

Higher National Unit Specification

General information for centres

Unit title: Statistics for Science 1

Unit code: DN8C 34

Unit purpose: This Unit is designed to enable candidates to gain an understanding of the application of statistics to science. Candidates should develop an appreciation of the need for statistical analysis. They will also interpret the findings in the context of a scientific problem.

On completion of the Unit the candidate should be able to:

1. Use and understand basic statistical concepts.
2. Use probability trees and apply probability distributions.

Credit points and level: 1 HN Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: Entry to this unit is at the discretion of the centre however, it is advisable that candidates have prior knowledge of basic statistics and possess good numerical skills. This may be evidenced by possession of Intermediate 2 Mathematics or Standard Grade Mathematics at Credit, or equivalent. A working knowledge of a computerised spreadsheet system, such as Excel, is also recommended.

Core skills: There may be opportunities to gather evidence towards the core skill of Numeracy at Higher level in this Unit, although there is no automatic certification of core skills or core skills components.

Context for delivery: This Unit is included in a number of Group Awards for Science. If this unit is delivered as part of a Group Award it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: This Unit will be assessed by means of a combination of written/oral responses and/or computer printouts. Assessments will be closed book and under controlled conditions. However some formulae can be supplied to the students for use in the assessment.

Higher National Unit specification: statement of standards

Unit title: Statistics for Science 1

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Use and understand basic statistical concepts

Knowledge and/or skills

- Construct appropriate statistical diagrams
 - Stem and leaf
 - Dot plots
 - Box plots
 - Histograms
 - Scatter diagrams
 - Line graphs
 - Bar charts
 - piecharts
- central tendencies and measures of dispersion for raw data: -
 - mean,
 - median,
 - quartiles,
 - range,
 - standard deviation,
 - coefficient of variation,
 - difference between estimating population characteristics and true population characteristics .
- central tendencies and measures of dispersion for data presented in a frequency table, both ungrouped and grouped: -
 - mean,
 - range,
 - standard deviation
 - coefficient of variation
 - difference between estimating population characteristics and true population characteristics .

Higher National Unit specification: statement of standards (cont)

- correlation and linear regression
 - estimating regression parameters
 - predicting

Outcome 2

Use probability and probability distributions

Knowledge and/or skills

- Rules of Probability in conjunction with Probability Trees.
- Normal Distribution
- Binomial Distribution
- Poisson Distribution

Evidence requirements for the unit

The evidence requirements for this unit consist of a closed book assessment of 2 hours duration sampling each outcome as directed.

- Outcome 1 – All knowledge and skills assessed on a sample basis:
 - Four out of the eight topics for the first set of knowledge and skill, one of which should be a scatter diagram.
 - Three out of the seven topics in the second set of knowledge and skills,
 - Three out of the five topics in the third section
 - One from two in the fourth section.

Outcome 2 – Three out of the four knowledge and skills are assessed. One question must be to draw and use a probability tree to calculate an answer to a probability question.

This unit will be assessed by means of a combination of written/oral responses and/or computer printouts.

Assessments will be closed book and under controlled conditions. However some formulae should be supplied to the students for use in the assessment: mean, standard deviation and coefficient of variation for outcome 1 and Normal, Binomial and Poisson distributions for Outcome 2

In order to ensure that candidates will not be able to foresee the exact form of the assessment, a different examination is required each time the Unit is assessed.

Higher National Unit specification: statement of standards (cont)

Assessment guidelines for the unit

The assessment paper could be composed of an appropriate balance of short answer, restricted response and structured questions. The basis of the unit is that students learn when to use the appropriate statistics and to interpret their results, so it is expected that computers or calculators with statistical functions are used in the assessment to perform the calculations, especially in questions for outcome 1.

Data for the assessment can be set up for students in a computer file so that assessment time is not spent by them time entering in data.

An overall mark of 60% constitutes a pass.

Administrative Information

Unit code:	D8NC 34
Unit title:	Statistics for Science 1
Superclass category:	RB
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Higher National Unit specification: support notes

Unit title: Statistics for Science 1

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

The aim of this Unit is to enable HN science candidates to apply the techniques of descriptive statistics to data from scientific analysis, and to apply the basic ideas of probability. Throughout the unit the emphasis should be on the need to be aware of variability in all scientific analysis.

