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FOREWORD

This booklet contains reports written by Examiners on the work of candidates in certain papers. **Its contents are primarily for the information of the subject teachers concerned**.

STATISTICS

GCE Ordinary Level

Paper 4040/01

Paper 1

General comments

Once again, many very good scripts were submitted, but, as last year, probably not the same proportion of extremely high marks was achieved as was the case a few years ago. There were possibly a number of reasons for this. One point, made in this report last year, but which has clearly not been taken on board by some candidates relates to a situation, which occurred quite frequently in this paper, where a question requests that a final answer should be given to a particular level of accuracy. Time and again such a request was not complied with by a number of candidates. The resulting loss of marks is needless, as indeed it is when, as appeared to happen in a few cases involving answers to two questions, a question instructs 'copy and complete the table', and it appears that a candidate has completed the table in the question paper but not copied it into his/her answer booklet.

Another common cause of loss of marks arose when a question asked for comment. This almost always requires a candidate to make some relevant statement in the context of the question, not just to make some general remark on the topic concerned which appears to have been learned by rote from a textbook.

A point made in this report for both of the last two years is still not being acted upon by a very small number of candidates. This is that where an answer requires the use of graph paper, only the graphical part should be given on the graph paper, with the rest of the solution appearing in the candidate's answer booklet.

However, there is one point of importance in **Question 10**. The same error was made by approximately one-third of all candidates. It was not the case that all candidates from certain Centres made the error while all candidates from other Centres did not. There were many instances of some candidates at a Centre making the mistake and others not. The conclusion has to be that there is a problem of understanding the topic concerned (the method of semi-averages) for many candidates, and therefore this may be something on which Centres need to concentrate in their teaching of the topic more so than has been the case in the past.

That having been said, however, the overall performance of candidates must be commended. There were very few really poor papers.

Comments on specific questions

Section A

Question 1

Almost all candidates knew how to interpret the pictogram given in the question, and the vast majority scored highly. The most common error occurred in part **(iv)** through failure to appreciate the 'without replacement' nature of what was requested, resulting in a denominator of 450 being given in both the probabilities which were to be multiplied together.

Answers: **(i)** 120; **(ii)** $\frac{4}{15}$; **(iii)** 30; **(iv)** 0.119.

Question 2

Most candidates indicated sufficient working to show how they arrived at the given answer to part **(i)** to earn the available mark. Where, as in part **(ii)**, a request for tabular presentation of the result is made, the marks cannot be scored if this is not done. Most did, however, comply with the request. In parts **(iii)** and **(iv)** there was occasional confusion between 'committee' and 'village', the correct solution for one part sometimes appearing as the candidate's answer to the other.

Answers: **(ii)** Men 3 4 2, Women 2 5 4; **(iii)** $\frac{1}{4}$; **(iv)** 0.2625 or 0.263.

Question 3

The vast majority of candidates scored full marks. The most common error involved confusion between the median and the mean.

Answers: **(i)** Mode 6; **(ii)** Median 7; **(iii)** Mean 8.

Question 4

This was the first question in the paper where candidates met a request, in fact two, for answers to a specified level of accuracy. In this case, most did comply with the request. A small amount of tolerance is allowed for drawing a pie chart, and the vast majority of those presented were within it, and charts were well drawn and annotated.

Answers: **(i)** 55°, 129°, 136°, 40°; **(iii)** 7.7 cm.

Question 5

Most candidates were able to read appropriate values from the graph, and then use those values correctly, but many did not comply with the requests, in all parts of this question, for answers to specific levels of accuracy.

Answers: **(i)** 41 minutes; **(ii)** 24 minutes; **(iii)** 82.9%.

Question 6

The most frequent errors in all three parts of the question involved incorrect denominators in probabilities presented as fractions. Parts **(i)** and **(iii)** were answered correctly by about half of all candidates. Comparatively few were able both to interpret what part **(ii)** was asking, and then convert it into a correct probability; and only a handful spotted the 'quick' solution using the complement rule.

Answers: **(i)** $\frac{19}{40}$; **(ii)** $\frac{77}{80}$; **(iii)** $\frac{1}{5}$.

Section B

Question 7

Many candidates scored quite highly on this question, but apart from those who scored full marks, it was almost always the case that the majority of the marks obtained by a candidate were obtained in part **(a)**. In line with the experience of recent years, most candidates were able to calculate crude and standardised death rates, loss of marks being more frequently the result of arithmetic errors rather than the use of incorrect methods. Quite frequently, however, a mark was lost because the units of the death rates (either 'per thousand' in words, or the corresponding symbol) were not given. The most common source of error in part **(b)** was the fact that there were some households which had no pet at all, something which a considerable number of candidates failed to appreciate, despite the hint given in the table in part **(b)(i)**. This cost many candidates marks in parts **(i)** and **(iii)**. In part **(b)(i)** there were a few instances of a clear suspicion that a candidate had completed the table in his/her question paper, but then not copied it into an answer booklet. The question did clearly state, 'copy and complete'.

