

Technician Level

Paper 9a

Business Statistics

Extended Syllabus

INTRODUCTION

Extended Syllabuses are part of a comprehensive package of support materials offered by SIAT. This package includes past question papers, Model Answers, and a range of How to Pass books, all of which are designed to offer help and guidance to teachers and candidates, and to enhance chances of success in SIAT examinations.

What are they?

Extended Syllabuses specify in detail the learning and assessment requirements of SIAT examinations.

Each one, produced by the subject Chief Examiner, will state in detail the following:

- Aims and assessment objectives of the examination
- Level of English
- Syllabus topics and syllabus coverage in examinations
- Examination format
- Guided learning hours
- Candidate answer guidance
- Pass mark information and mark allocation
- Recommended reading list and support material
- Detailed listing of syllabus topics and syllabus elements

Who are they for and how can they be of use?

They are designed for:

- Teachers who will find them invaluable when designing courses and planning lessons
- Candidates who will find them essential because they can be used as checklists when preparing for examinations. Candidates will also be able to refer to Extended Syllabuses when planning revision programmes

Paper 9a Business Statistics

Aims

The aims of this syllabus are to enable candidates to develop:

- a knowledge and understanding of more advanced statistical techniques
- the ability to apply this knowledge and understanding in solving business problems.

Assessment Objectives

The examination will assess the candidate's ability to:

- demonstrate a knowledge and understanding of basic and more advanced statistical techniques including the collection and presentation of data.
- apply the above knowledge and understanding in solving business problems.

Level of English

Candidates should have a standard of English equivalent to LCCIEB English for Business Level 2.

Candidates should cover ALL topics of the Extended Syllabus. Because of the nature of Business Statistics there is some overlap with the Intermediate Level syllabus, particularly on Syllabus Topics 1, 2 and 3.

Syllabus Topics

1. Quantitative Information
2. Descriptive Statistics
3. Forecasting
4. Uncertainty
5. Statistical Inference

Examination Format

- The time allowance for the examination is 3 hours
- Candidates will be required to answer 5 questions from a choice of 8
- All questions carry equal marks

Guided Learning Hours

SIAT recommends that 140-160 Guided Learning Hours (GLHs) provide a suitable course duration for an 'average' candidate at this level. This figure includes direct contact hours as well as other time when candidates' work is being supervised by teachers. Ultimately, however, it is the responsibility of training centres to determine the appropriate course duration based on their candidates' ability and level of existing knowledge. SIAT experience indicates that the number of GLHs can vary significantly from one training centre to another.

Frequency of Topics in Examinations

For each examination full or part questions are set on Syllabus Topics 4 and 5. The remaining questions (or part questions) are taken from Syllabus Topics 1, 2, 3. Questions may be drawn from 2 or more syllabus topics.

Candidate Answer Guidance

Marks are awarded for correct working as well as for correct answers and for an appropriate level of accuracy.

Where a correct answer is provided, without working, a candidate will normally be given full marks for that section. However, where a question asks for a specific method, then that method must be used and shown, otherwise the candidate will normally receive no marks for that section. Candidates are advised that it is normally to their advantage to show all working.

Candidate Performance Measurement

For questions involving numerical processes, examination marks are divided into 'method' marks and 'accuracy' marks. Method marks are awarded for following the correct method for each step. To score accuracy marks, the correct method mark for that step must have been scored. In general accuracy marks are subdivided into 2 categories 'correct answer only' and 'follow through'. 'Correct answer only' means that only the correct answer is acceptable (but some latitude is usually allowed for very minor errors). 'Follow through' mark is awarded if subsequent work is correct following an earlier arithmetic error provided the method is correct.

For the 'comment' for descriptive parts of questions, 1 or 2 marks are awarded for each relevant point.

Pass Mark Information

Pass	50%
Credit	60%
Distinction	75%

Mark Allocation

Marks will be awarded for the appropriateness of the method used as well as for the accuracy of the answer.

Marks will not normally be reserved for appropriate use of English, correct use of grammar, for a specific format of answer, or for presentation, except where specifically stated in the question (such as asking for the answer in a particular format). Candidates should, however, be aware of the need for clear, intelligible and unambiguous answers. An answer must be comprehensible in order to gain marks.

Recommended Reading and Support Material

Reading list

Title	Author	Publisher	ISBN Code
How to Pass Business Statistics Second and Third Levels	D Friend	LCCIEB	1 86247 005 7

Support Material

Model Answers and past question papers are available from SIAT Customer Service Team.

