Toynbee Curriculum
Knowledge Maps

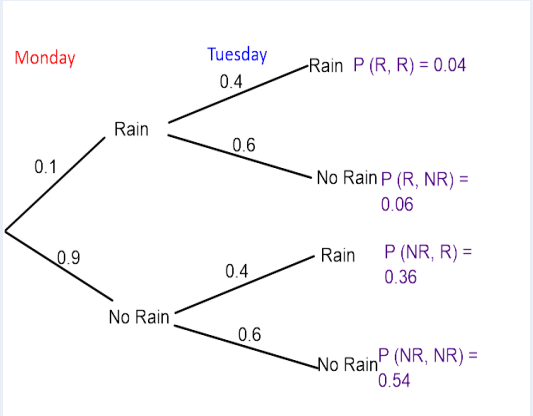
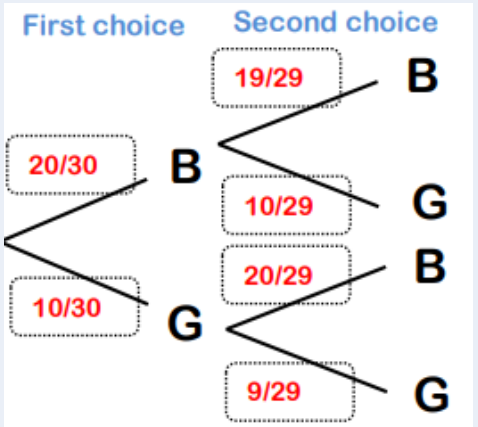
MATHS (Data and Probability)

Toynbee School

SIMPLE PROBABILITY

Keywords:	Trial, Event, Outcome, Random, Experimental probability, Relative frequency, Theoretical probability, Estimate, Independent			
Definition / Description:	Trial: a test or experiment Event: an occurrence or outcome Outcome: possible results of an experiment Random: Something that happens without bias Biased: having a tendency towards something away from the normal Mutually Exclusive: events that cannot happen at the same time Estimate: give an approximation of the actual value Independent: events that do not depend on each other			
Knowledge points –	**Experimental probability** (Relative frequency): a probability that is determined on the basis of a series of experiments	**Theoretical probability**: what is expected to happen based on the possible outcomes, assuming equalling likely events	**The OR rule**: In mutually exclusive events, to find the probability of one event OR another event happening we ADD the probabilities	**The AND rule**: In Independent events, to find the probability of one event AND another happening, we MUTLIPLY the probabilities
Knowledge point examples:	Experimental Probability is found by repeating an experiment and observing the outcomes. $P(\text{event}) = \frac{\text{number of times event occurs}}{\text{total number of trials}}$ Example: A coin is tossed 10 times: A head is recorded 7 times and a tail 3 times. $P(\text{head}) = \frac{7}{10}$ $P(\text{tail}) = \frac{3}{10}$	Theoretical Probability is what is expected to happen based on mathematics $P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{total number of possible outcomes}}$ Example: A coin is tossed. $P(\text{head}) = \frac{1}{2}$ $P(\text{tail}) = \frac{1}{2}$	P (A OR B) = P(A) + P(B) When two dice are rolled, the probability of getting a 3 OR a 4 = P (3 and 4) = P(3) + P(4) $= \frac{1}{6} + \frac{1}{6}$ $= \frac{2}{6}$ $= \frac{1}{3}$	P (A and B) = P(A) x P(B) When two dice are rolled, the probability of getting a 3 AND a 4 = P (3 and 4) = P(3) x P(4) $= \frac{1}{6} \times \frac{1}{6}$ $= \frac{1}{36}$
Linked Knowledge Maps:	Further Probability Fractions Ratio			

