Report on the Examination (NQF)

NQF unit: Introduction to Quantitative Methods

Examination Session: June 2015

Introduction/General comments:
The standard of scripts appears to be similar to that of previous sessions with students achieving grades across the entire range. Although the exam paper provided a good coverage of the syllabus, students tended not to answer the more graphical and probability based questions; relatively few students attempted questions 5, 6, 7 and 8. While students made significant improvements in a number of areas in this examination session, some students continue to exhibit problems with the application and interpretation of quantitative methods to actual business situations.

Question 1:
This question concerned the application of the four rules of numeracy, expressing data in different formats, comparing numbers and approximating data. This was the most popular question on the paper, with most students scoring reasonably high marks.

Part (a) required the application of the four rules of numeracy to fractions, including the use of square roots. Most students performed very well in this question, although a common mistake for students was the failure to understand the implication of the brackets and the two minus signs in part (ii), with many students incorrectly multiplying instead of adding the '14' and '18' on the denominator.

Part (b) required a decimal to be expressed as a fraction in its simplest form, as a percentage and as a decimal correct to 1 decimal place. This part was generally answered well.

Part (c) required an operating profit to be expressed to 3 significant figures. A common mistake made by students was to express the amount as "£525" instead of "£525,000". Students also had to calculate a 20% tax on this amount; some students had difficulty conceptualising this calculation.

Part (d) required students to convert data from standard form to the normal decimal form. This posed a particular problem for a number of students.

Question 2:
This was a relatively popular question. It concerned the application of quantitative methods to business situations.

Parts (a and b) required students to conceptualise business problems using quantitative methods. A number of students experienced difficulty conceptualising the problems and hence found it difficult to apply the appropriate calculations.

Part (c) required students to convert foreign currency with commission, using an exchange rate. Compared to previous examination sessions, students performed very well on this calculation. However, a number of students failed to given their answer to the nearest Dollar as stipulated in the question.

Question 3:
This question concerned the application of quantitative methods to business situations, notably calculations involving interest and depreciation. This was a relatively popular question on the paper, although the application of interest and depreciation formulae posed conceptual problems for some students.

Part (a) concerned the calculation of the future value of an asset using both the straight line and reducing balance methods. Compared to previous examinations, some students had difficulty answering this question, with a significant number of students unable to correctly apply the straight line method. Students also lost marks for treating the calculated value for depreciation as the future value of the asset.

Part (b) concerned simple and compound interest calculations. Students generally had no problem applying the compound interest formula in part (i) when interest was compounded annually. A common mistake when applying the compound interest formula was however to present the final value of the investment with interest, rather than just the interest received as requested. Most students were however unable to correctly apply the compound interest formula in part (ii) when calculating interest on a six monthly basis.

Part (c) required students to rearrange the formula for calculating compound interest in order to solve for the interest rate of an investment, given that the original principal, the accrued amount and the term were known. While there was a marked improvement in the number of students that were able to accurately demonstrate how to rearrange the formula and solve for the interest rate, compared with previous examination sessions, there were still a number of students that were unable to complete all of the mathematical steps required.

Question 4:
This question concerned the use of algebraic methods. Specifically, students were required to simplify and solve equations. This was a relatively popular question, with a high number of students attaining good marks.

Part (a) required students to use a linear equation to solve for the values of *x* and *y*, when given one value. Students performed relatively poorly on this question. Virtually all students failed to realise that the values of *x* and *y* in the equation were in '000s and thus the values supplied in the question needed to be divided by 1,000 before being used in the equation to solve for either *x* or *y*.

Part (b) required students to solve algebraic expressions and quadratic equations. Students generally performed well solving for the value of *x*. As in previous examination sessions a common mistake made by a number of students was to ignore the implication of the minus sign when rearranging the linear equation in part (i) and when solving the quadratic equation by formula in part (iv). Students tended to perform least well trying to solve for *x* when presented with fractions in part (ii).

Part (c) required students to simplify a logarithm expression to a single log term. The performance of students on this question was much improved compared with previous examination sessions.

Question 5:
This question required students to distinguish between different types of data and to represent and interpret data using a cumulative frequency curve.

Part (a) required students to differentiate between quantitative and qualitative data, with examples. In the main this part was well attempted with good definitions and examples of the two terms presented.

Part (b) required students to classify data as either continuous or discrete. In the main this part was well attempted.

Part (c) required students to use a quadratic equation to calculate the value of *y* for a range of *x* values, and then to use this data to plot a fully labelled graph of their quadratic equation. Most students showed little difficulty calculating the value of *y* for the values of *x* = 0 to 8 although for the

value of x = -1 this proved more difficult for a number of students. In the main, students made a good attempt at plotting their graph. Consistent with previous examination sessions, students typically lost marks for failing to: include a title; label the x and y axes; and draw a 'smoothed' line through the data points.

