OCR
Oxford Cambridge and RSA

GCE

Quantitative Methods (MEI)

Advanced Subsidiary GCE AS **H133**

OCR Report to Centres June 2016

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This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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OCR REPORT TO CENTRES

G244 Introduction to Quantitative Methods (MEI)

General Comments:

Candidates have again responded well to the exam paper and most attempted all of the questions, although some need to be encouraged to do so and others may need to plan their time more effectively so that they can complete the final question. In particular candidates used their skills appropriately to respond to question 6 on control trial, question 1 on exchange rates and question 4 on interpreting data. Candidates did not seem to have the knowledge required to respond to question 5(ii) on calculating a simple interest rate or question 3(iii) on weighted averages. Question 2 on standard form and question 8(iv) and 8(vi) on speed distance time formulae were other areas to practise**.**

Candidates need to practise their skills on questions requiring longer calculations and structured or extended comments. In particular completing relevant sections of the core maths personal finance unit would be beneficial (http://www.core-maths.org/resources/financial-maths/). Perhaps making use of spreadsheets would be beneficial including writing down formulae onto worksheets, checking worksheets and using formats for currency and percentages to help with rounding.

Results suggest candidates were not familiar with trying and selecting from a variety of comparisons from tables using different denominators. Perhaps visual techniques such as putting circles or triangles around matching pairs from both tables of control trial data could help identify the correct percentages to compare. Also practice of the skill of sketching or plotting a logarithmic and exponential graph would be valuable.

The best answers showed evidence of prior discussion of the insert material, clear line-by-line methodology for more complex, multi-stage questions and good exam technique for underlining key information and multiple instructions in questions and then setting them out clearly in the answer space.

Candidates responded well to discussion questions and showed evidence of thinking skills and resilience in unfamiliar contexts and questions which required several parts to be completed successfully in order.

Comments on Individual Questions:

Question No. 1

Most candidates were successful with this question. Clear working showed those who were familiar with the context of exchange rates particularly with a buy and sell rate. The main errors were: choosing the wrong rate or dividing where they should have multiplied and vice versa. Most were able to round down but some forgot or were confused and subtracted €5 or converted rather than subtracting the €81.25 spent. Some credit was given where rounding was correctly applied to the wrong figure or the initial conversion was correct. Care needs to be taken when writing currency so that £ is clearly different from € and particularly in a question where the direction of conversion is critical.

Question No. 2

Most candidates interpreted the context correctly and attempted to add for question 2(i) and subtract for question 2(ii). However many did not spot the mixed units of length in the question and the instruction to give answers in standard form in kilometres rounded to one significant figure. A few candidates were confused by the context involving circular orbits and attempted to use π to calculate a circumference. The mark scheme gave credit for understanding the context as well as for unit conversion and standard form skills.

Question No. 3

Most candidates were able to calculate a percentage change in question 3(i) and make a successful comparison in question 3(ii). The best answers showed evidence of practice of a clear standard method such as calculating change and putting this over the original or the entirely equivalent comparing new over old (minus 1). A few candidates made mistakes with counting or rounding, others were confused about which base should be used for comparison or merely calculated change rather than percentage change. Some did not follow the instructions in the question here or in question 3(ii) and attempted to find annual percentage change using the 6th root as change was over a six year period.

A variety of methods were permitted in question 3(ii) using either the 2008 or 2014 average speed as a base for comparison. Those who compared old over new generally did not then go on to subtract this from one so the method for calculating percentages was incomplete. Marks were awarded provided a correct interpretation was drawn even for incorrect percentages but a statement of this outcome was required for the second E mark. Practice was again evident in clear working.

Many candidates were able to fill in the table in question 3(iii) most of these with signs indicating the direction of change although this was not required in the table. However only a few candidates attempted a weighted average for question 3(iii) and only a very few correct answers were seen. A few candidates were given special credit for calculating the weighted mean for speed in 2008 and then the weighted mean for speed in 2014 and subtracting to find a 2.8% decrease.

