Course report 2024

Advanced Higher Statistics

This report provides information on candidates' performance. Teachers, lecturers and assessors may find it useful when preparing candidates for future assessment. The report is intended to be constructive and informative, and to promote better understanding. You should read the report with the published assessment documents and marking instructions.

We compiled the statistics in this report before we completed the 2024 appeals process.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2023: 171

Number of resulted entries in 2024: 150

Statistical information: performance of candidates

Distribution of course awards including minimum mark to achieve each grade

A	Number of candidates	68	Percentage	45.3	Cumulative percentage	45.3	Minimum mark required	84
B	Number of candidates	30	Percentage	20.0	Cumulative percentage	65.3	Minimum mark required	72
C	Number of candidates	25	Percentage	16.7	Cumulative percentage	82.0	Minimum mark required	60
D	Number of candidates	13	Percentage	8.7	Cumulative percentage	90.7	Minimum mark required	48
No award	Number of candidates	14	Percentage	9.3	Cumulative percentage	100	Minimum mark required	N/A

We have not applied rounding to these statistics.

You can read the general commentary on grade boundaries in the appendix.

In this report:

- ‘most’ means greater than 70%
- ‘many’ means 50% to 69%
- ‘some’ means 25% to 49%
- ‘a few’ means less than 25%

You can find statistical reports on the statistics and information page of our website.

Section 1: comments on the assessment

Question paper 1

Question paper 1 performed as expected.

Question paper 2

Question paper 2 performed as expected.

Section 2: comments on candidate performance

Question paper 1

Question 1(c)(ii)

Most candidates did not gain any marks because their answers omitted at least one key word about the check. For example, the response: '80% of expected frequencies had to be more than 5 and none less than 1', was not sufficient to gain mark 6. This is because the response does not include the complete phrase 'at least 80% …' and includes 'more than 5' instead of 'at least 5'.

Question 1(c)(iii)

Many candidates gained at least 1 of the 2 marks available. Many candidates gained mark 7. Refer to note 1 in the marking instructions and the commonly observed responses for details of accepted responses.

Question 1(d)(i)

Many candidates gained all 3 marks.

Question 1(d)(ii)

Many candidates did not gain any marks.

Mark 12 required candidates to communicate that the check had to be performed on each of the two samples, and not by using the pooled proportion and total sample size.

The most common reason candidates missed out on mark 13 was making comments that were too definite. Refer to note 4 in the marking instructions and the commonly observed responses for details of accepted responses.

Question 1(e)

Most candidates gained at least 1 of the 2 marks available.

Many candidates provided more than the two comments required. Please refer to the marking instructions for details on how this was marked.

Question 2(a)

Only a few candidates gained the 2 marks available. Candidates needed to clearly refer to two distinct groups, and not use generic phrases such as 'the data is not normal'. Many candidates provided more than the two reasons required. Refer to the marking instructions for details on how this was marked.

Question 2(b)(i)

Most candidates did not gain any marks. Hypotheses must always refer to population parameters. The word 'median' on its own is insufficient, and candidates should instead use 'population median', or the Greek letter eta, η.

Question 2(b)(ii)

Most candidates gained at least 2 of the 3 marks available. The clearest responses described the process of ranking as, firstly, ordering the values in size, and then numbering the values. Simply stating 'rank the data' was not sufficient.

Question 2(c)

Most candidates gained the 1 mark available. This was the first time that identification of a missing rank value from a computer output had featured in question paper 1.

Question 2(e)(i)

Most candidates did not gain any marks. Candidates' responses highlighted their level of comfort with p values, and how they are seen to align with critical values for two-tailed hypothesis tests.

Question paper 2

Question 1

Most candidates gained all 3 marks.

Question 2

Most candidates gained all 5 marks. Candidates' clear use of correct notation was significantly improved, when compared to previous years.

Question 3(b)

Most candidates gained at least 3 of the 4 marks available.

Many responses included evidence of the good habit of checking that $np > 5$ and $nq > 5$.

Many incorrect responses for mark 5 involved candidates stating that
$P(Z > -2.55) = 1 - P(Z < 2.55)$.

Question 4

Many candidates gained at least 5 of the 6 marks available.

For mark 4, many candidates incorrectly stated that there were 3 degrees of freedom. For mark 6, some candidates framed conclusions to hypothesis tests in terms of the null hypothesis instead of the alternative hypothesis.