Formulae

A list of formulae for use with this paper is printed at the rear of this syllabus. This formulae list is available to candidates of the appropriate examination. The list contains the principal formulae appropriate to the level, but is not intended to be exhaustive. Centres and candidates should pay careful attention and note those syllabus items where the relevant formulae are not given in the list.

Syllabus

1 Quantitative Information

Candidates must be able to:

1.1 Graphical presentation

- 1.1.1 Differentiate alternative forms of data eg discrete and continuous
- 1.1.2 Know the circumstances in which the various graphs/diagrams/ charts should be used.
- 1.1.3 Construct the various types of bar charts, pie charts, pictograms, Z charts, Lorenz curve and graphs.
- 1.1.4 Construct a semi-log graph.
- 1.1.5 Draw neat and tidy graphs/diagrams/charts.
- 1.1.6 Label axes; give titles of diagrams; when given, state source of data.
- 1.1.7 Use shading, where appropriate.
- 1.1.8 Comment on graphs/diagrams/charts.

1.2 Survey methodology

- 1.2.1 Understand the difference between primary and secondary data.
- 1.2.2 Know the difference between a census and a survey and their relative advantages and disadvantages.
- 1.2.3 Understand the nature of a sampling frame.
- 1.2.4 Understand the term sampling fraction.
- 1.2.5 Know the various methods of sampling and their advantages and disadvantages.

- 1.2.6 Know the advantages and disadvantages of the interview and the postal questionnaire as methods of collecting data.
 - 1.2.7 Understand the problem of interviewer bias.
 - 1.2.8 Understand the principles of questionnaire design.
 - 1.2.9 Design a questionnaire.
 - 1.2.10 Recognise the problem of non-response and know the methods of attempting to overcome the problem.
 - 1.2.11 Understand the need for a pilot survey before conducting a large-scale survey
- 1.3 Use of Computers in Business Statistics
- 1.3.1 Recognise that most businesses store data on computers
 - 1.3.2 Understand that some computer-stored data can be processed statistically.
 - 1.3.3 Understand that graphics packages and spreadsheet packages enable charts, diagrams and graphs to be produced.
 - 1.3.4 Understand that spreadsheet packages and special statistics packages allow statistical calculations to be carried out accurately and speedily.

2 Descriptive Statistics

Candidates must be able to:

- 2.1 Measures of location and dispersion - grouped data
 - 2.1.1 Construct a cumulative frequency table.
 - 2.1.2 Draw a cumulative frequency curve (ogive).
 - 2.1.3 Draw a histogram, and be able to deal with unequal class intervals.
 - 2.1.4 Calculate mean, median and quartiles (the relevant formula for the mean is given in the formulae list but not the formula for the median).
 - 2.1.5 Obtain the median and quartiles from the cumulative frequency curve.
 - 2.1.6 Obtain the mode from either a histogram or from a formula (the relevant formula is *not* given in the formulae list).

- 2.1.7 Calculate standard and quartile deviations (the relevant formula for the standard deviation is given in the formulae list but not the formula for the quartile deviation).
- 2.1.8 Know that the variance is the square of the standard deviation.
- 2.1.9 Understand what measures of location and dispersion represent.
- 2.2 Measures of location and dispersion - ungrouped data
 - 2.2.1 Calculate the mean, median, mode, quartiles and geometric mean (the formulae are **not** given in the formulae list).
 - 2.2.2 Calculate the standard deviation (the relevant formula is given in the section marked "one sample t test").
 - 2.2.3 Calculate the quartile deviation (the formula is **not** given).
 - 2.2.4 Calculate the mean deviation (the formula is **not** given in the formula list).
- 2.3 Measures of skewness
 - 2.3.1 Find Pearson's measure of skewness (the relevant formula is given in the formulae list).
 - 2.3.2 Find a quartile measure of skewness (the relevant formula is *not* given in the formulae list).
 - 2.3.3 From a histogram, relate positive or negative skewness found from the skewness formula to the shape of the histogram.
- 2.4 Coefficient of variation
 - 2.4.1 Calculate a coefficient of variation (the relevant formula is given in the formula list).
 - 2.4.2 Understand the use of the coefficient of variation.
- 2.5 Index Numbers
 - 2.5.1 Calculate Laspeyres and Paasche index numbers (both price and quantity formulae for these index numbers are given in the formulae list).
 - 2.5.2 Find Laspeyres or Paasche index numbers if value or cost is given instead of price/quantity.
 - 2.5.3 Understand the advantages and disadvantages of Laspeyres and Paasche index numbers.

