Random circumstance 🡪 anything where the outcome is unknown

Eg. Flipping a coin/rolling a dice/ buying a lotto ticket/speeding and hoping not to get caught

Probability: number between 0 and 1

--Associated with an outcome of the random occurrence

--Representing how likely that outcome is

**Relative frequency probability:**

Probability is the proportion of times where that outcome would occur ***IN THE LONG RUN***

Assume something and calculate theoretical.

Ex: coins are fair. P(heads)=1/2

Repeat many times and actually find proportion empirical.

Ex: P(stuck)=2/70

*Ex*1:

About 3% of buses are late=A randomly chosen bus has a 3% chance of being late.

BUT your bus isn’t a random bus.

**Personal probability (Subjective probability):**

Degree which you believe the outcome will happen.

***One*** *possible outcome -* ***simple event***

***Collection*** *of all outcomes -* ***sample space***

*Any* ***set of******one or more*** *outcomes –* ***event***

*Any* ***set or two or more*** *outcomes –* ***compound event***

*Ex3:*

Flip 2 coins:

Sample space: {TT, HH, HT, TH}

No tails: {HH}🡪 simple event

Not all tails: {HT, TH, HH}🡪compound event

Probability rules

-always between 0(impossible) and 1 (certain)

-**sum** of probabilities for all simple events in sample space is **1**.

If all simple events are equally likely and there are k of them. P=1/k

*Ex4:*

P(glasses)=13/31 , P(6)=1/6 , P(2heads on 3coin flips)=3/8 {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}

Complementary events:

Have no simple events in common, and together include the whole sample space.

2 coins---“not all tails” and “all tails” A Ac

If one event is A, complement Ac

P(A)+P(Ac)=1 🡪 P(Ac)=1-P(A)

*EX5:*

P(online class)=0.198=19.8%

P(no online class)=1-0.198=0.802=80.2%

**Mutually exclusive events (disjoint events)**

🡪 Have no simple events in common

***Ex6***

“roll 3” and “roll even” are mutually exclusive

“roll 3” and “roll odd” are not mutually exclusive

**Independent and dependent events:**

Independent: knowing that one occurs does not change the probability of the other event.

Dependent: knowing that one happen does change probability.

7 marble in a bag, 5 blue 2red. Pick one randomly

P(blue)=5/7 P(2nd is blue) with placement-put it back=5/7 without placement(dependent)=4/6

***Conditional probabilities:***

P(B)—probability of event B(unconditional)

P(B|A) --- “probability of B, given A”

Conditional probability of b given that we know a happened/will happen,

P(roll 6|rolled even)=1/3 {~~1~~,2,~~3~~,4,~~5~~,6,}

P(roll even|rolled 6)=1

P(B|A)doesn’t equal to P(A|B)

P(draw blue|drew blue w/o replacement)=2/3

P(black card|drew a red card)=26/51

How to tell if events are **independent**?

🡪read-life context makes in obvious.

🡪P(A|B)=P(A), P(B|A)=P(B)

🡪P(A and B)=P(A)\*P(B)

**The word “or”**

**“would you like coffee or (exclusive or, one or another, not both) tea?”**

**“would you like cream or (inclusive or, and/or, can be both) sugar?”**

**In math always use inclusive “or”\*\***