Scheme of Work

GCSE (9-1) Statistics

Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Statistics (1ST0)

GCSE Statistics (1ST0)

Higher Tier

Scheme of Work

Unit		Title	Estimated hours	
			Condensed course	Full course
1	a	Types of data	3	6
	b	Population and sampling	3	6
	c	Sampling methods	4	8
	d	Planning and collecting data	4	8
2	a	Qualitative and discrete data	4	8
	b	Continuous data	4	8
	c	Tabulation	1	2
3	a	Measures of central tendency – mode, median and mean	3	6
	b	Measures of dispersion – range, quartiles, interquartile range, interpercentile range, interdecile range and standard deviation	4	8
	c	Box plots, skewness, calculating and representing outliers	4	8
4	a	Describing correlation by inspection, lines of best fit and Spearman's rank correlation coefficient, Pearson's product moment correlation coefficient	4	8
5	a	Calculating moving averages, seasonal and cyclic trends	3	6
6	a	Simple probability and theoretical probability	1	2
	b	Probability from two-way tables, sample space diagrams, tree diagrams and Venn diagrams	3	6
7	a	Interpreting index numbers in context and simple calculations	2	4
8	a	Binomial distribution	5	10
	b	Normal distribution and standardised scores	5	10
	c	Quality assurance	3	6
		Total hours	60	120

1a. Types of data
(1b.01, 1b.02, 1b.03, 1b.04)

Teaching time
3–6 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:
- Recognise that data can be obtained from primary and secondary sources;
- Recognise the difference between quantitative and qualitative variables;
- Recognise the difference between discrete and continuous data;
- Recognise and use scales of measurement – categorical, rank, ordinal;
- Categorise data through the use of well-defined, precise definitions or class boundaries;
- Understand, use and define situations for grouped and ungrouped data;
- Understand the meaning of bivariate data and multivariate data;
- Know the difference between independent and dependent variables.

1b. Population and sampling
(1c.01, 1c.02, 2h.02, 2h.03)

Teaching time
3–6 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:
- Understand the meaning of the term population and sample;
- Understand the word 'census' with regard to small scale and large scale populations;
- Understand the reasons for sampling and that sample data is used to estimate values in a population;
- Understand that sample size has an impact on reliability and replication;
- Understand, design and use a sampling frame;
- Apply and use Peterson's data capture technique to estimate population sizes and know the assumptions made.

1c. Sampling methods
(1c.03, 1c.04, 1c.05, 1c.06)

Teaching time
4–8 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:
- Understand the terms random, randomness and random sample;
- Understand the use of random numbers and some of the methods of generating these:
  - random number tables;
  - random number function on the calculator;
  - picking random numbers from a hat;
- Be able to select a random sample, or a stratified sample, by one category as a method of investigating a population;
- Appreciate how bias in a sampling procedure might occur and how it might be minimised;
- Know the difference between:
  - opportunity (convenience) sampling;
  - systematic sampling;
  - quota sampling;
  - judgement sampling;

- stratified sampling (note this could be by more than one category).

1d. Planning and collecting data (1a.01, 1a.02, 1a.03, 1d.01, 1d.02, 1d.03, 1d.04, 1d.05, 1d.06, 1d.07)	**Teaching time** 4–8 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Understand that there are different methods to collect primary data from different sources;
- Identify appropriate sources of secondary data;
- Extract data from secondary sources, including those based on ICT;
- Understand that data needs to be 'cleaned' before being used;
- Understand the aspects of accuracy, reliability, relevance and bias as related to secondary data;
- Know the purpose of pilot surveys
- Know how random response is used for sensitive questions

- Understand the techniques used to deal with possible problems associated with the collection of data (including issues of sensitivity);
- Understand why control groups are used in questioning and testing and the system of matched pairs to avoid bias.
- Form a hypothesis, and know the appropriate strategies to test this hypothesis;
- Be aware of factors involved with testing a hypothesis (including time, costs, ethical issues, confidentiality and convenience);
- Identify problems that may arise with the statistical enquiry cycle (e.g. non response of surveys, difficulty estimating the population or unexpected outcomes) and come up with strategies to help overcome these.

