 on a regular die.

<u>THE COMPLEMENT OF AN EVENT</u> (we represent this with an apostrophe `)
This is the probability that an event will NOT occur. The probability of an event plus the probability of it's complementary event will always add up to 1 (or 100%)

Ex. If R is the event that it will rain tomorrow and P(R) = 0.3
Then the probability that it will NOT rain tomorrow is P(R`) = 1 – 0.3 or 0.7

The **<u>SAMPLE SPACE,</u>** often represented by the **<u>OMEGA SYMBOL</u>**, Ω, is used to represent all possible outcomes for a given situation.

Ex. Ω = {1, 2, 3, 4, 5, 6} for rolling a die
Ω = {heads, tail} for tossing a coin
Ω = {red, blue, yellow} for picking a primary colour
Ω = {I, II, III, IV} for choosing a quadrant in a Cartesian Plane
Ω = {on, off} for a light switch

<u>COMBINATIONS</u> = Total # of Possible Outcomes (multiply!!) = the number of elements in Ω

- this makes up the denominator of the probability ratio

When you are asked to calculate all possible outcomes for a given situation, you **multiply.**

Ex. I have 3 pairs of pants, 5 shirts and 4 pairs of shoes. How many different outfits can I create?

(3) (5) (4) = 60 combinations of outfits (or 60 different outcomes)
(pants) (shirts)(shoes)

Ex. I roll a regular 6-sided die twice

(6 outcomes on the 1^{st} roll) (6 outcomes on the 2^{nd} roll) = 36 different outcomes

Ex. I flip a coin 3 times

(2 outcomes on 1^{st} toss) (2 outcomes on 2^{nd} toss) (2 outcomes on 3^{rd} toss) = 8 different outcomes

<u>SIMPLE VS COMPOUND EVENTS</u>

Random experiments can either be simple (one event) or compound (more than one event).

Examples

Simple Events	**Compound Events**
• picking one card from a deck • drawing one name from a hat • rolling a die once • flipping a coin once	• taking 2 marbles from a jar • rolling a die twice • rolling two dice • flipping a coin twice • flipping three coins • flipping a coin once AND rolling a die once

Here is how you could record <u>some</u> of the possible outcomes in a compound experiment.

Ex. Flip a coin and roll a die. (H, 4) (H,3) (T, 1)

Ex. Tossing 2 dice four times. (6, 2) (3, 4) (1, 1) (5, 3)

Ex. Flipping three coins twice. (H, H, T) (T, T, T) (T, H, T)

<u>PROBABILITY OF COMPOUND EVENTS</u>

To calculate the probabilities that multiple events WILL occur, we **multiply** each of the probabilities

Ex. If the probability of it raining today is 0.2 and the probability of it raining tomorrow is 0.3, then:

P(rain today AND rain tomorrow) = (0.2)(0.3)

= 0.06 or 6%

DEPENDENT VS INDEPENDENT EVENTS

Compound events can be independent or dependent.

INDEPENDENT (one outcome has **NO effect** on the probability of the next outcome) ** **WITH REPLACEMENT**	**DEPENDENT** (the outcome of one event DOES effect the probability of another outcome) ****WITHOUT REPLACEMENT**
If I roll a 5 on a die, it does NOT change the likelihood of what I will roll next What I get on the spinner the first time does not change the probability of what I get on the spinner the next time. If I have 2 red marbles and 3 blue marbles in a bag. I pick one marble, **put it back** in the bag and choose a 2nd marble, then all of the probabilities each time I choose remain the same. P(both red) = $\frac{2}{5} \cdot \frac{2}{5}$ $= \frac{4}{25}$ or 16%	If I have 2 red marbles and 3 blue marbles in a bag. I pick one marble, **DO NOT put it back** in the bag and choose a 2nd marble, then the probabilities of getting red & blue for the 2nd marble will be different. P(both red) = $\frac{2}{5} \cdot \frac{1}{4}$ (if the 1st is red, then there is only 1 red left out of 4 marbles) $= \frac{2}{20}$ $= \frac{1}{10}$ or 10%