

Moderator's Commentary

OCR Level 3 Nationals in ICT

Unit 3: Problem solving

This Support Material booklet is designed to accompany the OCR Level 3 Nationals specification.

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Introduction

OCR has produced these candidate exemplar portfolios to support teachers in interpreting the assessment criteria for the OCR Nationals specifications.

This exemplar material serves as a general guide. It provides the following benefits to a teacher:

- gives teachers an appreciation of the type of work that can be produced for this unit
- shows how the mark scheme has been applied by a senior assessor.

Please note that this resource is provided for advice and guidance only and does not in any way constitute an indication of grade boundaries or endorsed answers.

Moderator's Commentary: Unit 3

Problem solving Candidate Name: MC

AO	Pass	Merit	Distinction
Guidance for AO1	<p>For Assessment Objective 1, the problem might be given to the candidates in general terms, but they should then carry out their own initial investigations and set their own hypotheses. For example, they might be asked to investigate some of the social effects of the Internet on young people. They would then use sources such as the World Wide Web to find out some of the main issues and set themselves hypotheses, such as 'Young people with access to the Internet at home do better at school' and/or 'Young people who spend more than 1 hour a day using the Internet are less fit than those who don't'. Merit and Distinction candidates should set more complex hypotheses, which consider whether other factors, eg the age group of the young person, affect the result, requiring more complex analysis. It is likely that many candidates, especially at the higher levels, will come up with more than one hypothesis.</p> <p>Candidates should be able to define the sort of information they need to find out in order to support or disprove their hypotheses. Some of this information might come from existing surveys, and information from publications such as Social Trends. However, the majority of the information will need to come from primary research, eg questionnaires. Candidates will need to identify the criteria that will be used to test the hypothesis. They will need to consider what the spreadsheet is required to do: the input, processing of data and the output required eg the type of graphs or charts that would be most suitable. There may be additional user requirements eg details of user aids, such as drop down lists and forms, to help the input, which will also need to be included. However, detailed plans for the spreadsheet itself are not required</p> <p>Although candidates need to comply with data protection legislation there is no need for them to demonstrate detailed knowledge of, for example, Data Protection principles, rather they should understand that statistical data does not require the collection, storage or processing of personal data as defined in data protection legislation. Whilst this must be considered at the beginning of the work, candidates must also demonstrate in work throughout the unit that they understand these requirements by complying with the requirements in their data collection, storage and analysis.</p>		
AO1 Define a statistical problem to be investigated	<p>Candidates will describe the background to the problem.</p> <p>They will set a simple hypothesis and list some criteria to be used to test it.</p> <p>They will identify some of the data that needs to be collected and briefly explain how it will be processed.</p> <p>They will demonstrate an understanding of Data Protection legislation and give a brief explanation of how they will comply with this.</p>	<p>Candidates will clearly describe the background to the problem.</p> <p>They will set a complex hypothesis and clearly describe criteria that will be used to test it.</p> <p>They will identify the data that needs to be collected and explain how it will be processed.</p> <p>They will demonstrate an understanding of Data Protection legislation and explain how they will comply with this.</p>	<p>Candidates will explain thoroughly the background to the problem.</p> <p>They will set a complex hypothesis and clearly describe and justify the criteria that will be used to test it.</p> <p>They will identify the data that needs to be collected and explain clearly how it will be processed.</p> <p>They will demonstrate an understanding of Data Protection legislation and explain how they will comply with this.</p>
AO1 NOTES MERIT	<p>The candidate has provided evidence of a wide range of research about dentistry, some of which is of dubious relevance to the overall theme being investigated. However, she has provided a range of details about the background to the problem and has set a complex hypothesis – linking both gender and employment status to the frequency of visits to the dentist. She also has a further part to her investigation – to see if age is an additional contributory factor. She does not describe well criteria that would be used to test her hypothesis, but does identify clearly the data she needs to collect and how she will comply with data protection legislation. Understanding of data protection legislation is shown by the additional comments that have been added to each of the standard statements. It should be noted that simply copying the requirements of the Data Protection Act without any additional comments would not demonstrate understanding. The processing to be carried out is explained quite clearly, although the explanation of the age chart is a little confusing (seems to be proposing to create a pie chart from unrelated percentages) and the exact analysis of opinions is not stated.</p> <p>Had the candidate clearly described criteria that could be used to test the hypothesis, ie 'unemployed males will on average visit the dentist less than twice a year, employed females will visit the most, employed males and unemployed females will visit more often than unemployed males and less often than employed females' then a Distinction could have been considered. At present a MERIT is the best fit.</p>		

