

PROBABILITY

(CHANCE OF SOMETHING HAPPENING)

NON-NUMERICAL PROBABILITY / LIKELIHOOD : WE USE

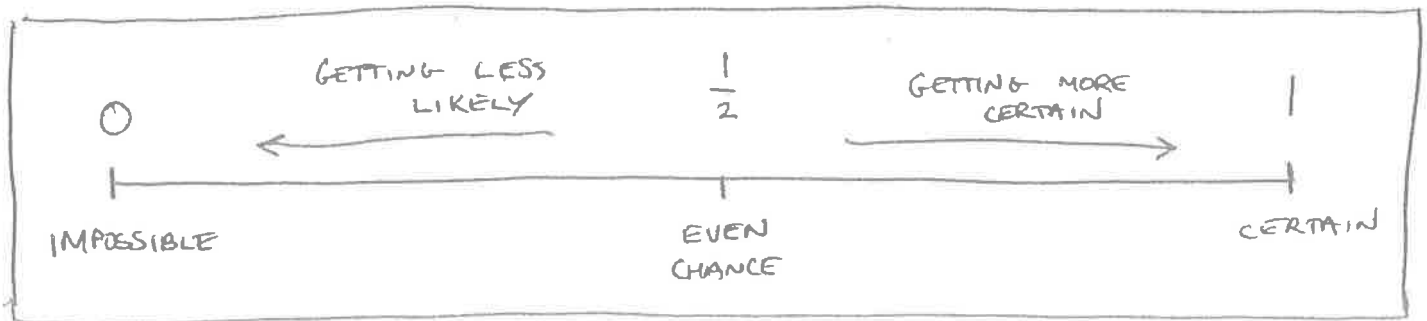
- IMPOSSIBLE
- CERTAIN
- LIKELY
- UNLIKELY
- EVEN CHANCE
- etc.

NOTE: EVEN CHANCE DOES NOT MEAN THE SAME THING AS EQUALLY LIKELY!

eg THE PROBABILITY OF GETTING A "HEAD" FROM THE TOSS OF A COIN IS EVEN CHANCE. (OR 50/50)

BUT THE PROBABILITY OF A DICE LANDING ON A 3 IS NOT EVEN CHANCE - EVEN THOUGH IT IS EQUALLY LIKELY TO LAND ON A 3 AS ANY OTHER NUMBER.

WE MEASURE PROBABILITY OR LIKELIHOOD ON A SCALE FROM 0 (IMPOSSIBLE) TO 1 (CERTAIN)



PROBABILITY IS NUMERICAL. IT MUST BE BETWEEN 0 AND 1. WE USUALLY WRITE PROBABILITY AS A FRACTION (BUT IT IS OFTEN ^{WRITTEN AS} A DECIMAL TOO).

$$\text{PROBABILITY} = \frac{\text{NUMBER OF DESIRABLE OUTCOMES}}{\text{TOTAL NUMBER OF POSSIBLE OUTCOMES}}$$

THIS IS THE NUMBER OF OUTCOMES WHICH MATCH WHATEVER WE'RE CALCULATING THE PROBABILITY OF

eg PROBABILITY OF SELECTING A "HEART" FROM A DECK OF CARDS = $\frac{13}{52}$

← NUMBER OF HEARTS
← TOTAL NUMBER OF CARDS

(FOR MORE ON "OUTCOMES" SEE NOTES ON COUNTING / PERMUTATIONS)

RELATIVE FREQUENCY — ALSO KNOWN AS EXPERIMENTAL PROBABILITY

• BASED ON OBSERVATIONS / TRIALS OF ACTUAL EVENTS (eg ROLLING A DICE / SCORING A PENALTY etc)

$$\text{RELATIVE FREQUENCY} = \frac{\text{NUMBER OF TIMES THAT EVENT HAPPENS}}{\text{NUMBER OF TRIALS CARRIED OUT}}$$

eg. IF I ROLL A DICE 100 TIMES AND GET A "SIX" 20 TIMES, THEN THE RELATIVE FREQUENCY OF GETTING A SIX IS $\frac{20}{100}$ (WE SAY 20 'OUT OF' 100)

IMPORTANT

THE MORE TIMES WE CARRY OUT THE EXPERIMENT / TRIALS, THE MORE RELIABLE THE RELATIVE FREQUENCY BECOMES.

So IF I TOSS A COIN FIVE TIMES AND GET FOUR TAILS, IT DOESN'T MEAN IT'S A BIASED COIN, BUT IF I TOSS IT 5,000 TIMES AND GET 4,000 TAILS, WE CAN PROBABLY SUGGEST THE COIN MUST BE BIASED! → **BIASED = UNFAIR**

EXPECTED FREQUENCY — HOW MANY TIMES WOULD WE EXPECT A CERTAIN EVENT HAPPENS?

ANSWER: MULTIPLY THE NUMBER OF TRIALS BY THE PROBABILITY OR THE RELATIVE FREQUENCY,

eg IF A SPINNER LANDS ON RED 50 TIMES OUT OF 75 SPINS, HOW MANY TIMES SHOULD IT LAND ON RED IF I SPIN IT 200 TIMES

$$\text{EXPECTED FREQUENCY} = 200 \times \frac{50}{75}$$

RELATIVE FREQUENCY

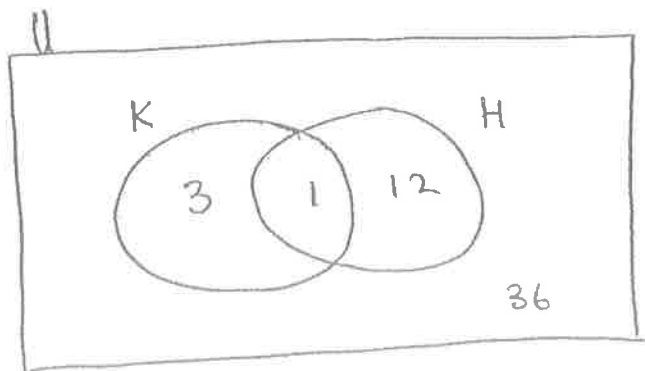
COMBINED EVENTS (MORE THAN ONE EVENT HAPPENS)

- 1) USING TREE DIAGRAM / TWO-WAY TABLE / SYSTEMATIC LISTING, WRITE DOWN ALL THE COMBINED OUTCOMES WHICH ARE POSSIBLE.
- 2) USE SAME RULES OF PROBABILITY AS BEFORE.
i.e. HOW MANY COMBINED OUTCOMES MATCH WHAT WE'RE LOOKING FOR?

VENN DIAGRAMS (SETS)

- THESE CAN BE VERY USEFUL FOR CALCULATING PROBABILITIES SUCH AS AND / OR

eg THE EXAMPLE ABOVE



#U = TOTAL NUMBER OF CARDS

#K = NUMBER OF KINGS

#H = NUMBER OF HEARTS.

eg (i) Q. WHAT'S THE PROBABILITY OF GETTING A KING OR A HEART?

A. $3 + 1 + 12 = 16$, SO $\frac{16}{52}$

(ii) Q. WHAT'S THE PROBABILITY OF GETTING A KING AND A HEART

A. $\frac{1}{52}$ (THE "INTERSECTION")