Comparison document

(Version 2.1 April 2016 compared to previous version)

Advanced Higher Statistics Course Assessment Specification (C703 77)

The purpose of this document is to give a quick, visual guide to any amendments or clarifications made during the revision process.

Valid from August 2015

This edition: April ~~2015~~2016, version 2.~~0~~ 1

Please refer to the note of changes at the end of this Course Assessment Specification for details of changes from previous version (where applicable).

Course outline

Course title:	Advanced Higher Statistics
SCQF level:	7 (32 SCQF credit points)
Course code:	C703 77
Course assessment code:	X703 77

The purpose of the Course Assessment Specification is to ensure consistent and transparent assessment year on year. It describes the structure of the Course assessment and the mandatory skills, knowledge and understanding that will be assessed.

Course assessment structure

Component 1 — question paper	100 marks
Total marks	**100 marks**

This Course includes eight SCQF credit points to allow additional time for preparation for Course assessment. The Course assessment covers the added value of the Course.

Equality and inclusion

This Course Assessment Specification has been designed to ensure that there are no unnecessary barriers to assessment. Assessments have been designed to promote equal opportunities while maintaining the integrity of the qualification.

For guidance on assessment arrangements for disabled learners and/or those with additional support needs, please follow the link to the Assessment Arrangements web page: www.sqa.org.uk/sqa/14977.html.

Guidance on inclusive approaches to delivery and assessment of this Course is provided in the *Course/Unit Support Notes*.

Assessment

To gain the award of the Course, the learner must pass all of the Units as well as the Course assessment. Course assessment will provide the basis for grading attainment in the Course award.

Course assessment

SQA will produce and give instructions for the production and conduct of Course assessments based on the information provided in this document.

Added value

The purpose of the Course assessment is to assess added value of the Course as well as confirming attainment in the Course and providing a grade. The added value for the Course will address the key purposes and aims of the Course, as defined in the Course Rationale. It will do this by addressing one or more of breadth, challenge or application.

In this Course assessment, added value will focus on the following:

- breadth — drawing on knowledge and skills from across the Course
- challenge — requiring greater depth or extension of knowledge and skills
- application — requiring application of knowledge and skills in practical or theoretical contexts as appropriate

This added value consists of:

- using a range of complex statistical concepts
- identifying and using appropriate statistical models and skills
- using mathematical reasoning skills to extract and interpret information, think logically and evaluate evidence
- communicating conclusions, exhibiting appreciation of their limitations
- explaining the consequences of choice of method

To achieve success in the Course, learners must show that they can apply knowledge and skills acquired across the Course to unseen situations.

The question paper requires learners to demonstrate aspects of breadth, challenge and application in appropriate contexts for statistics. The use of a calculator will be permitted.

Grading

Course assessment will provide the basis for grading attainment in the Course award.

The Course assessment is graded A–D. The grade is determined on the basis of the total mark for the Course assessment.

A learner's overall grade will be determined by their performance across the Course assessment.

Grade description for C
For the award of Grade C, learners will have demonstrated successful performance in all of the Units of the Course. In the Course assessment, learners will typically have demonstrated successful performance in relation to the mandatory skills, knowledge and understanding for the Course.

Grade description for A
For the award of Grade A, learners will have demonstrated successful performance in all of the Units of the Course. In the Course assessment, learners will typically have demonstrated a consistently high level of performance in relation to the mandatory skills, knowledge and understanding for the Course.

Credit
To take account of the extended range of learning and teaching approaches, remediation, consolidation of learning and integration needed for preparation for external assessment, six SCQF credit points are available in Courses at National 5 and Higher, and eight SCQF credit points in Courses at Advanced Higher. These points will be awarded when a grade D or better is achieved.

Structure and coverage of the Course assessment

The Course assessment will consist of one Component: a question paper.

Component 1 — question paper
The purpose of the question paper is to assess statistical skills. A calculator may be used.

The question paper will sample the skills, knowledge and understanding that are contained within the 'Further mandatory information on Course coverage' section at the end of this Course Assessment Specification.

The question paper will consist of a series of short response questions~~,~~ and extended response questions ~~and short case studies~~ set in contexts that require the application of skills developed in the Course. Learners will be expected to communicate responses clearly and to justify solutions. The paper will have 100 marks.

For more information about the structure and coverage of the Course assessment, refer to the Question Paper Brief.