AO	Pass	Merit	Distinction
Guidance for AO2	<p>If data is collected electronically then work for Assessment Objectives 2, 3 and part of 4 might be carried out simultaneously, although each objective must be assessed separately.</p> <p>Assessment Objective 2 requires candidates to design and implement a data collection strategy. At Pass level candidates' choice of method might include some data of limited usefulness. At Distinction level candidates' strategies will ensure that appropriate data is collected and is stored in a way that will protect the anonymity of the data subjects.</p> <p>Where data is to be collected over a time period, sample interval and/or frequency should be defined by Distinction candidates.</p>		
AO2 Design and carry out a data collection activity	<p>Candidates will plan and carry out a data collection activity to gather some suitable data for their investigation.</p> <p>The plan will include a suitable sampling method.</p> <p>Candidates will list some of the constraints that could affect the reliability of their study.</p> <p>They will collect some useful data.</p>	<p>Candidates will plan and carry out a data collection activity to gather a range of suitable data for their investigation.</p> <p>The plan will include a suitable sampling method and size.</p> <p>Candidates will describe most of the constraints that could affect the reliability of their study and identify some areas of potential error in their sampling regime. They will collect the data identified.</p>	<p>Candidates will plan and carry out a data collection activity to gather the data that is necessary for their investigation.</p> <p>They will make appropriate use of research and data collection methods. The plan will include a suitable sampling method and size, and frequency/interval if appropriate, with justification of choices.</p> <p>Candidates will describe the constraints that could affect the reliability of their study and identify areas of potential error in their sampling regime.</p> <p>They will explain the steps they have taken to eliminate bias from their study. They will collect the data identified.</p>
AO2 NOTES WEAK DISTN	<p>The candidate has defined the sample size and methods to be used, although there is a little confusion here. Although she says she is going to use random sampling the overall description does not back this up. She claims that she will use a combination of two techniques in order to ensure the 'sample can be reliable and the results valid' but the real (and acceptable) reason seems to be convenience/pragmatism. She then describes what appears to be an attempt at quota sampling, although she does not consider how this might be achieved. The actual method chosen and used appears to be reasonably appropriate, but not necessarily correctly identified. There is throughout this section a clear attempt to give reasons for choices, but these are not all valid and to be considered 'justification' there should be some indication of the alternatives considered and why they were rejected. A Distinction level candidate would be expected to accurately describe different methods and then choose an appropriate method, explaining why this method has been chosen and why alternatives were not considered to be as suitable. Similarly, she has given a vague reason for choosing a sample size of 100, but not justified why this has been chosen above, say 50 or 200.</p> <p>Constraints affecting reliability and potential errors relating to sampling methods are well explained, although not always under the correct heading, and some steps to eliminate bias are explained.</p> <p>That data has been collected can be verified from the spreadsheet provided for AO3. This matches the plans and requirements in AO1.</p> <p>A DISTINCTION can be awarded here on a best fit basis, although there are elements of Distinction that have not been met well, and a true Distinction candidate would be expected to demonstrate more understanding of different sampling regimes.</p>		

