

THE PROBABILITY SCALE

PROBABILITY OF BEING BORN ON A TUESDAY

PROBABILITY OF FAIR COIN LANDING ON HEADS

PROBABILITY OF CHOOSING A BLACK BALL FROM THE BAG

PROBABILITY OF ROLLING A SEVEN

PROBABILITY THAT A MULTIPLE OF 10 WILL BE AN EVEN NUMBER

IMPOSSIBLE UNLIKELY 50/50 OR EVEN LIKELY CERTAIN

SPIN THE SPINNER TWICE

THE FIRST SPIN HAS NO IMPACT ON THE SECOND SPIN

THE SPINS ARE INDEPENDENT

PROBABILITIES FOR THE SECOND SPIN STAY THE SAME

BLACK AND BLACK

MULTIPLY THE PROBABILITIES

PROBABILITY OF BLACK → BLACK = $\frac{3}{8} \times \frac{3}{8} = \frac{9}{64}$

PROBABILITY OF BLACK → WHITE = $\frac{3}{8} \times \frac{5}{8} = \frac{15}{64}$

PROBABILITY OF WHITE → BLACK = $\frac{5}{8} \times \frac{3}{8} = \frac{15}{64}$

PROBABILITY OF WHITE → WHITE = $\frac{5}{8} \times \frac{5}{8} = \frac{25}{64}$

PROBABILITY OF THE SAME COLOUR TWICE = OR = $\frac{9}{64} + \frac{25}{64} = \frac{34}{64} = \frac{17}{32} = 53.1\%$

ADD THE PROBABILITIES

PROBABILITY OF TWO HEADS AND ONE TAIL IN ANY ORDER

EVERYONE IS IN THE RECTANGLE

A AND J DO BOTH

B DOES NEITHER

8 EQUALLY LIKELY OUTCOMES

THROW 3 FAIR COINS

PROBABILITY OF TWO HEADS AND ONE TAIL IN ANY ORDER = $\frac{3}{8}$

THE PROBABILITY THAT A RANDOM STUDENT FROM THE CLASS PLAYS SPORT BUT NOT MUSIC = $\frac{5}{12}$

12 STUDENTS IN THE CLASS

ABCDEF GHIJKL

MUSIC

SPORT

VENN DIAGRAMS

ROLL THE DIE

SUM THE SCORES

PROBABILITY OF SUM OF 8, 9 OR 10 = $\frac{6}{24} = \frac{1}{4} = 0.25$

PROBABILITY OF A SINGLE EVENT

ROLL A FAIR DIE ONCE

THE PROBABILITY OF AN EVENT = $\frac{\text{NUMBER OF OUTCOMES WHERE THE EVENT OCCURS}}{\text{TOTAL NUMBER OF EQUALLY LIKELY OUTCOMES}}$

ESTIMATE HOW MANY TIMES YOU WOULD ROLL MORE THAN 4 IF YOU ROLL THE DIE 150 TIMES

PROBABILITY OF ROLLING MORE THAN 4 = $\frac{2}{6} = \frac{1}{3}$

$\frac{1}{3} \times 150 = 50$

TREE DIAGRAMS

CHOOSE TWO BALLS FROM THE BAG (WITHOUT REPLACING THE FIRST ONE)

THE FIRST CHOICE IMPACTS THE SECOND CHOICE

THE CHOICES ARE DEPENDENT

PROBABILITIES FOR THE SECOND CHOICE CHANGE DEPENDING ON THE FIRST CHOICE

PROBABILITY OF BLACK → BLACK = $\frac{3}{8} \times \frac{2}{7} = \frac{6}{56}$

PROBABILITY OF BLACK → WHITE = $\frac{3}{8} \times \frac{5}{7} = \frac{15}{56}$

PROBABILITY OF WHITE → BLACK = $\frac{5}{8} \times \frac{3}{7} = \frac{15}{56}$

PROBABILITY OF WHITE → WHITE = $\frac{5}{8} \times \frac{4}{7} = \frac{20}{56}$

PROBABILITY OF THE SAME COLOUR TWICE = OR = $\frac{6}{56} + \frac{20}{56} = \frac{26}{56} = \frac{13}{28} = 46.4\%$