Question No. 4

Interpretation of statistics related to pre-release material required both discussion of modelling and understanding of distribution. This was evident but not consistent across all candidates or by ability as demonstrated on other questions. Most candidates achieved between 2 and 5 marks out of the 7 possible.

Question 4(i) was generally answered well; most achieved two marks and nearly all achieved at least one mark. Very few candidates suggested improvements rather than criticism but some were vague about why there was not clear evidence. Credit was given for valid use of the pre-release material (e.g. natural variation in snowdrop flowering) but most candidates correctly identified the weakness of a short time-span and a large assumption about weather patterns being drawn from relatively small changes in snowdrop flowering.

Candidates were not secure on the distinction between dependent and independent variables in question 4(ii) with some getting them the wrong way round and others choosing variables not in Fig. 4.1 despite the question leading them to it. Most candidates identified that March 12th was outside the range of observed values in question 4(iii)B and many also correctly identified variability had reduced in question 4(iii)C to achieve 3 marks. Some candidates did not explain that Fig.4.2 was not symmetrical or was skewed so therefore not Normal for question 4(iii)A - this should be a known curve shape - and others were not able to add the days in January and February correctly or found one or more of the statements to be true.

Question No. 5

Nearly all candidates achieved marks on question 5, many received 3 marks but none achieved 11 or 12 of the 12 available. Question 5(i) and question 5(v) were generally well done with nearly all recognising the wisdom of mother's advice and only one or two attempting to out-think her. Some did not recognise that monthly interest greater than monthly payment would result in everlasting debt, suggesting it would merely take longer to pay off. Others suggested higher payments would be required to pay off the debt. The best answers for question 5(i) included clear working for total interest and percentage interest.

Most candidates did not know how to begin question 5(ii) which was a gap in knowledge for all abilities. None stated the PRT formula for simple interest but a few got the answer by calculating annual interest of £450 and dividing by loan amount of £600. Quite a few attempted compound interest rather than simple interest calculations but many did not recognise the loan period was 1⅓ years.

Stronger candidates did well on the spreadsheet questions of question 5(iii) and 5(iv) as they were familiar with spreadsheet conventions for formulae and the direction of flow of spreadsheet calculations so they avoided circular references in question 5(iii). This was also useful in checking the solutions to question 5(iv) where careful rounding of the first entry was required; checking their entries worked in row 7 would have revealed where it went wrong for some. Other candidates missed the equals sign for formulae and used × or ÷ rather than the correct spreadsheet symbols for multiply * and divide / in question 5(iii). Some credit was given where candidates consistently did not round as this led to the correct answer but many were inconsistent in their approach to rounding which resulted in the loss of all 3 marks. Some candidates additionally filled in row 9 of the spreadsheet which was not required.

Question No. 6

Most candidates achieved over half of the marks available on question 6. Nearly all candidates successfully completed the two-way tables in question 6(i) and question 6(iii) and calculated probabilities in question 6(ii). Where a mistake was made on the two-way tables this often led to several more. Thorough checking might have prevented this. Some candidates divided by 320 or 1000 in question 6(ii) rather than by 500. Getting the correct denominator was vital for explaining both headlines in question 6(iv); dividing 'having parasite and disability' by 'total for both groups' and dividing 'having parasite and disability' by 'totals with parasite for both groups'. Some compared 4 or 12 with 16 successfully for question 6(iv)A but this technique was harder for question 6(iv)B where an equivalent fraction was necessary to compare 4/40 = 32/320 with 16/320 so comparing 32 with 16 to get 100% increase and fewer candidates achieved this.

Question No. 7

Most candidates successfully completed question 7(i), perhaps having completed a similar question on computer memory from last year's paper before the exam. Around half were aware of a benefit of using a logarithmic graph for question 7(iv). However some candidates did not complete question 7(ii), question 7(iii) and question 7(v) and others were unsuccessful on them so many achieved 2 or 3 marks from a possible 13 here.

Question 7(ii) states that in Generation 10 there are 1000 ancestors so most got question 7(ii)A correct but many candidates then multiplied by 1024 for the later parts of the question and so only achieved 1 mark. Credit was given for consistent use of 1024 throughout.