Although some tests can be done quickly manually, candidates should make use of computer spreadsheet statistical functions, or calculators with statistical functions to carry out calculations when appropriate and sensible. This unit could be integrated with a number of science units, such as IT.

Outcome 1 includes statistical concepts and presentation. Since the terms used in this Outcome are continually referred to throughout the unit, it is essential that all candidates start with a solid foundation. Most science projects are now written up on the computer so, where computers are available, the data can be input to a spreadsheet, and statistical functions used. Data given as frequency tables are included since referenced data, especially if the number of items involved is not small, may well be given in this format. The difference in notation and calculation between estimating the population characteristics from a sample, and dealing with the population as a whole should be explained. Correlation and regression completes this Outcome.

Computer spreadsheet statistical functions, or calculators with statistical functions can reduce the time taken in performing calculations and it is expected that these are used in order to keep time taken for this outcome to a minimum.

Outcome 2 considers rules of probability. The formulae need not be used to calculate probabilities when a probability tree can illustrate the probabilities more clearly. As regards the probability distributions, the candidate needs to be able to select the appropriate distribution to use under the circumstances. This outcome should include the use of the Normal as an approximation to Binomial and Poisson as appropriate. The Normal distribution should also include working from a given probability to calculate the associated z value, and therefore the x value for the probability. Standard Normal tables, Binomial tables and Poisson tables can be used when calculating probabilities. Alternatively computerised statistical functions are readily available and can be used, although care must be taken to explain the results

Higher National Unit specification: support notes (cont)

Guidance on the delivery and assessment of this Unit

This unit is likely to be delivered towards the start of the Group Award. This should allow the candidates to make use of their statistical knowledge when analysing results and working on projects. The Unit should be delivered in a way that enables the candidates to appreciate its relevance to the branch of science concerned. When teaching this unit, lecturers should include details on why a particular statistical analysis is being done and an interpretation of the results should be included, where applicable.

This Unit will be assessed by means of a combination of detailed responses and/or computer printouts.

Assessments will be closed book and under controlled conditions. However some formulae can be supplied to the students for use in the assessment: mean, standard deviation and coefficient of variation for outcome 1 and Normal, Binomial and Poisson distribution for Outcome 2.

The basis of the unit is that students learn when to use the appropriate statistics and to interpret their results, so it is expected that computers or calculator with statistical functions are used in the assessment to perform the calculations, especially in questions for outcome 1.

An overall mark of 60% constitutes a pass.

Open learning

This Unit could be delivered by distance learning. However, it would require planning by the centre to ensure the sufficiency and authenticity of candidate evidence. Arrangements would have to be made to ensure that the assessments for each outcome are delivered in a supervised environment under controlled conditions.

For further information and advice, please see *Assessment and Quality Assurance for Open and Distance Learning* (SQA, February 2001 – publication code A1030).

Candidates with additional support needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements for Candidates with Additional Support Needs* (BA 2399, SQA, due 2004).

Higher National Unit specification: support notes (cont)

General information for candidates

Unit title: Statistics for Science 1

This unit is designed to enhance your ability to apply statistical techniques to practical applications in science. Prior to commencement of this unit it is recommended that you will need a background in basic statistics as well as good numerical skills.

Outcome 1 covers statistical knowledge. Mean, median, quartiles, range, standard deviation and coefficient of variation are included along with statistical diagrams.. You will calculate these values for data which is unordered and also for data which is presented in a frequency table. You can use a computer or calculator with statistical functions to help you calculate these values. Correlation and regression procedure is also included in this outcome. You can do this on a computer if available.

Outcome 2 teaches you about probability. You will learn the rules of probability. Also you will learn how to construct probability trees which you can use to solve probability problems. Then you will be introduced to the Normal distribution, Binomial Distribution and the Poisson Distribution. You will learn when and how to use these, and to interpret your results.

This Unit will be assessed by means of a combination of written/oral responses and/or computer printouts.

Assessments will be closed book and under controlled conditions. However some formulae can be supplied to you for use in the assessment.

An overall mark of 60% constitutes a pass.