FURTHER PROBABILITY

Keywords:	Event / Independent / Dependent / Conditional			
Definition / Description:	**Event:** A particular result or set of results amongst the possibilities	**Independent:** events that have no impact on each other's results.	**Dependent:** events that have an impact on each other's results.	**Conditional:** the probability of an event (A), given that another (B) has already occurred
Knowledge points:	Tree diagrams Independent events: The outcome of the 1st event does not effect the probability of the 2nd event	Tree Diagrams Dependent events: The probability of the 2nd event is dependent on the outcome of the 1st event	Conditional Probability: The probability of second event given the outcome of the first	
Knowledge point examples:	The probability of it raining on Monday and Tuesday is shown in the tree diagram. Find the probability it rains on both days: P(RR) = 0.1 x 0.4 = 0.04 Find the probability it rains on one day: P(NRR) + P(RNR) = 0.06 + 0.36 = 0.42 	There are 20 boys and 10 girls in a class. Two pupils are chosen at random. What is the probability that a girl and boy are chosen? P(GB) + P(BG) = $\left(\frac{10}{30} \times \frac{19}{29}\right) + \left(\frac{20}{30} \times \frac{10}{29}\right) = \frac{40}{87}$ 	What is the probability of choosing a boy given they travel by car? $\frac{9}{13}$ |	Walk	Car	Total
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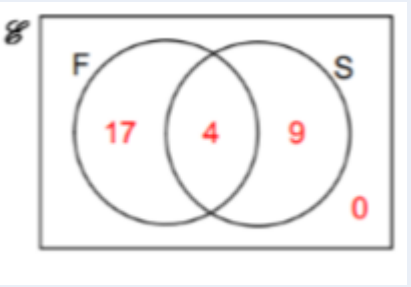
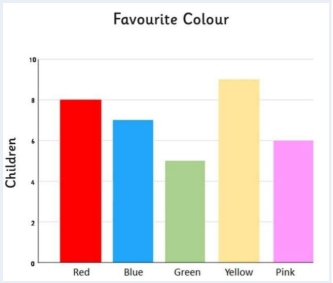
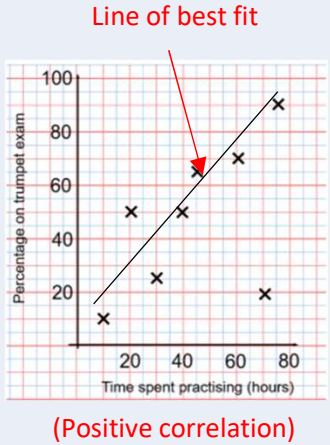
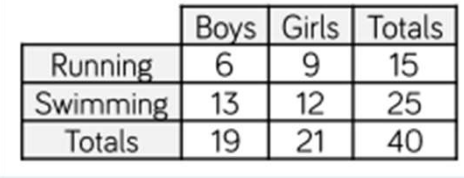
Boys	16	9	25
Girls	18	4	22
Total	34	13	47	 What is the probability that a student, *given* they study French, studies Spanish? $= \frac{17}{21}$ 
Linked Knowledge Maps:	Basic Probability Fractions Ratio			

STATISTICS – UNGROUPED DATA

Keywords:	Data / Sample / Frequency Table / Correlation / Discrete Data / Continuous Data					
Definitions/ Descriptions	**Data**: A collection of numbers or information	**Sample**: Contains all possible outcomes of an experiment	**Frequency Table**: An arrangement of data in columns	**Correlation**: The connection between two variables	**Discrete Data**: Separate or distinct items of data	**Continuous Data**: Data that is arranged into groups with no gaps
Knowledge points:	**Bar Chart** - uses bars of equal lengths to represent statisitics	**Pie Chart** – uses different sized sectors of a circle to represent data	**Pictogram –** a chart that uses pictures or symbols to represent data	**Scatter Graph** – compares two variables by plotting one value against the other	**Two Way Table** – used when handling data to illustrate two variables	
Knowledge point examples:	**Bar Chart:** 	**Pie Chart** 	**Pictograms:** 	**Scatter Graphs**  (Positive correlation)	**Two Way Table** 	