These errors led to further difficulties on question 7(v) where only a few correct answers were seen and a confusing mix of 1024 and 1000 written in a variety of decimal and standard form combinations or a blank table were more common. Candidates did not spot the millions stated in the question and in the table which was vital for getting the values in the correct decimal place.

Many were able though to describe the problem of more ancestors than world population but few then correctly identified the second assumption and how to relax it, preferring the first assumption instead which would merely postpone (or pre-date) the problem.

Where graphs were seen on question 7(iii), some showed exponential increase rather than decay for question 7(iii)A and others missed points or the line or had a curve for question 7(iii)B.

Question No. 8

The conversion between speed units in question 8(i) and question 8(iii) was done well by high achieving candidates but other candidates were unsure of the method and did not spot that the first row required for the table in question 8(iii) was given on the diagram.

The best answers for question 8(ii) made clear substitutions of values into the speed distance time formula and then were able to use this value and rearrange this formula in question 8(iv) to the form required. Some candidates found the thinking distance of 9m for question 8(ii) but got no further and others were able to calculate 0.675 seconds from this but not repeat the process for a different speed.

A similar method was shown by a few successful candidates on question 8(v) who found the braking distance of 14 m and substituted this and 13⅓ m/s into the formula. A few candidates used 48 km/h instead and one candidate lost a mark here for incorrect rounding of the answer.

A few candidates were able to combine the formulae from question 8(iv) and question 8(v) and substitute a converted speed as well as the value for k to achieve a suitable estimate. A few others calculated the speed conversion or used the formula for b or d correctly but then did not add to get the final estimate. These marks could have been achieved by more candidates had they attempted them.

Many candidates did not respond to all or parts of this question. Those who did generally scored a few marks, some on later parts where they persevered through the question. Most though scored 0 out of a possible 14 marks on this question despite a familiar context of driving, perhaps because of the combination of converting compound units with using speed distance time formulae or perhaps because they needed to practise exam technique for timekeeping.

G244 Introduction to Quantitative Analysis (Coursework)

Administration

Administration can cause difficulties in the moderation process if not carried out efficiently and in accordance with the instructions from the board. In the vast majority of centres, however, administration was effective. Most coursework arrived on time if not early, there were few clerical errors and the vast majority enclosed the Authentication Form, CCS160. This all made the process of external moderation very much easier.

Centres are once again reminded that it is also a great help to have the cover sheets filled in properly. This means

- Full candidate name and candidate number,
- Marks given by criteria rather than domain,
- Comments to help the external moderator determine which marks have been awarded and which have been withheld,
- An oral communication report.

Assessors are asked not to tick work that they have not checked, but they are required to do some checking of calculations so we do expect to see some annotation in the body of the work.

The marks of candidates in most centres were appropriate and acknowledgement is made of the amount of work that this involves to mark and internally moderate. The unit specific comments are offered for the sake of centres who have had their marks adjusted for some reason.

These reports should provide a valuable aid to the marking process and we would urge all Heads of Departments to ensure that these reports are read by all those involved in the assessment of coursework. All that follows has been reported before!

Introduction to Quantitative Analysis – G244
Administration, particularly from centres not entering candidates for MEI Structured Mathematics, was much improved this year. We still have problems outlined in the general section above and centres are encouraged to note the points made and the instructions distributed by OCR.

The standard of work was also much improved. There are still many reports, however, that do not meet the criteria and are rather too simple for a piece of coursework at this level.

Most of these were given the poor mark they deserved. There were still a number of centres, however, where the assessment was rather too generous requiring some scaling. Centres should note the comments below and also the specific centre report.

- Candidates should say why the investigation is worth doing
- The population should be clearly defined and the sampling procedure discussed. There are problems over this where the data are taken from an internet site where the details of the population are not given, but the marking criteria addresses those problems.
- A variety of displays should be used to describe the sample.
- Candidates should use a spreadsheet to carry out the calculations. A task where no calculations are done should obviously be avoided.
- Candidates should say why both the diagrams and calculations are appropriate.