Question 5(a)

Some candidates gained the 2 marks available. Many candidates were too precise in their description of the relationship and strayed into talking about the model itself, by mentioning exponential, and logarithmic functions. Many candidates also used the terms 'correlated' or 'correlation', which were inappropriate because the relationship they were describing was not linear.

Question 5(b)(ii)
Many candidates gained at most 3 of the 5 marks available. Many candidates incorrectly substituted the reciprocal of the fitted value into mark 9's expression.

Question 6(a)

Only a few candidates gained at least 4 of the 5 marks available. Many candidates missed out on the first 2 marks for:

- stating that the checks for $np > 5$ and $nq > 5$ were assumptions — these are not assumptions, but rather validity criteria that can be calculated and checked
- stating that 'they follow a normal distribution'
- not being clear about the exact event being modelled — for example 'crackers are independent' was not sufficient for mark 1

Question 6(b)

Many candidates gained the 2 marks available. However, refer to note 1 in the marking instructions, which relates to incorrect probabilistic statements.

Question 7

Many candidates gained all 5 marks. However, some candidates stopped at $\mathrm{V}(Y)$ and did not calculate $\mathrm{SD}(Y)$.

Question 8

Many candidates gained at least 7 of the 9 marks available. However, their errors included:

- for mark 4, substituting s^2, and not s, into the test statistic
- for mark 8, not being clear about the exact characteristic of the plants being tested, which, in this case, was plant height
- for mark 9, not clearly communicating that two distinct garden areas were being tested

Question 9(a)

Only some candidates gained the 2 marks available. Many candidate responses were not clear about the exact event being modelled. For example, 'components are independent' was not a sufficient response for mark 2.

Question 9(c)

Many candidates did not gain any marks. Many candidates did not communicate their intended strategy successfully. This suggested that they could have been unsure whether to use the Poisson probability distribution or the cumulative Poisson probability distribution.

Question 10

Many candidates gained at least 4 of the 5 marks available. There was evidence of good use of percentile notation, such as $z_{0.95}$. However, a commonly observed response for mark 1

was $\bar{x} \pm k\frac{\sigma}{\sqrt{n}}$,which is ambiguous. If candidates did not state 1.64 in mark 2, then they did not achieve mark 1 or mark 2.

Question 11(b)

Many candidates did not gain any marks. Many candidates did not name the correct type of data required for a chi-squared test of association. If candidates named an incorrect type, markers applied the marking instructions' commonly observed responses. However, many candidates were then not successful in correctly determining at least two variables that matched their stated data type.

Question 12(a)

Most candidates gained no more than 4 of the 6 marks available. Marks 1 and 2 of the marking instructions' illustrative scheme, along with notes 1, 2 and 3, are all critical to the success of completing this question accurately.

For mark 4, many candidates opted to convert from grams to kilograms, but they did not divide the variance by 1 000 000.

For mark 5, many candidates incorrectly stated that $P(Z > -1.723) = 1 - P(Z < 1.723)$.

Question 12(b)

Many candidates gained at least 5 of the 6 marks available. Many candidates did not achieve mark 12.

Question 13

Most candidates gained at least 4 of the 5 marks available. However, many candidates stated $101.89 < \bar{x} < 102.16$ instead of $101.88 < \bar{x} < 102.17$. They had adjusted the interval bounds by 0.01. This prevented an acceptable sample mean value of, say, 101.885 from being allowed.

Question 14(a)(ii)

Many candidates did not gain any marks. Many candidate responses were ambiguous because they did not include the terms 'sample' or 'population' in relation to mean and standard deviation.

Question 14(b)

Most candidates gained at least 1 of the 2 marks available, which showed that they had a good understanding of when to use the central limit theorem.

Section 3: preparing candidates for future assessment

Candidates' solutions should consistently and correctly use notation and have a clear and legible layout.