Answers: **(a)(i)** 15, 20, 2000, **(ii)** 14 per thousand, **(iii)** 13.8 per thousand; **(b)(i)** 14, 52, 12, 2, **(ii)** $\frac{52}{80}$, **(iii)** $\frac{4}{5}$, **(iv)** $\frac{3}{80}$.

Question 8

Almost all candidates attempted this question, and the vast majority scored highly on it. Reading appropriate values from the given graphs was accomplished very accurately in many cases, but a cause of concern in relation to parts **(i)(d)** and **(e)** was the number of candidates who clearly did not know what a percentile is. It was very pleasing to see how many candidates knew what had to be done with values read from the graph in parts **(ii)** and **(iii)**. It was less common, however, to see part **(v)** answered correctly, where a calculation had to be carried out and then a reading made from the graph based on the result of the calculation. In part **(vi)**, as in almost all questions requiring comment, something in context was required, not just a general 'textbook' statement. Here, for example, a candidate had to interpret the given information in order to write a comment about it. Anything on the lines of 'older people preferred the garden centre' or 'the ages of people at the garden centre were more dispersed than those of people at the swimming pool' was sufficient to score the mark. In part **(iii)** there were a few instances of a table having been completed in a question paper, but then not copied into an answer booklet.

Answers: **(i)(a)** 27 – 28, **(b)** 20 – 21, **(c)** 38 – 39, **(d)** 13 – 14, **(e)** 52; **(ii)** 6; **(iii)** 10, 24, 37, 9; **(iv)** $\frac{3}{10}$; **(v)** 24.

Question 9

Almost all candidates scored in the range four to twelve marks for this question, marks lower than this range being quite rare, and marks higher than it extremely so. The vast majority of even the weaker candidates were able to demonstrate that they knew the 'area is proportional to frequency' property of a histogram, to give the correct mid-values of the five groups, and to indicate a correct method for calculating the mean. Hardly any of even the best candidates gave a scale on the vertical axis of the histogram which matched the requirement of the question (e.g. 'number of employees per centimetre, or per $1000'), or gave a comment which actually answered what part **(vii)** asked. There was one particularly worrying aspect about a noticeable number of answers to part **(vii)**. The question asked 'which statistical measure of the average salary would you use?'. An answer was being looked for based on a comparison of the three 'measures of average' which had been obtained in answering earlier parts of the question. Many answers seen were irrelevant, but did at least relate to different measures of average, the mean, median or mode. Some candidates, however, chose the standard deviation, being apparently totally unaware that it is not a measure of average. The numbers involved in the calculation parts of this question were quite large, and it was therefore disappointing to see only a small handful of candidates opting to use an assumed mean and/or scale factor in their calculations. Finally, once again, some candidates, having worked through their calculations for the mean and standard deviation perfectly correctly, then lost a mark in part **(v)** and/or part **(vi)** through not giving their final answer to the requested level of accuracy.

Answers: **(i)** $17 000; **(iii)** $20 000 – $22 000 class; **(iv)** $12 500, $16 000, $18 500, $21 000, $22 500; **(v)** $17 050; **(vi)** $3450.

Question 10

The most pleasing aspect of answers to this very popular question was, as has been the case in 'line of best fit questions' in previous years, the high quality of much of the graphical work. There were, however, two very common causes of loss of marks. The less serious one, (less serious in that it can be easily rectified), related to two places towards the end of the question where marks were lost because a given answer did not do what the question asked. In part **(vi)** the question requested the equation of the line of best fit, so an answer which just obtains the values of the gradient and the intercept, but then does not present them in an equation is going to lose a mark. In part **(vii)** the question asked for an interpretation of the value of m. On script after script it was just stated that m was the gradient of the line, or, worse still, the numerical value of m was just repeated, neither of which is an interpretation. A comment putting m into the context of the two variables is required. Much more serious, however, was the error in method made by an amazingly high proportion of candidates when calculating the two semi-averages. The criterion for determining which pairs of values are used to calculate the semi-averages is that lower semi-average is calculated from the half of the pairs of observations which have the lowest values of the x-variable, and the upper semi-average from the half with the highest values of the x-variable. Approximately one-third of all candidates used the first four pairs of values in the table in the question to calculate one semi-average, and the remaining four to calculate the other.