- As commented last year, questions raised by the work should not be simply a discussion of what candidates might do instead or in addition to what has been done but questions that arise from the conclusions drawn.

G245 Statistics 1

General Comments:

As last year, the majority of candidates coped very well with this paper and a large number scored at least 60 marks out of 72. There was no evidence of candidates being unable to complete the paper in the allocated time. Most candidates had adequate space in the answer booklet without having to use additional sheets. Candidates who did need additional space often used the last page of the answer book, but a number did not, presumably not realising that it was available. It is also pleasing to report that losing marks due to over-specification was less of a problem than in previous years. Some candidates lost a mark in question 6 part (i) due to giving their answer to the mean and/or the standard deviation to 5 significant figures. A very small number gave probabilities to more than 5 significant figures thus again losing a mark.

Candidates usually scored very well on question 4 on frequency distributions, question 6 parts (i) and (iii) on data measures and histograms and on question 7 parts (i) on the binomial distribution. Even part (ii) of question 7, where candidates had to state hypotheses and define p, was very well answered. This is very pleasing, as up until recently, this topic has caused many candidates problems.

Questions on which candidates did not score so highly included question 3 parts (iii) and (iv) on probability, question 5 part (iii) on conditional probability and the latter parts of question 7 on hypothesis testing. In question 1, a surprisingly large number of candidates did not know how to find the quartiles correctly from a stem and leaf diagram, although most then knew the definition of outliers, so were able to gain marks in part (ii). Questions 2 and 3 caused difficulties to some candidates who scored highly in other areas of the paper. These two questions appeared to be a little less routine and required engagement with the scenario.

Candidates sometimes did not read the question carefully enough, so explanations did not always answer what was asked or explanations were missed out entirely. Candidates have, in most cases, been well prepared for calculations required in the paper but less so for analysing their findings. Although many candidates gave well written explanations, the poor handwriting, grammar and/or use of English made it difficult to work out what some others were trying to say. There were also problems with fours that looked like sixes or nines and ones and sevens that were difficult to tell apart.

Comments on Individual Questions:

Question No. 1

In question 1(i) the vast majority of candidates found the median correctly. A small minority misread/ignored the key to the stem and leaf diagram and gave an incorrect answer of 290. However under half of candidates found the quartiles correctly, with many using 5th and 15th values, which was penalised.

In question 1(ii) most candidates gained full marks, often on follow through from quartiles which were slightly out. The most common error was to use the median in calculations. A few candidates started from scratch and calculated mean and standard deviation. Some managed this successfully, but others made errors in their calculations, or incorrectly used a combination of both methods such as mean $\pm$ 1.5 $\times$ interquartile range.

Question No. 2

In question 2(i) many candidates thought that not losing meant winning, and hence gave the common wrong answer of $0.5^3 = 0.125$. Others tried to consider combinations of wins and draws, often without success. The fact that the question part was only worth 1 mark should have been a clue to the fact that there was an easier approach.

Question 2(ii) was generally well answered although a few candidates interpreted this as 'find three separate probabilities which they did, and listed them but with no addition thus scoring zero.

Only a small proportion of candidates used the most elegant approach (the first method in the mark scheme) for question 2(iii) and of those who did, many forgot to multiply by 6. Most candidates gave lists or tree diagrams to show P(WWL) etc., but many then did not multiply by 3, so the most common answer was 0.22, rather than the correct 0.66.

Question No. 3

Question 3(i) was generally well answered.

Question 3(ii) was generally well answered, although some candidates truncated their decimal rather than correctly rounding. The use of fractions was preferable here.

Only around two thirds of candidates scored the mark for question 3(iii). The most common error was to use combinations.

Again about two thirds of candidates scored both marks in question 3(iv), with many scoring the marks for their answer to part (iii), correct or not, multiplied by 6, rather than for the fairly simple $\frac{3}{5}\times\frac{2}{4}\times\frac{1}{3}$.