Setting, conducting and marking of assessment

Question paper

The question paper will be set and marked by SQA and conducted in centres under conditions specified for external examinations by SQA. Learners will complete this in 3 hours.

Further mandatory information on Course coverage

The following gives details of mandatory skills, knowledge and understanding for the Advanced Higher Statistics Course. Course assessment will involve sampling the skills, knowledge and understanding. This list of skills, knowledge and understanding also provides the basis for the assessment of Units of the Course.

This includes:

- knowledge and understanding of a range of complex statistical concepts
- the ability to identify and use appropriate statistical models
- the ability to apply more advanced operational skills in statistical contexts
- the ability to use mathematical reasoning skills to extract and interpret information, think logically and solve problems
- the ability to communicate conclusions, exhibiting appreciation of their limitations
- the ability to think analytically about the consequences of methodological choices

These skills will be assessed across the Course, in the context of the mandatory knowledge.

Statistics (Advanced Higher) Data Analysis and Modelling	
1.1 Applying skills to data presentation and interpretation	
Sub-skill	**Description**
Interpreting the Exploratory Data Analysis (EDA) of univariate data	Present and interpret sample data in an appropriate form using a table, dotplot, stem-and-leaf diagram and boxplot. Appreciate that there are different methods of data collection and the difference between discrete and continuous data. Identify possible outliers and suggest possible action to be taken.
1.2 Applying skills to probability theory	
Sub-skill	**Description**
Working with theoretical and experimental probabilities	Appreciate the necessary conditions for, and use of, the addition and multiplication laws of probability. Calculate probabilities for events which are not mutually exclusive. Compare calculated theoretical probabilities with those obtained experimentally, or by simulation using appropriate technology.
Calculating conditional probabilities	Calculate simple conditional probabilities. Calculate conditional probabilities requiring the use of Bayes' theorem or equivalent methods.

1.3 Applying skills to discrete random variables	
Sub-skill	**Description**
Modelling a discrete random variable	Construct the probability distribution of a discrete random variable. Generate values of discrete data by simulation or experiment and compare their distribution to theoretical models. Calculate the mean and standard deviation of a discrete random variable.
Using the laws of expectation and variance	Use the laws of expectation and variance: $E(aX+b)=aE(X)+b$ $E(X\pm Y)=E(X)\pm E(Y)$ $E(aX\pm bY)=aE(X)+bE(Y)$ $V(aX+b)=a^2V(X)$ $V(X\pm Y)=V(X)+V(Y)$, where X and Y are independent. Calculate $SD(aX+bY)$, where X and Y are independent.
1.4 Applying skills to particular probability distributions	
Sub-skill	**Description**
Using discrete probability distributions	Calculate uniform, binomial and Poisson probabilities. Use standard results for the mean and variance of these distributions. Simulate these distributions using appropriate technology and compare them to probability distribution models.
Using continuous probability distributions	Calculate rectangular (continuous uniform) ~~and normal~~ probabilities and use standard results for the mean and variance of this distribution. Calculate normal probabilities. Calculate probabilities in problems involving the sum or difference of two independent normal random variables.
Using the normal approximation to discrete probability distributions	Demonstrate an understanding of appropriate conditions for a normal approximation to a binomial or Poisson distribution, together with the parameters of the approximate distribution. Demonstrate the use of a continuity correction when applying a normal approximation to the binomial and Poisson distributions.

Statistics (Advanced Higher) Statistical Inference	
1.1 Applying skills to sampling and the central limit theorem	
Sub-skill	**Description**
Identifying and using appropriate random sampling methods	Appreciate that there are different methods of data collection, and be able to generate a simple random sample from a population. Describe and distinguish between simple random, systematic, stratified and cluster sampling. Appreciate that non-random sampling methods such as quota or convenience sampling could lead to an unrepresentative sample and biased conclusions.
Working with the distribution of sample means and sample proportions	Demonstrate an understanding that the sampling distribution of the sample mean from a parent population that is normal is itself normal. Demonstrate an understanding that the sampling distribution of the sample mean from a parent population which is not normal is approximately normal, by invoking the Central Limit Theorem when the sample is large enough. Describe the sampling distribution of the sample mean and use the appropriate standard error in calculations involving this distribution. Describe the sampling distribution of ~~a~~ the sample proportion and use the appropriate standard error in calculations involving this distribution. Use the sample mean as a best estimate of the population mean. Use the sample variance as an estimate of the population variance.
1.2 Applying skills to intervals and estimation	
Sub-skill	**Description**
Obtaining confidence intervals	Calculate a z-interval for the population mean. Appreciate the need to use Student's t-distribution when the population variance is unknown. Calculate an approximate confidence interval for the population proportion.