Answers: **(ii)** (79, 85), (44, 48), (114, 122); **(iii)** C; **(iv)** 77 cents; **(v)** 90 cents; **(vi)** $y = 1.06x$.

Question 11

As has been the case in recent years, a question on this topic proved to be the least popular in ***Se***. Again in common with past experience, the answers given by those candidates who did attempt it ten... be either very good or hardly worth any marks at all. Somewhat surprisingly, among those candidates w... fell between these two extremes, part **(c)** was usually the best-answered part of the question. One possibl... explanation for the comparative unpopularity of questions such as this one is that before the required probabilities can be found it is necessary to interpret from the information given in the question exactly what are the events whose probabilities are required. For example, in part **(a)** it was not only necessary to consider that the required outcome occur on particular trials, but also that it should not occur on others. In part **(b)** it was necessary to deduce that the required overall outcome could only occur if discs of the same colour were taken on the two draws. One way in which candidates can improve their likelihood of answering a question correctly is by explaining at each stage exactly what it is they are trying to do, rather than submitting a solution which just consists of a large quantity of numbers, without any indication of what each one represents.

Answers: **(a)(i)** $\frac{18}{125}$, **(ii)** $\frac{36}{125}$; **(b)** $\frac{33}{56}$; **(c)** $\frac{51}{256}$.

Paper 4040/02

Paper 2

General comments

The overall standard of work seen was very much in line with that last year, with one exception. This year, exceptionally high overall marks were less common than last year, mainly because a very popular ***Section B*** question was not answered well by the vast majority of candidates, (even many of those whose work was otherwise near-perfect), for two reasons explained in the detailed report on that question, **Question 9**.

A comment made in last year's report had not been heeded by many candidates. This was that where an answer is requested to a specific level of accuracy, then that request must be complied with if accuracy marks are not to be lost.

There was, however, one very pleasing aspect of many scripts. The comments made in previous reports about systematic sampling had clearly been acted upon, and there were many very commendable attempts at the question on sampling, which has not been the case in the past.

In general, the graphical/diagrammatic work in the two questions which required it was also of a high standard.

Comments on specific questions

Section A

Question 1

Although this question was very similar to the corresponding question in the November 2004 paper, on which comment had been made in the Report on the Examination, some candidates had still not realised that questions of this type simply require an application of the properties of scaling, and not long detailed calculations which almost always fail to achieve the required results. At the other extreme, many candidates were able simply to write down the six correct results and achieve full marks.

Answers: **(i)** $2m$, $2s$; **(ii)** $(m - 4)$, s; **(iii)** $(3m + 5)$, $3s$.

Question 2

Some candidates clearly had a good understanding of the topic being examined; the answers of others often appeared to be pure guesswork.

Answers: **(i)** *D*, *F*; **(ii)(a)** *A*, *C*, **(b)** *B*, *E*.

Question 3

In part **(i)** almost all candidates were able to give one valid comment, but very few gave a sufficient explanation which would gain two marks. Reference needed to be made to both the determination of an average and the removal of variation. Answers to the parts of **(ii)** often failed to score because the comments made were not 'reasons'. For example, in part **(c)** a comment that centring is not needed because there are seven days in a week is not a 'reason'. It needs to be specified what property of the number seven (i.e. that it is odd) makes centring unnecessary.

Question 4

It was very rare indeed to see a fully correct answer to this question. There were two common errors in relation to part **(ii)**. One showed an apparent confusion between the concepts 'mutually exclusive' and 'independent', in that quite a number of candidates gave as their answer to part **(ii)** what was in fact the correct answer to part **(i)**, in some cases where they had already given that same answer to part **(i)**. The other had one worrying aspect. The making of one particular common method error in part **(ii)** led to a result of 1.6 being obtained for the required probability, and yet it was almost totally unknown for a candidate to comment in some way or other that he/she realised this must be incorrect.

Answers: **(i)** 0.3; **(ii)** 0.6.

Question 5

Despite the example given in the question, some candidates were clearly confused as to which of the two rows in the table related to the variable, and which to frequencies. Many, however, had no problems in answering parts **(i)** and **(ii)** correctly. What was particularly pleasing was the number who were able to work out what was required to answer part **(iii)** as well as doing it correctly. Even better, some gave clear explanations of why they were doing what they were doing. Different results were allowed to part **(iii)** to cater for the different methods of evaluating the median of a frequency distribution.

Answers: **(i)** 6; **(ii)** 7; **(iii)** 5 (or 4).

Question 6

Many candidates scored well on this question, the most frequent problem being inability to cope with part **(ii)(b)**, where a price relative for one year was required, taking the following year as base year.