Question No. 4

Generally the solution of the equation to find k was carried out well, although not always entirely efficiently in question 4(i). Most candidates seemed to know that the sum of the probabilities should be 1, although not all thought it necessary to say so. However some did not include addition signs and so lost the marks, and others seemed to have no idea about addition of fractions, thinking that the sum of the probabilities was $^{5k}/_{70}$. Those who used $k = 1.2$ and verified the sum got some very easy marks, although not all were convincing enough to get full credit. The vast majority used the correct probabilities in part (ii), although not all tabulated them in a table to get the third mark in part (i).

Question 4(ii) was very well answered with about 80% of candidates scoring full marks. A few candidates only found $E(X^2)$ and a few used spurious division. Very few candidates attempted to find $E(X- \mu)^2$ and those who did were rarely successful.

Question No. 5

Question 5(i) was very well answered but a considerable number of candidates assumed that the probabilities were independent and calculated P(R) × P(S) . Some were more confused about the correct formula to use and calculated P(R) × P($R \cup S$).

The idea of the Venn diagram was well understood, and most candidates produced a fully correct solution for question 5(ii) (often following through from an error in part (i)). Very few noticed the contradiction produced by their wrong answer, which gave the outer zone as 0.0936 instead of 0.06 from the question.

Among those who had not made the independence error in part (i), the correct answer was quite common in question 5(iii). The explanation of what the probability means was usually correct but sometimes lacked sufficient detail. There were a few candidates who 'reversed' the statement and gave an explanation of P(S|R).

Question No. 6

Question 6(i) was fairly well answered with over half of candidates gaining full credit. A few had no idea how to proceed, but most used correct mid-points, although some made slips with them or occasionally used figures such as 25.5, 45.5, etc. The standard deviation proved more difficult for a number of candidates with a variety of wrong methods seen. Very few used the statistical functions on their calculator to do this question, despite this being the recommended method. A few candidates over-specified either or both of their final answers and so lost a mark.

Candidates found question 6(ii) rather more challenging, although almost half scored full marks. Trying to establish the proportion they were after was the biggest stumbling block. However, some were then unsure what to do with the figure of 145.83 once they had found it. Some rounded down to 145 (probably the most common mistake of those who understood what they needed to do) and others failed to finish by finding the percentage, just giving the final answer as a decimal 0.157.

Question 6(iii) was again well answered with around 80% of candidates gaining at least 4 marks out of 5. Various errors were seen, but none very commonly. The most frequently seen were: using frequency rather than frequency density, using a non-linear scale on one of the axes (usually the horizontal axis), stopping the horizontal axis at 120, and labelling the horizontal axis 'Class width'.

Over 90% of candidates scored the one mark available for question 6(iv).

A good number of candidates achieved full marks for question 6(v), and it was answered better than question 6 part (ii) which is a similar calculation. Of those who got the calculation incorrect most started with 240/990 or 20/990, rather than 200/990. The explanation over certainty was well answered with most candidates achieving this mark, whether or not they got the first 2 marks.

Although question 6(vi) is essentially a simple question, almost a third of candidates scored zero. Candidates struggled to provide acceptable comparisons, with many relying on terms such as "central tendency" when comparing the means, and relatively few discussing averages. A more encouraging proportion of candidates were able to provide a good interpretation for the differences in the standard deviations. Some thought that central tendency was something to do with variation. A number of candidates were unable to construct a proper, legible, grammatically correct sentence.

Question No. 7

Question 7(i)A was very well answered.

Again question 7(i)B was well answered, usually by use of tables, although some candidates did calculate the three probabilities, add and subtract from 1. A few candidates forgot to subtract from 1, and a few just subtracted P(X = 2) from 1.

The majority of the candidates found question 7(i)C straightforward, but a small minority lost the mark when they rounded their final answer to 1 or 2.

As in recent years, candidates did well on question 7(ii), with over 80% gaining at least 3 marks out of 4. Most candidates scored the first two marks for the hypotheses, with many knowing that they needed to define p, thus scoring the third mark. A valid explanation of the reason for the form of the alternative hypothesis was usually given, even if not always very well worded.

