Scheme of work – Cambridge IGCSE® Mathematics (US) 0444

Unit 10: Statistics (Extended)

Recommended prior knowledge
All of Core and particularly Core 10. Only those parts of the learning objectives or notes and exemplars not included in the core units are itemised, so this document should be read alongside the core document.

Context
There are two Core statistics units and this is the second of two Extension statistics units. Once the Core 10 and the other prior experience for Core 10 is completed this unit can be slotted in at any point. It is probably best taught as a whole as there is a flow to the content.

Outline
The unit extends the knowledge of Core 10 so be aware that examination questions relate even the aspects of Core 10 may have a greater degree of challenge as they combine with other areas of mathematics. This unit specifically covers, averages for grouped/continuous data, histograms, cumulative frequency and using it to find interquartile range and median, box and whisker plots and comparing and justifying decisions based upon data.

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
		A useful source covering most of the unit with exercises.	www.cimt.plymouth.ac.uk/projects/mepres/book9/bk9_16.pdf
10.4	Mean, modal class, median, and range from grouped and continuous data.	**Notes and exemplars** The term *estimated mean* may be used in questions involving grouped continuous data. **General guidance** Modal Class As this is only a name for the collective of a group rather than single label data, if students understand mode as the tallest bar, biggest slice or item with the highest frequency in a frequency table they will not have difficulty about identifying it just using the new label. Medians from grouped data.	www.bbc.co.uk/schools/gcsebitesize/maths/data/measuresofaveragerev1.shtml Past Paper 43 June 2011 Q6 bii (syllabus 0580) Past Paper 42 June 2011 Q6 a (syllabus 0580) Past Paper 41 June 2011 Q8 a (syllabus 0580)

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
		This relies on students being able to identify the group in which the median will occur. **Teaching activities** Ask students to hold up 9 fingers and count in to find the middle finger and then to find the 5 from the 9 as a rule. Then do the same with 10 fingers and find a rule for the middle pair. Doing it with the hands gives a way of checking they have the right rule in an examination. As the similarity between the rules for finding the middle data with odd and even total numbers is one of the problems with the topic. The next difficulty is convincing students that even if they know the two middle items of data are 49th and 50th in the list that the frequency table has sorted the data in order. Asking students to recreate the list from the frequency table for single item data might be a way to convince them. Means from frequency tables. Students need to understand that the mean is the sum of the total data and is divided by the total items. Therefore the first teaching point is to ask students to identify from list of data the number of items of data, the sum of the data and hence the mean. The data is then collected into a frequency tables and they are reminded of their previous calculation, but have to work out how to get the two totals from the table. Show that the answer is complete rubbish if the totals of either column are divided by the number of rows. Midpoint means (estimated means) for grouped data. The technique is of course similar and the extra step is only to find the midpoints. It might be interesting to do some from the frequency tables and then to give them the raw data to see how good the estimate was. Once students are familiar with the techniques for calculating means from tables give out some that have been miscalculated with a variety of misconceptions and errors and ask students to correct them. This may include correcting labels and terms used in the statements.	

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10.5 **CCSS:** **S-ID1**	Histograms with frequency density on the vertical axis	**Notes and exemplars** Includes histograms with unequal class intervals. **General guidance** The most difficult step is to distinguish between a bar chart and a histogram. Some would debate whether a bar chart of continuous data (with equal class intervals) isn't just a special case of a histogram and this might be one way into the topic. The second question is why anyone would collect data that isn't in equal class intervals so why would you need a histogram? Often though statisticians use historic data that may not have been collected with a new analysis in mind. Census data collected every ten years doesn't always ask the same questions. So sometimes there is a twenty year gap, in some data streams. The second resource deals with these issues. The key teaching is: 1. Difference between bar charts and histograms 2. Learning frequency density 3. Plotting histograms 4. Retrieving information from histograms The 'mathsteaching' link provides four links the first and fourth are free and have some examples of histogram questions. The 'shodor' resource has a model lesson and the other two sites have the facts. Between them there are plenty of examples to try.	mathsteaching.wordpress.com/2008/01/07/histograms/ www.shodor.org/interactivate/lessons/HistogramsBarGraph/ www.bbc.co.uk/schools/gcsebitesize/maths/data/representingdata3hirev3.shtml www.gcsemathstutor.com/histograms.php Past Paper 43 June 2011 Q6 biii (syllabus 0580) Past Paper 41 June 2011 Q8 bii (syllabus 0580)
10.6 **CCSS:** **S-ID1** **S-ID2**	Cumulative frequency table and curve and box plots Median, quartiles, percentiles, and inter-quartile range	**General guidance** It seems trivial but when students create the cumulative frequencies prior to plotting they need to change the group names from the grouped frequency table. This skill in itself will help them understand cumulative frequency. Ensure students understand how to label the horizontal axis correctly for the cumulative frequency and know it is a curve not a series of points joined by straight lines. Seeing the elongated 'S' shape is not easy for some students.	www.bbc.co.uk/schools/gcsebitesize/maths/data/representingdata3hirev4.shtm www.censusatschool.org.uk/get-data/results/phase10 Past Paper 42 June 2011 Q6 b and c (syllabus 0580)

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
		Students need to understand it is the total of the data that is split into 4 equal sections not the end number written on the vertical axis. They must also realise the necessity of making the lines across the graph exactly horizontal to find the point to drop down to the horizontal axis. They must also understand that it is the points on the horizontal axis that they read off not the co-ordinates of the point on the graph or the vertical percentile points. Box and Whisker plots are best drawn below the horizontal axis on the same scale to make the links clear. If students are comparing two distributions and not drawing on the same axes then they should make them the same scale. Cumulative frequency is straight, its associated measures of median and interquartile range are straightforward if students learn the steps and follow them through – interpreting and understanding the values is more difficult. Making a statement about height or weight and using the large data sources at 'census at school', selecting year groups for comparison and drawing cumulative frequency graphs with box and whisker plots can give some purpose to the activities. It could then be compared to school data. Use it to select samples by a legitimate sampling technique. Though this isn't in the syllabus it gives further meaning to the topic.	
10.7 **CCSS:** **S-ID2** **S-ID3**	Use statistics appropriate to the shape of the data distribution to compare centre (median, mean) and spread (inter-quartile range) of two or more different data sets	**Teaching activities** Making a statement about height or weight and using the large data sources at 'census at school', selecting year groups for comparison and drawing cumulative frequency graphs with box and whisker plots can give some purpose to the activities. It could then be compared to school data. Use it to select samples by a legitimate sampling technique. Have a purposeful (meaningful for students) question to answer that can use secondary data sources to provide the data. Students select the graphs, and other stats to write a convincing argument. A group project rather than individual ones would be better. Justifying choice of	www.censusatschool.org.uk/get-data/results/phase10

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
		graphical and statistical presentation should be included. The resulting reports are presented to the class and the other groups, question or make a critique of the presented case. Students create a display to explain the stats included in this unit to another cohort of students.	