Using control charts	Construct and interpret a Shewhart control chart for the sample mean or proportion. Use the Western Electric rules to recognise when a process may be out of statistical control and influenced by common or special causes. Estimate chart parameter(s) from a sample when population data is unavailable.
1.3 Applying skills to bivariate analysis	
Sub-skill	**Description**
Fitting a linear model to bivariate data	Interpret a scatterplot, observing whether or not a linear model is appropriate. Calculate the least squares regression line of y on x. Appreciate the difference between regressing y on x and x on y.
~~Measuring the strength of~~Assessing the linear association between two variables	Calculate and interpret the product moment correlation coefficient. Calculate and interpret the coefficient of determination. Calculate a fitted value and its residual. Interpret a residual plot. Comment on given simple transformations to obtain improved models.
Estimating with bivariate data	Assess the reliability of prediction based on fitted values, considering the effects of correlation, interpolation and extrapolation. Calculate the appropriate statistics required for bivariate intervals. Construct a prediction interval for an individual response. Construct a confidence interval for a mean response.

Statistics (Advanced Higher) Hypothesis Testing	
1.1 Applying skills to parametric tests	
Sub-skill	**Description**
Identifying and performing an appropriate one sample test for the population mean and proportion	Perform a specified test for the population mean, for the cases: i) σ^2 known (z-test) ii) σ^2 unknown but a large sample (z-test) iii) σ^2 unknown with a small sample (t-test) Perform a z-test for the population proportion. Select and justify the choice of an appropriate test, together with its underlying assumptions.
Identifying and performing an appropriate two sample test (independent or paired data) for comparing population means and proportions	Use a t-test to assess evidence about the population mean difference in a paired data experiment. Test the hypothesis that two populations have the same mean, for cases where population variances are: i) known (z-test) ii) unknown but samples are large (z-test) iii) unknown and samples are small (t-test) Test the hypothesis that two populations have the same proportion, for only the case where both samples are large. Select and justify the choice of an appropriate test, together with its underlying assumptions.
1.2 Applying skills to non-parametric tests	
Non-parametric tests make no assumptions about the distributional form of populations, eg normality. As a result the hypotheses are often framed in terms of medians rather than means. The use of ranks may help to reduce the influence of outliers in the data. The use of a continuity correction is expected if a normal approximation is employed. Formulae for the mean and variance of the test statistic will be given.	
Sub-skill	**Description**
Identifying and performing an appropriate test for population median/s	Use a Wilcoxon Signed-Rank test to assess evidence about the population median from a simple random sample and about the population distributions from paired data. Use a Mann-Whitney test to assess evidence about the

	medians of two populations using independent samples. Use a normal approximation, when required in any calculation of a test statistic or *p*-value. Select and justify the choice of an appropriate test, together with its underlying assumptions.
Identifying and performing an appropriate chi-squared test	Perform a chi-squared test for goodness-of-fit to a discrete distribution. Perform a chi-squared test for association in a contingency table. Deal with small expected frequencies.
1.3 Applying skills to bivariate tests	
Sub-skill	**Description**
Identifying and performing an appropriate hypothesis test on bivariate data	Test the hypothesis that the slope parameter in a linear model is zero. Test the hypothesis that the population correlation coefficient is zero. Communicate appropriate assumptions.

Administrative information

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History of changes to Course Assessment Specification

Version	Description of change	Authorised by	Date
2.0	Pages 6–12: extensive changes to 'Further mandatory information on Course coverage' section.	Qualifications Development Manager	April 2015
2.1	Page 5: 'Structure and coverage of the Course assessment' section — reference to short case studies removed; reference to the Question Paper Brief added. Pages 6–12: 'Further mandatory information on Course coverage' section — minor changes to second sub-skill for: Data Analysis and Modelling, Assessment Standard 1.4; Statistical Inference, Assessment Standards 1.1 and 1.3.	Qualifications Manager	April 2016