Part (d) required students to identify certain points on their graph. Most students were able to easily identify the co-ordinates at which the quadratic function intersected the y-axis (part (iii)). However, fewer students were able to identify the values of x when y = 0 (part (i)) and the values of x and y when the function was at its minimum (part (ii)); particularly where students had drawn a horizontal line to connect the co-ordinates at the bottom of their plotted function, resulting in no specific minimum set of co-ordinates.

Question 6:
This question concerned the application of statistical methods. Specifically, it required students to calculate summary statistics as well as representing and interpreting data. Relatively few students attained good marks on this question.

Part (a) required students to determine the modal class and calculate the mean of a grouped frequency distribution. Students generally showed a lack of understanding of how to determine the modal class. As in previous examination sessions, students showed difficulty calculating the mean of a grouped dataset; common errors included failing to compute mid-values for each class interval correctly, using n (i.e. the number of class intervals) as the value for $\sum f$, and a general lack of understanding of how to calculate $\sum fx$.

Part (b) required the construction of a cumulative frequency distribution table. Relatively few students used the class intervals of 'less than 130', 'less than 140', 'less than 150', 'less than 160', 'less than 170', 'less than 180', 'less than 190', and 'less than 200', as stipulated in the question, in the construction of their cumulative frequency distribution table; instead students generally incorrectly used the class intervals '120 to less than 130', '130 to less than 140', '140 to less than 150', '150 to less than 160', '160 to less than 170', '170 to less than 180', '180 to less than 190' and '190 to less than 200'.

Part (c) required the construction of a fully labelled cumulative frequency curve. In general, students made a good effort constructing their cumulative frequency curve, although a good number of students plotted a 'frequency curve' rather than a 'cumulative frequency curve'. Consistent with previous examination sessions, many students' cumulative frequency curves were poorly scaled and presented, and failed to include a title, axes labels and the appropriate axes units (particularly on the x-axis).

Part (d) required students to interpret their cumulative frequency curve. While a fair number of students were able to interpret the median and interquartile range from their cumulative frequency curves, many students showed a general lack of understanding of how to use their cumulative frequency curves to interpret these summary statistics.

Part (e) required students to explain why the interquartile range is a more reliable measure of dispersion than the range. Most students demonstrated little or no understanding of why this might be the case.

Question 7:
This question concerned the application of the laws of probability. It was a standard question, similar to that set on previous papers. Despite this, relatively few students attempted it and those that did generally experienced difficulties with relatively few students attaining good marks.

Part (a) required students to explain, using examples, what is meant by the term subjective probability. Most students demonstrated little or no understanding of the term.

Part (b) required students to construct a two-way contingency table, using the data presented in the question, to calculate probabilities. In the main, students showed little problem constructing the contingency table. More difficulty was, however, shown calculating the probabilities for independent, and non-mutually exclusive events.

Question 8:
This question also concerned the application of the laws of probability. It was a standard question, similar to that set in previous sessions. Despite this, only a few students answered this question and performance was particularly poor. In the main the answers presented were incomplete suggesting a lack of understanding of the application of the laws of probability.

Part (a) required the use of probabilities to calculate the expected value of an outcome. Students failed to show any understanding of how to calculate expected values.

Part (b) required students to determine and interpret *z*-values and probabilities using the normal distribution, making use of tables. Students failed to show understanding of how to determine probabilities using the normal distribution.

Conclusions:
As in previous examination sessions, performance on an individual question basis varied widely with students achieving grades across the entire range. While there were some excellent scripts which demonstrated the students' ability to undertake the required mathematical and statistical calculations to a high standard, and to interpret their results in the context of a business environment, there were also some very disappointing scripts.

Although marked improvements have been made in the performance of students in a number of areas, students continue to exhibit problems with the application of quantitative methods to business situations, the application of statistical methods, the construction and use of graphs to conceptualise business problems and the application of the laws of probability.

Recommendations to students and tutors for future examinations:
Based on the June 2015 examination, I would recommend students and tutors spend a little more time:

- Applying the four rules of numeracy without the use of a calculator, focusing in particular on the subtraction of negative numbers and the importance of correctly sequencing arithmetic operations.
- Expressing data in standard form and to a certain number of significant figures.
- Applying quantitative methods to business situations.
- Understanding how to use different formulae for the required business application, notably the use of the compound interest formula to calculate interest on a six monthly basis.
- Calculating the future value of an asset using the straight line method.
- Simplifying equations and logarithm expressions, rearranging equations to solve for x, and calculating the factors of quadratic equations.
- Using quadratic equations to calculate the values of y over a range of x values, focusing in particular on the calculation of y values when $x < 0$.
- Plotting mathematical graphs for quadratic equations (applying the general rules and principles of graphical construction, including choice, range and scale of axes) and identifying points of importance on graphs (including points of maximum and minimum, points of intercept with the x and y axes).

- Identifying modal class intervals, and calculating the mean of grouped data.
- Representing and interpreting data using cumulative frequency curves (applying the general rules and principles of graphical construction, including choice, range and scale of axes).
- Using appropriate formulae to determine probabilities for independent and non-mutually exclusive events.
- Calculating expected values.
- Interpreting and using *z*-values to calculate the probability under the normal distribution.