AO	Pass	Merit	Distinction
<p>Guidance for AO3</p>	<p>Assessment Objective 3 requires candidates to create a spreadsheet and enter and store the collected data. Candidates will need to ensure that the inputs to the spreadsheet match the collected data. They will need to consider how the data is going to be input and this will largely determine the type of interface designed. Where data is to be entered manually into the spreadsheet, an effective interface, required at the higher levels, would be a form, with macros to insert the data into the main sheet(s) and to reset the form. The layout of this form and other features such as drop-down boxes will determine how easy to use it is.</p> <p>Consideration will also need to be given to how the data is going to be protected from unauthorised access, alteration and loss. This should include a range of worksheet/workbook protection as well as file security options (eg protection against opening and editing).</p> <p>Validation and password/cell protection can be evidenced from the electronic file but candidates should make clear where such features have been used. If hard copy evidence is relied upon screenshots must be produced to show the measures taken.</p>		
<p>AO3</p> <p>Collect data and store it using a spreadsheet</p>	<p>Candidates will create a simple interface for entering data into a spreadsheet.</p> <p>They will include at least one suitable validation routine to limit data entry errors.</p> <p>They will store some useful data.</p>	<p>Candidates will create an effective interface for entering data relevant to their research into a spreadsheet.</p> <p>They will include suitable validation routines to limit data entry errors for most items of data where this is appropriate.</p> <p>They will store the data collected and take at least one measure to ensure its security.</p> <p>They will demonstrate an understanding of the need for security measures.</p>	<p>Candidates will create an effective and easy-to-use interface for entering data relevant to their research into a spreadsheet. .</p> <p>They will use a range of effective validation methods to minimise data entry errors wherever possible.</p> <p>They will store the data collected and protect it from unauthorised access and from accidental and deliberate change and loss.</p> <p>They will demonstrate a thorough understanding of the need for security and the range of measures that are needed.</p>
<p>AO3 NOTES</p> <p>MERIT</p>	<p>The electronic spreadsheet file provides additional evidence for this AO. The work was originally prepared using Excel 2007 but an earlier version is provided as well.</p> <p>A simple interface has been used to enter data directly into spreadsheet columns, with appropriate validation applied to each column. Ease of data entry has been achieved through the use of drop-down boxes and the freeze panes option used to enable column headings to be always visible, although a form has not been used, which would be expected at the higher levels. All the data required has been stored. In the file. Although all the validation used was the same – from a list – this was entirely appropriate for the data collected and candidates should not be penalised for this. However, she could have shown an understanding of other methods that could have been used, which would have strengthened a Distinction claim. Understanding of security and the need for different measures is good, and a full range of measure have been used, including password protection of the electronic file, which has been removed for the purpose of this activity.</p> <p>Had a form been created for input of data to the spreadsheet then this AO could have been awarded a DISTINCTION. Without this, a MERIT can clearly be awarded on a best-fit basis.</p>		