LIST OUTCOMES

PROBABILITY OF COMBINED EVENTS

SPACE DIAGRAM

ROLL THE DIE

SUM THE SCORES

SPIN THE SPINNER

PROBABILITY OF SUM OF 8, 9 OR 10 = $\frac{6}{24} = \frac{1}{4} = 0.25$

VENN DIAGRAMS

12 STUDENTS IN THE CLASS

ABCDEF GHIJKL

MUSIC

SPORT

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ROLL THE DIE

SUM THE SCORES

SPIN THE SPINNER

PROBABILITY OF SUM OF 8, 9 OR 10 = $\frac{6}{24} = \frac{1}{4} = 0.25$

PROBABILITIES SUM TO ONE

THE PROBABILITY OF AN EVENT NOT HAPPENING = 1 - THE PROBABILITY THE EVENT HAPPENS

THE PROBABILITIES OF ALL THE POSSIBLE OUTCOMES MUST SUM TO 1

CHOOSE A BALL AT RANDOM FROM THE BAG

PROBABILITY OF CHOOSING A BLACK BALL = $\frac{2}{9}$

PROBABILITY OF NOT CHOOSING A BLACK BALL = $1 - \frac{2}{9} = \frac{7}{9}$

RESULT: WIN 0.6, DRAW 0.15, LOSE ?

PROBABILITY OF LOSING = $1 - 0.6 - 0.15 = 0.25$

PROBABILITY OF COMBINED EVENTS

SPACE DIAGRAM

ROLL THE DIE

SUM THE SCORES

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SPACE DIAGRAMS

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TWO-WAY TABLES

HOW STUDENTS COME TO SCHOOL

	WALK	BUS	CYCLE	TOTAL
BOYS	42	70	29	141
GIRLS	59	37	13	109
TOTAL	101	107	42	250

THE PROBABILITY A RANDOM STUDENT IS A BOY WHO CYCLES = $\frac{29}{250}$

THE PROBABILITY A RANDOMLY CHOSEN STUDENT IS FEMALE = $\frac{40 + 49}{192} = \frac{89}{192}$

RELATIVE FREQUENCY

THEORETICAL PROBABILITY

PROBABILITY OF WIN = $\frac{2}{5} = 40\%$

ASSUMING ALL SECTORS HAVE AN EQUAL CHANCE

EXPERIMENTAL PROBABILITY

ESTIMATING THE PROBABILITY FROM REPEATED TRIALS

NUMBER OF WINS	5	18	42	196	403
NUMBER OF TRIALS	10	50	100	500	1000
RELATIVE FREQUENCY	50%	36%	42%	39.2%	40.3%

RELATIVE FREQUENCY = $\frac{\text{NUMBER OF WINS}}{\text{NUMBER OF TRIALS}}$

MORE TRIALS → MORE RELIABLE THE ESTIMATE

MEAN, MEDIAN, MODE

MEASURE THE CENTRE OF THE DATA

RANGE MEASURES THE SPREAD OF THE DATA

FROM A LIST OF DATA

MEAN, MEDIAN, MODE + RANGE

TEST: 11 8 14 10 5 19 14 8 16 14

MODE = 14 (OCCURS 3 TIMES)

MEAN = $\frac{11+8+14+10+5+19+14+8+16+14}{10} = \frac{119}{10} = 11.9$

MEDIAN = 11 (MIDDLE VALUE)

MEAN, MEDIAN, MODE + RANGE

FROM A LIST OF DATA

MEAN, MEDIAN, MODE + RANGE

TEST: 11 8 14 10 5 19 14 8 16 14

MODE = 14 (OCCURS 3 TIMES)

MEAN = $\frac{11+8+14+10+5+19+14+8+16+14}{10} = \frac{119}{10} = 11.9$

MEDIAN = 11 (MIDDLE VALUE)

FREQUENCY TREES

YEAR 12: MALE 65, FEMALE 40

YEAR 13: MALE 38, FEMALE 49

THE PROBABILITY A RANDOMLY CHOSEN STUDENT IS FEMALE = $\frac{40 + 49}{192} = \frac{89}{192}$

COLLECTING DATA

DISCRETE DATA

PRIMARY DATA

CONTINUOUS DATA

SECONDARY DATA

COLLECTED BY YOURSELF

TOO EXPENSIVE OR TIME CONSUMING TO ASK THE WHOLE POPULATION

QUICKER AND CHEAPER TO ASK A SAMPLE

POPULATION

SAMPLE

BUT... SAMPLE IS ONLY A SELECTION OF OPINIONS AND CAN BE BIASED

SCATTER GRAPHS

DISPLAY PAIRS FROM TWO SETS OF DATA

LINE OF BEST FIT

CAUSATION

CORRELATION NOT CAUSATION

ICE CREAM SALES

SUNGLASSES SALES

OUTLIER

A POINT WHICH DOES NOT FIT THE PATTERN OF THE REST OF THE DATA

STRONG NEGATIVE CORRELATION

WEAK NEGATIVE CORRELATION

NO CORRELATION

WEAK POSITIVE CORRELATION

STRONG POSITIVE CORRELATION

THE CONNECTION BETWEEN THE TWO SETS OF DATA

BAR CHART

WHAT IS YOUR FAVOURITE TYPE OF PIZZA?