Only about half of the candidates scored any marks for question 7(iii)A at all. Many candidates did not use any numbers so could not gain all the marks, but were awarded special case 2 if they gave a very convincing explanation. Some of those that did state that P($X \leq 0$) = 0.1216 then failed to show a comparison with 10% or 0.1 and so only scored 1 mark.

Those candidates who had 0.1216 in the previous part usually gave the correct answer of 13% for question 7(iii)B. Some who did not get marks in the previous part did give the correct answer, so they probably simply did not know how to verbalise the previous answer. However under half scored the mark, some by simply failing to round to an integer.

There were many good, clear answers to question 7(iv) but there were still a good proportion of candidates that were tempted to use point probabilities. A significant number who did use the correct probability (or probabilities if using a critical region method) failed to give the conclusion of the test in context. Some lost the final mark for commenting that the proportion had not changed instead of had not reduced and some gave a conclusion which was too assertive.

G246 Decision Mathematics 1

General Comments:

As always, many of the candidates for this paper exhibited very poor communication skills. Communication skills go hand-in-glove with thinking skills. Candidates who could not read and understand, and who could not think clearly nor express themselves clearly, could not do well on this paper

Comments on Individual Questions:

Question No.1

The first question carried an obvious moral tale about gambling, which will perhaps be well used in future revision classes. Regrettably, the message will have eluded the many candidates who failed with part (iv).
Parts (i), (ii) and (iii) were answered well, which makes the repeated failures in part (iv) all the more surprising. Having considered what happens, and then simulated what happens, it should have been clear that the mean required in part (iv) was the mean monetary outcome. This shows that the expectation is for a substantial loss. Instead many candidates computed simulated probabilities of winning/losing. This misses the point when wins were always £100, but when losses in this scenario were £700 a time.

Question No. 2

This question was also well answered. The most common mistake in part (i) was to give only the updating probabilities, instead of using them in the updating calculation.
The other parts were answered well, with many candidates referring to unequal probabilities in their answers to (iv).

Question No. 3

Parts (i) and (ii)(A) were answered well, but very few marks were scored in (ii)(B). It had been hoped that the solution for the cube, described in the question, would have pointed the way. Inevitably there were candidates who described a colouring, which does not answer the question.

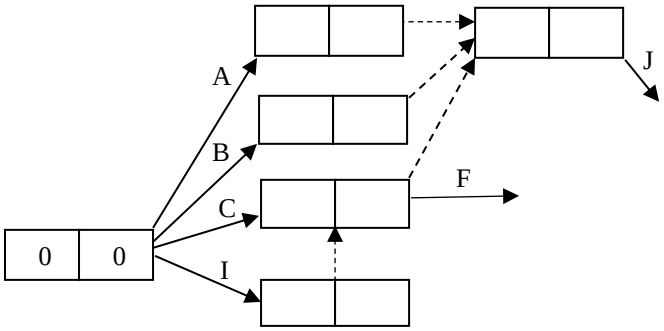
Question No. 4

This question proved to be too difficult for nearly all candidates. Very few decent graphs were seen.

Most could do parts (i) and (ii), but thereafter confusion reigned. Candidates could not get to grips with the scenario, and it was common to see $x >$ (or $\geq$) 20 for (iii) and $y >$ (or $\geq$) 24 for (iv). The instruction seemed clear enough in (v), but there were very few attempts to use $z = 20 – x – y$.
Given all that, few could make any coherent sense of where they had got to in terms of drawing the feasible region.

Question No. 5

This question started by requiring candidates to model written precedence expressions by a list of immediate predecessors. This made it more difficult than usual to produce the activity-on-arc network in part (ii). Creditable attempts were seen, but many candidates lost marks in their use of dummy activities. For instance, many candidates did not realise that the following logic is OK for F (immediate predecessors of C and I) but not for J (A, B and C), since it also has I as one of its immediate predecessors.



Question No. 6

Part (a) was answered well. In part (b) examiners needed to be convinced that Kruskal was being used in (i) and Prim in (ii). The safest way to do this is to show the order of including arcs for Kruskal, and the order of including vertices for Prim.

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