AO	Pass	Merit	Distinction
Guidance for AO4	<p>In Assessment Objective 4 candidates must create and use a spreadsheet to analyse their results. There is no specific requirement for the spreadsheet workbook to contain more than one sheet, although higher level candidates might choose to organise their data across a number of sheets, perhaps putting summary tables on separate sheets.</p> <p>The statistical element of analysis may not be particularly advanced, as there is no requirement for candidates to have any advanced understanding of statistics. However, Distinction candidates should compare results across subgroups within the sample. For example, whilst Pass candidates might find the average number of hours spent using the Internet, Merit and Distinction candidates might also find the average number of hours spent by males and females and Distinction candidates might go on to compare these figures with the average number of hours spent by males and females in different age groups.</p> <p>Candidates should provide, as a minimum, evidence that they have tested the formulas in their spreadsheets by using test data that makes the results easy to check, by estimating the results and checking that the actual results are of the same order as the estimate or by using manual calculations or a calculator to work out what the result should be. Higher level candidates should provide a detailed test specification which tests all aspects of the spreadsheet, including input of data, validation and functions used.</p>		
AO4 Create a suitable spreadsheet to analyse the data	<p>Candidates create a structure to analyse and present the results of their study.</p> <p>They will apply appropriate titles, labels and formatting to display most information clearly.</p> <p>They will use appropriate functions to analyse some of the data, providing some useful data relevant to the hypothesis.</p> <p>They will carry out at least one test of their spreadsheet and use the results to make changes, if appropriate.</p>	<p>Candidates create an effective structure to analyse and present the results of their study.</p> <p>They will apply appropriate titles, labels and formatting to display most information clearly.</p> <p>They will use appropriate functions to analyse the data, providing a range of useful data relevant to the hypothesis.</p> <p>They will devise a test plan and use it to ensure that the spreadsheet works effectively.</p>	<p>Candidates create an effective and efficient structure to analyse and present the results of their study.</p> <p>They will apply appropriate titles, labels and formatting to display all information clearly.</p> <p>They will use appropriate functions to carry out a thorough analysis of the data, providing a range of useful data relevant to the hypothesis.</p> <p>They will devise a comprehensive test plan and use it to ensure that the spreadsheet works effectively.</p>
AO4 NOTES MERIT	<p>The candidate's intention was to present the evidence for this AO electronically, but printouts have been included in the pack for delegates. This explains why no attempt has been made to format the printouts/page breaks.</p> <p>Although clearly the candidate has viewed the spreadsheet as a tool to produce results rather than to present them, there are comments that are sufficient to allow a user to understand many of the summary tables (regrettably these cannot be seen on the printouts), but not all of the summaries on the 'male' and 'female' sheets, where additional filters have been applied but the data is not labelled. The structure and functions used are not the most effective/efficient. Rather than using formulas to summarise all the data there has been a degree of manual copying and pasting from one sheet to another, notably when the candidate wanted to separate the responses from males and females. The summary formulas and filter would have been more appropriately applied to the main sheet, or at least copied using formulas.</p> <p>A pivot table has been used to create a useful table linking occupational status and number of visits. Other summary tables have been produced using a combination of filters and COUNTIF formulas. The data produced is reasonably comprehensive, even though the methods used are at times a bit cumbersome.</p> <p>Much of the analysis relies upon charts, as indicated in AO1. It is very pleasing to see that the candidate is looking for comparisons and correlations rather than simply charting the results of every question. However, the tables of figures produced are largely single counts and there is no data that can be used to test the initial hypothesis, which identified unemployed males as a group.</p> <p>The presentation of data in the spreadsheet is limited and the appropriateness of the methods not consistent but the overall results are reasonably good. Had there been more clearly labelled summary data, perhaps using pivot tables, analysing data by groups, including something that looked specifically at the unemployed males then a Distinction could have been considered. Without this a MERIT is the best fit for this AO.</p>		

AO	Pass	Merit	Distinction
Guidance for AO5	<p>For Assessment Objective 5, candidates are required to produce charts/graphs that provide some useful information relevant to the hypothesis. All candidates at this level need to produce charts that display the data effectively, with consideration to the different requirements of discrete and continuous data. At higher levels candidates are required to demonstrate their understanding of why their choices of chart/graph types are appropriate.</p> <p>There is a requirement at Distinction level to create three different types of chart, but these also must be appropriate and relevant. If a candidate decides that by using the most appropriate types of chart for the data they have collected they will use less than this, they might provide further evidence of creating different types of charts, with explanations of why these were eventually rejected.</p>		
AO5 Create suitable graphs/charts	Candidates will create at least one chart that is relevant to their hypothesis and appropriate for the data being presented. They will use some formatting and labelling features to improve the presentation of their chart(s).	Candidates will create at least two different types of chart that are relevant to their hypothesis and appropriate for the data being presented. The choice of chart types is briefly explained. They will use appropriate formatting and labelling features to improve the presentation of their charts.	Candidates will create at least three different types of chart that are significant to their hypothesis. The choice of chart types will be appropriate and fully explained. They will use appropriate formatting and labelling features to display the data effectively.
AO5 NOTES MERIT	<p>The candidate has produced a large number of charts, mostly bar charts (often comparing two or more data sets) but also pie charts and a 'doughnut' chart. Most of these are appropriately formatted and labelled, although some improvements could have been made, eg making the colours consistent on the two pie charts comparing male and female, making the difference between the split bar charts on frequency clearer. The order of bars often inhibits easy interpretation of the data, which is a significant factor in deciding whether or not the data is displayed effectively. A Distinction candidate would be expected to notice this and go back and rearrange the data so that the charts are more effective.</p> <p>Some, though not all, of the charts are appropriate for the data being presented, and the doughnut chart, though quite complex because of the number of divisions, gives some useful comparisons, which the candidate uses quite well in AO6. The candidate has not really considered the relative appropriateness of absolute values and percentages, with many of the bar charts being difficult to interpret because of the different numbers in each group. The most significant chart to the hypothesis would have been one to compare some summary figure of dentist use across unemployed and employed males and females, but this has not been attempted.</p> <p>The candidate has attempted to explain her choices of chart types, and these explanations show that she is clearly trying to read information from them, but it cannot be considered that these are fully explained. Although there are some aspects of Distinction met for the best fit level for this AO, taking into account the overall quality, appropriateness and relevance of the charts produced, is MERIT.</p>		