	Boys	Girls	Totals
Running	6	9	15
Swimming	13	12	25
Totals	19	21	40

Dora did a survey of her class whether they prefer running or swimming. She recorded the results in a two-way table

Linked Knowledge Maps:	Statistics – grouped Data

Statistics – Grouped Data

Keywords: Histogram / Frequency Density / Class Interval / Distribution / Cumulative / Frequency / Polygon / Median / Interquartile range / Box Plot / Estimated Mean

Definition / Description:

Cumulative Frequency diagram represents a running total of frequencies as a graph

Box Plot visually shows the distribution of data by identifying five points in a data set

Interquartile range measures the spread of data between the upper and lower quartiles. A small interquartile range shows consistent data

Histogram is a graphical representation of data points organised into ranges

Frequency density is the frequency per unit for the data in each class. It is used to plot histograms

Class interval is the numerical width of any class in a particular distribution, defined as the difference between the upper class limit and the lower class limit

Estimated Mean is the average using midpoints of grouped data.

Knowledge points:

Cumulative Frequency:
1. Calculate the running total
2. Plot at the Upper boundary of class
3. Join with a smooth curve

Box Plot:
5 points from data needed:
1. Minimum value
2. Lower quartile
3. Median
4. Upper quartile
5. Maximum value

Interquartile range:
Subtract Lower quartile from Upper quartile

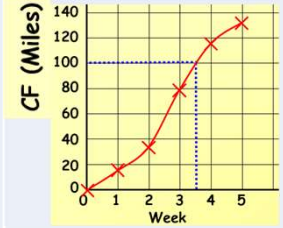
Histogram:
1. Find class width of each category
2. Divide frequency by class width to find Frequency Density

Estimated Mean:
1. Find midpoint of data range
2. Multiply each frequency by this midpoint to find a breakdown of total
3. Add up breakdown of totals to find final total
4. Divide final total by total frequency

Knowledge point examples:

A cyclist records the number of miles he travels each week

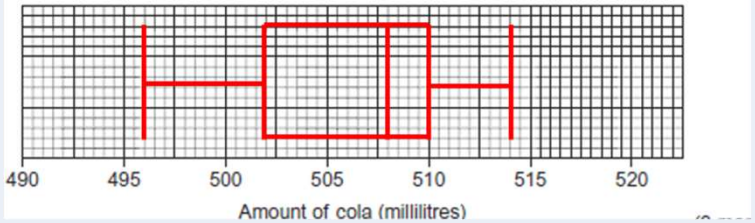
Weeks	Number of miles (frequency)	Cumulative Frequency
1	17	17
2	19	36
3	42	78
4	38	116
5	14	130

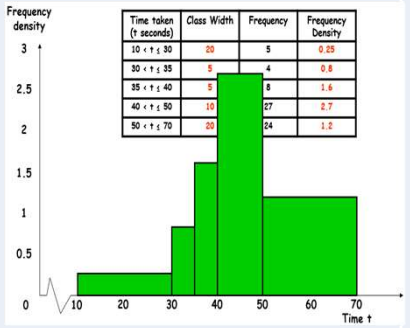


Here is some information about the amount of cola contained in a sample of bottles from machine A.

Minimum	Lower quartile	Median	Upper quartile	Maximum
496 ml	502 ml	508 ml	510 ml	514 ml

Draw a box plot to represent this information.





Speed (mph)	Frequency (f)	Midpoint (m)	$f \times m$
$20 \le s < 25$	4	22.5	90
$25 \le s < 30$	10	27.5	275
$30 \le s < 35$	12	32.5	390
$35 \le s < 40$	15	37.5	562.5
$40 \le s < 45$	9	42.5	382.5
	50		1700

Mean = Total sum ÷ total Frequency
= 1700 ÷ 50
= 34 mph

Linked Knowledge Maps

Statistics – ungrouped data
Averages