2a. Qualitative and discrete data (1b.02, 2a.01, 2a.02, 2a.03, 2a.05, 2a.06, 2a.07, 2a.08)	**Teaching time** 4–8 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Construct, draw, use and understand:
  - Pictograms;
  - Bar charts;
  - Multiple or composite bar charts for qualitative and discrete data;
  - Vertical line graphs;
  - Stem and leaf diagrams;
  - Venn diagrams;
- Understand the distinction between well-presented and poorly presented data;
- Understand the potential for visual misuse, by omission or misrepresentation;
- Transform from one presentation to another;
- Understand how to discover errors in data and recognise data that does not fit a general trend or pattern;
- Use Comparative 2D and 3D representations;
- Group data into class intervals and be aware of the advantages and implications of doing so.

2b. Continuous data
(1b.02, 2a.01, 2a.02, 2a.03, 2a.04, 2h.01)

Teaching time
4–8 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Construct, draw, use and understand:
  - Pie charts;
  - Histograms with equal and unequal class intervals and unequal class intervals.
  - Frequency polygons;
  - Cumulative frequency diagrams;
  - Population pyramids;
  - Choropleth maps;
  - Box plots;
- Transform from one presentation to another;
- Understand how to discover errors in data and recognise data that does not fit a general trend or pattern;
- Group data into class intervals and be aware of the advantages and implications of doing so;
- Use calculated/given summary statistics for continuous data to make estimates of population characteristics, for example, samples to estimate the population mean.

2c. Tabulation
(2a.01)

Teaching time
1–2 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Construct, draw, use and understand:
  - Two-way tables and tally charts and any other data represented in a table format.