AO	Pass	Merit	Distinction
Guidance for AO6	Assessment Objective 6 requires candidates to prepare a presentation of their findings, which might be as a slide-show presentation to accompany a talk, as a website or as a written report.		
AO6 Present findings to an audience	<p>Candidates will create a straightforward presentation about the findings of their data analysis.</p> <p>This will address their hypothesis and include at least one table of data and at least one graph/chart.</p> <p>They will state, with at least one reason, whether the analysis has supported or disproved the hypothesis.</p>	<p>Candidates will create a detailed presentation about the findings of their data analysis. This will address their hypothesis and include a range of tables and graphs/charts, formatted and presented effectively.</p> <p>They will explain whether the analysis has supported or disproved the hypothesis.</p> <p>The presentation will be mostly appropriate for the audience and purpose.</p>	<p>Candidates will create a comprehensive presentation about the findings of their data analysis. This will address their hypothesis and include a range of tables and graphs/charts, formatted and presented effectively.</p> <p>The presentation will be of near professional standard.</p> <p>Candidates will explain the extent to which the analysis has supported or disproved the hypothesis.</p> <p>They will evaluate the effectiveness of the spreadsheet model.</p>
AO6 NOTES MERIT	<p>.The candidate has summarised her findings in a PowerPoint presentation which is consistently formatted, with speaker notes adding more detail. Two tables are included, showing the breakdown of the sample into gender, age and employment, then the charts are presented, with appropriate commentary. Despite the fact that she has not actually looked at unemployed males as a group she does address her initial hypothesis at a fairly simple level. She does not look at the actual difference between the groups, so does not differentiate between the data supporting her hypothesis as absolutely true and looking at the <i>extent</i> to which it is supported. However, she does present a good range of data and charts, sufficient to consider it reasonably comprehensive.</p> <p>The candidate has attempted to evaluate the effectiveness of the spreadsheet model and does touch upon the fact that the lack of numeric data prevented her from creating correlation data. However, she seems to interpret this as a limitation of Excel rather than of her own model. There is no consideration of the effectiveness of her own structure. This might have been more easily achieved if the group had looked at each other's models at this point, and seen alternative ways of collecting, structuring and analysing the data.</p> <p>MERIT is the best fit for this AO.</p>		

Overall grade: Merit

AO1	AO2	AO3	AO4	AO5	AO6
MERIT	DISTINCTION	MERIT	MERIT	MERIT	MERIT

The overall grade awarded for this unit is a strong **MERIT**. The candidate has put in a lot of effort to reach the higher levels but weaknesses in understanding are evident throughout the AOs, preventing an overall Distinction from being achieved. AO2 is only a weak Distinction.

Candidate's Work: Candidate MC