Answers: **(i)** 117.6; **(ii)(a)** 104.0 (or 104), **(b)** 91.7 (or 92).

Section B

Question 7

Although, as is often the case with this type of question, many candidates scored highly, it was unusual to see full marks being achieved. This was usually due to a failure to appreciate, in parts **(i)** and **(iv)**, that when selection of a packet was involved, the probability was $\frac{1}{2}$ that one particular packet would be chosen. Another error seen quite often was the failure to appreciate that when sweets of different colours were chosen the principle of 'either order' applied, but that this was not the case when selecting sweets of the same colour. The 'without replacement' scenario in part **(v)** was handled correctly by a majority of candidates.

Answers: **(i)** 0.458; **(ii)** 0.485; **(iii)** 0.194; **(iv)** 0.0758; **(v)** 0.101.

Question 8

Almost all candidates scored the three marks available in part **(i)**, but although many were clearly along the right lines in part **(ii)**, explanations were often insufficiently detailed to score the mark. The n feature of answers to parts **(iii)** and **(iv)** was the high standard of graphical work submitted by the v majority. There was the usual 'problem' with comments in part **(v)**, however, as answers were often genera points rather than the contextual comment required. Questions of the type of part **(vi)** have appeared frequently in the paper in recent years, and yet many candidates still do not appreciate that the components should sum to zero. In part **(vii)**, many just gave a reading from their graph without applying the appropriate component to it, although the question gave the clearest of hints that this needed to be done.

Answers: **(i)** 57, 59, 24.3; **(vi)** –6.4.

Question 9

This proved to be very popular, attempted by very nearly all candidates, no doubt because its three parts contained questions of types which have appeared in almost all papers in recent years. However, it was very rare indeed to see a script on which more than half marks were scored. This was almost always due to the same two reasons, failure to read the question sufficiently carefully, and failure to use a method specified in the question. In both bold print in the introduction, and in a column heading in the table of data, the variable was clearly stated as 'age last birthday', but almost all candidates took it as 'age to the nearest year'. This resulted in, for example, 44.5 being used as the lower limit of the median class, rather than the correct 45. Unfortunately, about half of those who correctly used 45 then failed to follow through their reasoning to the upper limit of the class (54.999..... i.e. 55) and so used a class width of something other than the correct 10. The end result of these various mistakes was very few correct medians and inter-quartile ranges indeed. In part **(iii)** the question clearly states 'using an assumed mean of 30 years', and yet in about half the attempts seen there was no mention of this value, let alone an attempt to use it. Candidates must understand that when a question specifies a particular method, that is the one which must be used if more than just a few marks are to be scored. In this case an answer which made no mention of the assumed mean could score only a maximum of two marks out of the eight available. Finally, the results in parts **(ii)** and **(iii)** were all requested to one decimal place, and yet some candidates who had managed to avoid making all the other mistakes mentioned above then failed to comply with this instruction.

Answers: **(i)** 46; **(ii)** 18.0; **(iii)(a)** 43.0.

Question 10

In contrast to the two common errors in the previous question, there were two very pleasing features about many of the answers to this question. Two comments which have both been stressed more than once in recent reports finally appear to have been acted upon, resulting in answers of high quality from a considerable number of candidates. Firstly, the procedure for selecting a systematic sample was frequently seen being applied perfectly correctly. Secondly, a pleasingly large number of candidates obviously read part **(v)** sufficiently carefully to realise that they were being asked to consider each of their four selected samples in turn, and investigate how well each represented the overall population in terms of gender and age group. General 'textbook' comments about sampling methods, which scored no marks at all, were much less common than in previous years. All this, together with the high standard of work on simple random and stratified sampling seen in previous years being maintained, meant that high marks on this question were relatively common, although the question itself was probably the least popular in ***Section B***.

Answers: **(i)** 12, 02, 09, 01, 04; **(ii)(a)** 01, 03, **(b)** 02, **(c)** 05, 08, 11, 14; **(iii)(a)** 2 male, 3 female, **(b)** 02, 08, 10, 05, 15; **(iv)(a)** 2 from group I, 1 from group II, 2 from group III, **(b)** 14, 15, 01, 09, 07.

Question 11

This question proved very popular, and the best part of most answers was the diagrammatic presentation in part **(b)**. Although most candidates managed to obtain a moderate number of marks in part **(a)**, there were two common causes of marks being lost. In part **(a)(ii)** the same point was often made more than once but using different wording, and obviously a mark cannot be awarded twice for the same answer. Part **(a)(iii)** was a rare example of general comment, rather than comment in a particular context, being required, but the question did clearly specify that comments comparing two different types of bar chart were required, and so comments which were not of a comparative nature failed to score any marks.