3a. Measures of central tendency – mode, median and mean

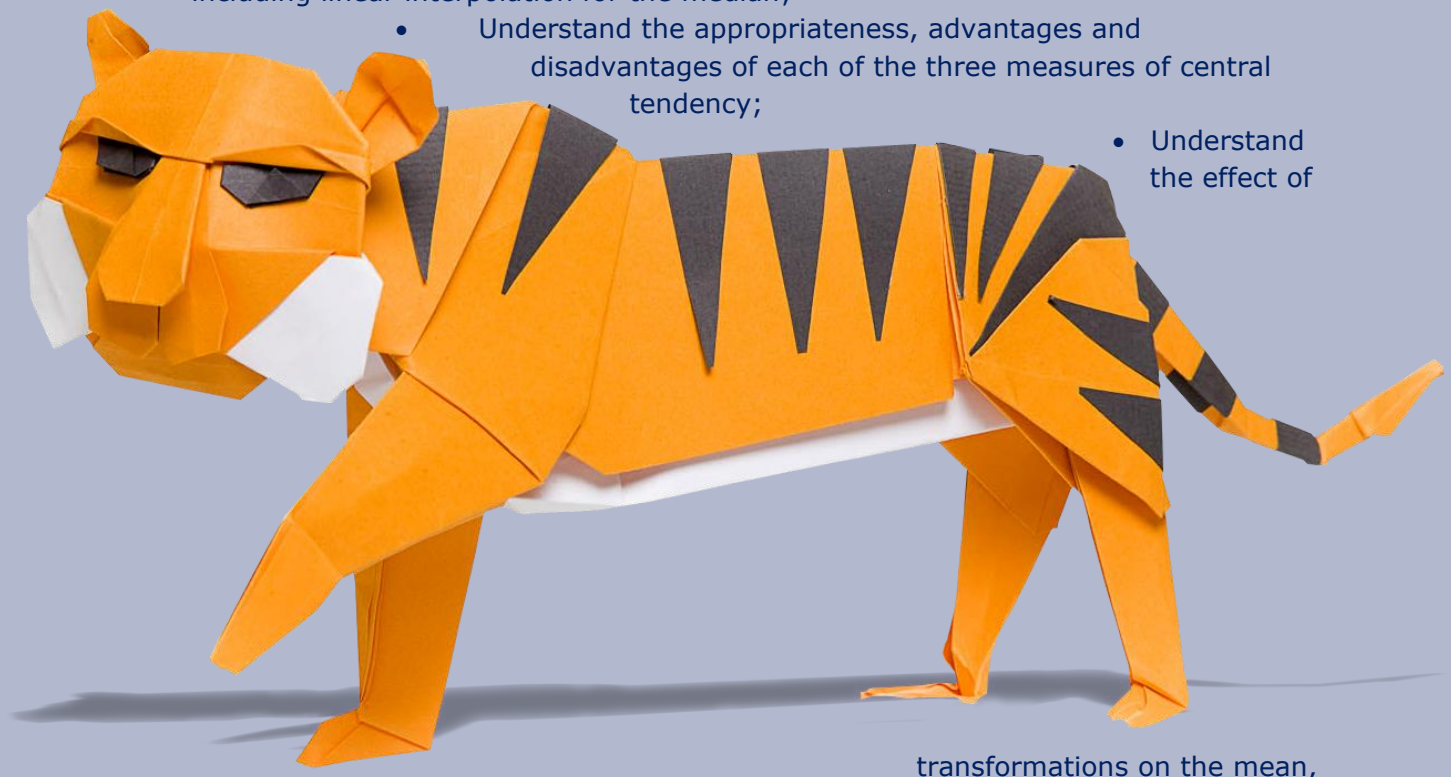
Teaching time 3–6 hours

(2b.01, 2b.02, 2b.03, 2h.01)

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Calculate the mean, mode and median for a list of numbers;
- Calculate the mean, mode and median for discrete data listed in a table (grouped);
- Calculate the mean, mode and median for continuous data listed in a table (grouped) including linear interpolation for the median;
- Understand the appropriateness, advantages and disadvantages of each of the three measures of central tendency;
- Understand the effect of transformations on the mean, mode, median;
- Calculate the geometric mean and weighted mean.



3b. Measures of dispersion – range, quartiles, interquartile range, interpercentile range, interdecile range and standard deviation

Teaching time 4–8 hours

(2b.01, 2c.01, 2c.04, 2c.05)

OBJECTIVES

By the end of the sub-unit, students should be able to:

- calculate the range, quartiles, percentiles and interquartile range for discrete and continuous data;
- calculate the interpercentile range and interdecile range;
- calculate the standard deviation;

- compare data samples and to compare sample data with population data when given measures of dispersion.

3c. Box plots, skewness calculating and representing outliers

Teaching time 4–8 hours

(2a.09, 2a.10, 2a.03, 2b.03, 2c.02, 2c.03, 2c.04)

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Construct, interpret and use box plots from summary statistics;
- Construct, interpret and use box plots from cumulative frequency graphs;
- To calculate outliers using the formulae
  Small outlier is $< LQ - 1.5 \times IQR$
  Large outlier is $> UQ + 1.5 \times IQR$
  Or outlier is outside $\mu \pm 3\sigma$
- To show outliers on box plots and comment with reference to the original data;
- To determine skewness by inspection and calculation;
- To make interpretations in context;
- To use box plots as a method to compare two (or more) sets of data for dispersion, measure of central tendency and skewness;
- Identify simple properties of the shape of distributions of data including symmetry, positive and negative skew.

4a. Describing correlation by inspection, lines of best fit and Spearman's rank correlation coefficient, Pearson's product moment correlation coefficient

Teaching time 4–8 hours

(1b.03, 2e.01, 2e.02, 2e.03, 2e.04, 2e.05, 2e.06, 2e.07, 2e.08)

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Plot points as points on a scatter diagram;
- Recognise positive, negative and zero correlation by inspection;
- Understand the distinction between correlation and causality;

- Draw a line of best fit through $(\overline{x}, \overline{y})$ to the points on a scatter diagram and to find the equation of the regression line;
- Understand the pitfalls of interpolation and extrapolation;
- Interpret data presented in the form of a scatter diagram;
- Calculate and interpret Spearman's rank correlation coefficient;
- Interpret Pearson's product moment correlation coefficient;
- Understand the distinction between Spearman's and Pearson's correlation coefficients
- Know and apply the following words: positive, negative, zero, causation, association, interpolation, extrapolation, independent variable, explanatory variable, response variable, dependent variable;
- Describe and make comparisons of the strength of correlation.

