

Handling and Interpreting Data Work Scheme

This FSMQ requires a total of 60 guided learning hours that could be timetabled in a variety of ways eg 2 hours per week for 30 weeks, 4 hours per week for 15 weeks, 5 hours per week for 12 weeks. A suggested work scheme showing topics and methods to be covered is given below. There is plenty of scope for varying the order and time allocation.

The following techniques should be introduced as soon as possible and used throughout the course:

- using tables to record results
- rounding values appropriately
- using spreadsheets to carry out calculations and display results in tables and statistical charts and graphs
- checking calculations using estimates, inverse operations and different methods.

Although the topics are listed separately, it would be beneficial to follow a number of statistical investigations through from the initial collection and organisation of data to an analysis of the situation making use of statistical charts and measures. Where possible these investigations should reflect the students' other areas of work and interests.

Topic Area	Content	Nuffield Resource	Coursework Portfolio Requirements
<p>Define Hypotheses, Collect and Organise Data (3 hours)</p>	<p>Define a hypothesis, and decide what data needs to be collected in order to test it.</p> <p>Differentiate between discrete and continuous data.</p> <p>Design a questionnaire (ensuring that questions are not biased, leading, complex or offensive) and other data collection forms for data from observation and measurement. Transfer data from data collection forms to tables produced by hand and into a spreadsheet. Include use of tally charts and frequency tables and grouping data using equal and unequal intervals.</p>	<p>Sports Questionnaires (starter)</p> <p>Set of 50 responses in questionnaire form and as a spreadsheet. Teacher Notes include short exercises giving practice in statistical techniques.</p>	<p>Note</p> <p>The requirements are listed on the following pages. The way in which these requirements are split between the investigations will depend to a large degree on the contexts involved. Ideally students should investigate real situations from their other areas of study, work or interests.</p> <p>In order to begin portfolio work as soon as possible, teachers will need to plan carefully the order in which they cover topics. The order suggested here may not be the most suitable for some groups and it may well be more appropriate to cover parts of each topic area at separate times, rather than as a block as listed here.</p>



Topic Area	Content	Nuffield Resource	Coursework Portfolio Requirements
Statistical Charts (8 hours)	Draw by hand and interpret: <ul style="list-style-type: none"> pictograms bar charts stem and leaf diagrams (including back-to-back diagrams) histograms (with equal and unequal class widths) pie charts (using the area of the pie charts to compare the characteristics of two different populations) line graphs Use a spreadsheet to draw bar charts, pie charts and line graphs. Discuss the use of scales, area (etc) to exaggerate findings.	Solar Eclipse (starter) Lots of data for discussion and suggestions for analysis.	1 Reports of at least two investigations showing the use of statistical techniques, measures and diagrams. In the totality of the reports the student should : <ul style="list-style-type: none"> state clearly the aims of the investigation choose a suitable sample for the investigation select the most appropriate data devise and use an appropriate data collection form use a spreadsheet to record the results of the data collection use tables to present <ul style="list-style-type: none"> raw data grouped data use <ul style="list-style-type: none"> measures of location and spread relevant, clear and accurate statistical diagrams to summarise and compare the raw and grouped data use probability measures, if appropriate, to calculate, describe and explain the likelihood of an event(s) occurring for the sample of the investigation and project the findings to a larger sample investigate the effect of using at least two different groupings of part of the data on diagrams and measures summarise findings and draw relevant and valid conclusions.
		Histogram (skills activity) Instructions explaining how to construct an accurate histogram and frequency polygon in Excel	
		Draw line graphs in Excel (starter) Activity that shows students how to draw line graphs in Excel.	
		Draw pie charts in Excel (starter) Activity that shows students how to draw a pie chart in Excel and change its appearance.	
		Pie Charts (starter) Activity that shows students how to draw a pie chart by hand. Also includes practice exercise with real data – can be used as follow up to ‘Draw pie charts in Excel’ activity.	
		Interpreting Curves (skills activity) Discussion sheets and exercise on interpreting and sketching line graphs. Focuses on the shape of graphs.	
Statistical Measures (6 hours)	Find sum, mean, mode, median and range (raw data and grouped data). Find the mean using a formula in words: $\frac{\text{sum of (mid - value of group} \times \text{frequency)}}{\text{number of observations}}$ or symbols: $\frac{\sum x}{n} \text{ or } \frac{\sum (xf)}{n} \text{ where } n = \sum f .$ Use a spreadsheet to sort data and find the sum, mean, median, mode and range. Print out spreadsheet formulae. Choose appropriate measures of location to represent and compare different sets of data.	Safety on the Roads (skills activity) Graphs and charts for interpretation.	
		Datasets (skills activity) Data concerning road accidents, causes of mortality, marriage, divorce and food consumption in an Excel spreadsheet.	
		Election Results (skills activity) Spreadsheet containing the 2001 and 2005 General Election Results. Select data for practice in drawing charts, finding % etc.	
		5 a day (assignment) An investigation to find out to what extent people understand and follow government advice to eat 5 portions of fruit and vegetables per day.	