Candidates should be able to:

- follow the correct sequence of steps for all hypothesis tests
- state either 'reject H_0' or 'do not reject H_0' at the end of hypothesis tests
- give conclusions that are not too definitive, by using phrases such as 'evidence to suggest that...'
- give conclusions phrased in terms of the alternative hypothesis, and not the null hypothesis, for example, when there is insufficient evidence to reject H_0, then there is insufficient evidence to support H_1 — this is not the same as saying that H_0 is true

Question paper 1 and question paper 2

The following advice may help prepare future candidates for the Advanced Higher Statistics question papers. Teachers and lecturers should:

- encourage candidates to write all assumptions with high levels of precision that include referencing both the context and the appropriate population parameters and distributions
- ensure that candidates know that $\mathrm{P}(Z \geq -z)$ is equal to $\mathrm{P}(Z \leq z)$, and understand why it is not equal to $1-\mathrm{P}(Z \leq z)$, where Z is a continuous random variable and z is a real number
- ensure that candidates know how to identify the different types of data used for the hypothesis tests in this course, such as discrete, continuous and categorical data
- encourage candidates to become more familiar with approximating p values from test statistics and critical values
- encourage candidates not to give more than the question's instructed number of reasons, or assumptions
- ensure candidates know how to calculate the required number of degrees of freedom for a chi-squared goodness-of-fit test, when the parameter of the modelling distribution is provided
- ensure candidates know how to discern, and communicate, the difference between summing a number of independent random variables, and working with a constant multiple of a single random variable
- encourage candidates to transcribe information from the statistical formulae and tables booklet with complete accuracy
- encourage candidates to write in clear terms about each sample mentioned in a two-sample test scenario, and not to refer to the data holistically or as a single entity
- ensure candidates write hypotheses that always mention population parameters, either by the appropriate use of the correct letters, or the specific inclusion of the word 'population'
- encourage candidates not to automatically claim that data is normally distributed, when it is not a required condition

- ensure candidates practise describing the underlying assumptions of both binomial and Poisson distribution modelling situations, in terms of the context and the events being modelled
- ensure candidates can accurately adapt their workings and answers when working with linear regression calculations on transformed data

Teachers and lecturers delivering the Advanced Higher Statistics course, and candidates taking the course, can consult the detailed marking instructions for the 2024 course assessment on SQA's website. These illustrate the communication requirements for questions on, for example, two-sample tests; working with independent and identically distributed random variables; and describing routine checks and processes.

Appendix: general commentary on grade boundaries

SQA's main aim when setting grade boundaries is to be fair to candidates across all subjects and levels and maintain comparable standards across the years, even as arrangements evolve and change.

For most National Courses, SQA aims to set examinations and other external assessments and create marking instructions that allow:

- a competent candidate to score a minimum of 50% of the available marks (the notional grade C boundary)
- a well-prepared, very competent candidate to score at least 70% of the available marks (the notional grade A boundary)

It is very challenging to get the standard on target every year, in every subject, at every level. Therefore, SQA holds a grade boundary meeting for each course to bring together all the information available (statistical and qualitative) and to make final decisions on grade boundaries based on this information. Members of SQA's Executive Management Team normally chair these meetings.

Principal assessors utilise their subject expertise to evaluate the performance of the assessment and propose suitable grade boundaries based on the full range of evidence. SQA can adjust the grade boundaries as a result of the discussion at these meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper or other assessment has been more, or less, difficult than usual.

- The grade boundaries can be adjusted downwards if there is evidence that the question paper or other assessment has been more difficult than usual.
- The grade boundaries can be adjusted upwards if there is evidence that the question paper or other assessment has been less difficult than usual.
- Where levels of difficulty are comparable to previous years, similar grade boundaries are maintained.

Every year, we evaluate the performance of our assessments in a fair way, while ensuring standards are maintained so that our qualifications remain credible. To do this, we measure evidence of candidates' knowledge and skills against the national standard.

During the pandemic, we modified National Qualifications course assessments, for example we removed elements of coursework. We kept these modifications in place until the 2022–23 session. The education community agreed that retaining the modifications for longer than this could have a detrimental impact on learning and progression to the next stage of education, employment or training. After discussions with candidates, teachers, lecturers, parents, carers and others, we returned to full course assessment for the 2023–24 session.

SQA's approach to awarding was announced in March 2024 and explained that any impact on candidates completing coursework for the first time, as part of their SQA assessments, would be considered in our grading decisions and incorporated into our well-established

grading processes. This provides fairness and safeguards for candidates and helps to provide assurances across the wider education community as we return to established awarding.

Our approach to awarding is broadly aligned to other nations of the UK that have returned to normal grading arrangements.

For full details of the approach, please refer to the National Qualifications 2024 Awarding — Methodology Report.