5a. Calculating moving averages, seasonal and cyclic trends

(2b.01, 2f.01, 2f.02)

Teaching time
3–6 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Plot points as a time series;
- Draw a trend line by eye and use it to make a prediction;
- Interpret seasonal and cyclic trends in context;
- Calculate and use a 4 point moving average or other specified appropriate moving average;
- Find the mean seasonal variation and extrapolate the data to make predictions for future years.

6a. Simple probability and theoretical probability

Teaching time 1–2 hours

(3p.01, 3p.02, 3p.03, 3p.04, 3p.05, 3p.06, 3p.07, 3p.08, 3p.09, 3p.10)

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Calculate estimates of probabilities and represent these as fraction, decimal or percentage;
- Interpret probability values;
- Understand the meaning of the words 'impossible', 'certain', 'highly likely', 'likely', 'unlikely', 'possible', 'evens', and present them on a likelihood and number scale;
- Compare expected frequencies and actual frequencies;
- Recognise that experimental probability will tend towards theoretical probability as the number of trials increases;
- Identify bias if experimental probability does not tend towards theoretical probability;
- To know and apply formulae conditional probability and independent events;
- Use collected data and calculated probabilities to determine and interpret relative risks and absolute risks, and express in terms of expected frequencies in groups;
- Comment on the differences between experimental and theoretical values in terms of possible bias.

6b. Probability from two-way tables, sample space diagrams, tree diagrams and Venn diagrams

Teaching time 3–6 hours

(3p.07, 3p.08, 3p.09)

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Produce, understand and use a sample space;
- Understand the terms mutually exclusive and exhaustive and to understand the addition law $\mathrm{P}(A \text{ or } B) = \mathrm{P}(A) + \mathrm{P}(B)$ for two mutually exclusive events;
- Draw and use probability tree diagrams for independent events. (At most three events)
- Use Venn diagrams and two-way tables to represent all possible outcomes;
- Understand, use and apply the addition for mutually exclusive events, and multiplication laws for independent events;
- To calculate conditional probability following a tree diagram, two-way table or Venn diagram.

7a. Interpreting index numbers in context and simple calculations

Teaching time 2–4 hours

(2d.01, 2d.02)

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Have an understanding of the retail price index (RPI), consumer price index (CPI) and gross domestic product (GDP) and other index numbers in context;
- Calculate and interpret simple index numbers;
- Calculate and interpret rates of change over time including, but not limited to, births, deaths, house prices, unemployment and percentage change.

8a. Binomial distribution
(3p.11)

Teaching time
5–10 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Understand the notation $\mathrm{B}(n, p)$;
- Identify when a binomial distribution should be used and the conditions needed;
- Calculate probabilities using any standard method including use of calculator;
- Know the calculation for the mean of a binomial distribution is np;
- Know the properties for the binomial distribution

8b. Normal distribution and standardised scores
(2c.05, 2c.06, 3p.12, 3p.13)

Teaching time
5–10 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Know the shape of a normal distribution curve and how this occurs;
- Understand the notation $N(\mu, \sigma^2)$;
- Know the conditions that make the normal distribution model suitable;
- Know that 68% of data lies within one standard deviations of the mean, 95% of data lies within two standard deviations of the mean;
- Know how to draw two distribution curves on the same graph;
- Use standardised scores to compare two samples of data.

8c. Quality assurance
(2c.04, 2c.05, 2g.01, 2g.02)

Teaching time
3–6 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Understand the process of quality assurance and see why this is necessary in the real world;
- Know how to calculate both warning limits and action limits;
- Know how to draw warning limits and action limits on a sample mean, median or range versus sample number graph;
- Understand how action and warning limits are used in the manufacturing process.