FREQUENCY TABLE

PIZZA	TALLY	FREQ.
MARGHERITA		4
PEPPERONI		4
BBQ CHICKEN		5
HAWAIIAN		3
OTHER		4
TOTAL		20

PICTOGRAM

PIZZA

FREQUENCY

MARGHERITA

PEPPERONI

BBQ CHICKEN

HAWAIIAN

OTHER

● = 4 PEOPLE

PIE CHART

PIE CHART

ANGLE

100.8°

64.8°

129.6°

21.6°

43.2°

360°

FREQUENCY 50

FREQUENCY $\times 360^\circ = \text{ANGLE}$

CONDITIONAL PROBABILITY

PROBABILITY A STUDENT TAKES THE BUS GIVEN THEY ARE A GIRL = $\frac{37}{109}$

90 STUDENTS ARE ASKED HOW LONG IT TAKES THEM TO COME TO SCHOOL

HISTOGRAMS

CLASS WIDTH	TIME (mins)	FREQ.	FREQUENCY DENSITY
5	0 ≤ t < 5	9	9 ÷ 5 = 1.8
5	5 ≤ t < 10	17	17 ÷ 5 = 3.4
10	10 ≤ t < 20	15	15 ÷ 10 = 1.5
10	20 ≤ t < 30	31	31 ÷ 10 = 3.1
30	30 ≤ t < 60	18	18 ÷ 30 = 0.6

THE WIDTH OF EACH INTERVAL

FREQUENCY = FREQUENCY DENSITY \times CLASS WIDTH

THE AREA OF EACH BAR IS EQUAL TO THE FREQUENCY OF THAT CLASS

30 \times 0.6 = 18

CUMULATIVE FREQUENCY

THE HEIGHTS OF 120 STUDENTS IN A SCHOOL ARE RECORDED

CUMULATIVE FREQUENCY

JOIN POINTS WITH SMOOTH CURVE

HEIGHT, h (cm)	FREQUENCY
130 ≤ h < 140	5
140 ≤ h < 150	13
150 ≤ h < 160	20
160 ≤ h < 170	39
170 ≤ h < 180	28
180 ≤ h < 190	15

TO FIND THE UPPER QUARTILE: 3/4 of 120 = 90

TO FIND THE MEDIAN: 1/2 of 120 = 60

TO FIND THE LOWER QUARTILE: 1/4 of 120 = 30

LOWER QUARTILE = 156 cm

MEDIAN = 166 cm

UPPER QUARTILE = 173 cm

INTER-QUARTILE RANGE = UPPER QUARTILE - LOWER QUARTILE = 173 - 156 = 17

A MEASURE OF SPREAD NOT AFFECTED BY OUTLYING VALUES

REPRESENTING DATA

REPRESENTING DATA

PIZZA

FREQUENCY

MARGHERITA

PEPPERONI

BBQ CHICKEN

HAWAIIAN

OTHER

● = 4 PEOPLE

BOX PLOTS

BOX PLOTS

A VISUAL REPRESENTATION OF THE MEDIAN, QUANTILES, MAXIMUM AND MINIMUM

LOWER QUARTILE = 156 cm

MEDIAN = 166 cm

UPPER QUARTILE = 173 cm

MINIMUM = 137 cm

MAXIMUM = 188 cm

INTER-QUARTILE RANGE = 173 - 156 = 17

A MEASURE OF SPREAD NOT AFFECTED BY OUTLYING VALUES

SCATTER GRAPHS

STUDENT HEIGHT (cm)

HANDSPAN (cm)

STUDENT	A	B	C	D	E	F	G
HEIGHT (cm)	132	139	151	157	165	173	180
HANDSPAN (cm)	17.7	19.2	20.9	19.7	21.5	17.8	21.8

HANDSPAN = 23.2 cm

LESS RELIABLE PREDICTION AS HEIGHT 190 cm IS OUTSIDE THE RANGE OF THE DATA SET

EXTRAPOLATION

HANDSPAN = 19.6 cm

MORE RELIABLE PREDICTION AS HEIGHT 150 cm IS INSIDE THE RANGE OF THE DATA SET

PREDICT HANDSPAN FOR HEIGHT OF 150 cm

USE THE LINE OF BEST FIT

PREDICT HANDSPAN FOR HEIGHT OF 190 cm

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REPRESENTING DATA

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CUMULATIVE FREQUENCY

JOIN POINTS WITH SMOOTH CURVE

HEIGHT, h (cm)	CUMULATIVE FREQUENCY
h < 140	5
h < 150	18
h < 160	38
h < 170	77
h < 180	105
h < 190	120

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