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Cumulative Frequency Graphs (3 hours)	Draw cumulative frequency graphs, indicating the range, median, quartiles, inter-quartile range and percentiles. (Could be drawn on a spreadsheet as well as by hand.)	Cumulative frequency graphs in Excel (skills activity) Activity that shows students how to draw a cumulative frequency graph in Excel.	The investigations must include <ul style="list-style-type: none"> written evidence of all mathematical analysis and computation evidence of estimation and checking to ensure that the work is accurate consideration of the limitations involved when the findings are projected to a larger sample qualitative reference to the accuracy of the findings in the light of any errors that there may have been in the data and taking account of the sample size. Note if a questionnaire is used, questions must be relevant, not repetitive, clear and unbiased, with a sample of at least 25. (Total 8 hours)
Box and Whisker Plots (3 hours)	Draw and interpret box and whisker plots.	Box and Whisker Plots (skills activity) Students can use this Excel spreadsheet to draw up to 4 box and whisker plots. Includes instructions.	
Scatter Diagrams (4 hours)	Understand ideas of positive correlation, negative correlation and no correlation. Draw a line of best fit by eye through the mean point.	Athletics (skills activity) Excel spreadsheet contains large datasets of track and field events.	
Probability (3 hours)	Express probabilities as fractions, decimals and percentages. Understand that probabilities lie between 0 and 1 and understand the numerical values associated with events having low, equally likely and high probabilities. Use $P(\text{not } A) = 1 - P(A)$ Estimate probabilities from real data, understanding the idea of, and limitations of, probability as relative frequency for simple situations. Use probabilities from small data sets to project to larger populations, understanding the limitations resulting from factors such as sample profile, when the data was collected etc.	A Risky Business (skills activity) Data Sheet and probability worksheet involving accidents in the home and at work and leisure. Applying for HE (skills activity) Data Sheets and spreadsheet giving gender, age, ethnic origin and other information about HE applicants. Worksheet and Teacher Notes suggest uses. Crime in the Regions (assignment) Assignment in which students compare crime figures for their region with other regions.	

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Interpret and Compare Data Sets (6 hours)	Use measures of location and spread and probability together with statistical and probability diagrams to come to conclusions about data and compare similar data sets.	Climate (skills activity) Excel spreadsheet containing sunshine, rainfall and temperature data for England and Wales, Northern Ireland and Scotland for each month in every year from 1961 to 2003.	
		Football Figures (skills activity) Excel spreadsheet containing 2007-8 data for each premier league club. Teacher Notes suggest uses.	
		Heart Rate (assignment) Assignment in which students are told how to measure heart rate and then asked to plan and carry out an investigation.	
		Larks and Owls (assignment) Assignment in which students carry out an investigation involving sleep.	
Critical Analysis (6 hours)	Critically examine statistical work done by other people. <ul style="list-style-type: none"> Consider the use of diagrammatic representations of data in order to bias findings (eg by manipulation of axes or use of area to exaggerate findings). Question if the data used has been selected to strengthen a case (eg a subset of data may have been used or certain data discarded). Consider whether alternative measures and diagrams would have been more or less useful in highlighting findings. Identify what it is not possible to conclude from the data and consider what extra information or data is needed. 	Global Warming (assignment) Gives a list of websites that have reports or articles about global warming including statistical evidence. Students analyse one of these reports to meet the second portfolio requirement.	2 A report critically examining a piece of work produced by others and based on at least three statistical measures and/or diagrams. The report should include consideration of: <ul style="list-style-type: none"> the appropriateness and accuracy of the measures used the clarity of presentation of measures and diagrams in light of the overall findings of the report how alternative measures and diagrams could have been used how the chosen sample may affect how the results should be interpreted how particular results and findings have been highlighted and how other conclusions could possibly have been drawn.
Revision (6 hours)			(4 hours)