- 2.5.4 Calculate a weighted index number (the relevant formula is given in the formulae list).
- 2.5.5 "Splice" index numbers (the relevant formula is **not** given in the formulae list)
- 2.5.6 Rebase 2 sets of index numbers to a common base, so that comparisons can be made.
- 2.5.7 Use an index of retail prices and an index of earnings to find an index of "real" earnings.
- 2.5.8 Use an index of retail prices for "index linking" eg of pensions.
- 2.5.9 Understand the construction and use of at least one major index eg the index of retail prices or the index of industrial production.

3 Forecasting

Candidates must be able to:

3.1 Correlation and regression

- 3.1.1 Draw a scatter diagram, know how to place the dependent variable on the vertical axis and the explanatory variable on the horizontal axis.
- 3.1.2 Comment on the data from a scatter diagram whether the data lies on a line or a curve and the presence of outliers.
- 3.1.3 Calculate a least squares regression line (the relevant formulae are given in the formulae list).
- 3.1.4 Plot regression line on scatter diagram.
- 3.1.5 Use regression line for forecasting purposes and be able to comment on the likely accuracy of forecasts.
- 3.1.6 Calculate the product moment correlation coefficient (the relevant formula is given in the formulae list).
- 3.1.7 Test whether the product moment correlation coefficient is significantly different from (or greater or less than) zero (the relevant formula is given in the formulae list, but the number of degrees of freedom is *not* given in the formulae list).
- 3.1.8 Rank a set of data and be able to deal with ties.
- 3.1.9 Calculate Spearman's rank correlation coefficient (the relevant formula is given in the formulae list).

3.1.10 Obtain the coefficient of determination (the relevant formula is given in the formulae list) and understand what this coefficient measures.

3.2 Time Series

3.2.1 Plot a time series - time along the horizontal axis.

3.2.2 Understand the difference between the additive and multiplicative models.

3.2.3 From a time series plot or other procedures, recognise which model to use in finding seasonal factors.

3.2.4 Use a moving average to calculate the trend and to know when the trend needs to be centred.

3.2.5 Plot trend on time series graph.

3.2.6 Calculate the seasonal factors for either the additive or multiplicative model. The appropriate model should be used.

3.2.7 Calculate seasonally adjusted values.

3.2.8 Understand why seasonally adjusted values are found.

3.2.9 Find likely future values of the trend either graphically or by a simple method (fitting a least squares regression line is not expected, as this is too time consuming).

3.2.10 Use the future trend to forecast future values.

3.2.11 Discuss the likely accuracy of any forecast.

4 Uncertainty

Candidates must be able to:

4.1 Probability

4.1.1 Understand the classical and the empirical definitions of probability.

4.1.2 Understand the concept of "mutually exclusive events."

4.1.3 Understand the addition and multiplication rules of probability.

4.1.4 Draw a Venn diagram.

4.1.5 Draw a tree diagram.

4.1.6 Use Venn and tree diagrams to solve probability problems.

- 4.1.7 Recognise and solve problems involving conditional probability.
- 4.1.8 Understand the simple applications of Bayes theorem.
- 4.1.9 Understand simple problems involving mathematical expectation and know that the expected monetary value is the product of the probability and the money value.

Note: Probability questions will not be set which require a knowledge of Binomial or Poisson distributions.

4.2 Normal distribution

4.2.1 Use the normal distribution tables (a limited version of the normal tables as given in the formulae list) Examination questions are constructed so that, in general, the tables can be Used without interpolation. Interpolation is not expected.

4.2.2 Use the formula $z = \frac{x - \mu}{\sigma}$

(the relevant formula is **not** given in the formulae list).

4.2.3 Understand that for a linear combination of 2 or more independent normal distributions, the sum is normally distributed with a mean which is the sum of the individual means and a variance which is the algebraic sum of the individual variances.

4.2.4 Understand the uses of the normal distribution.

5 Statistical Inference

Candidates must be able to:

5.1 Procedure for significance tests

5.1.1 Understand the concept of a sampling distribution.

5.1.2 Understand that for all significance tests 5 steps are required whether listed or implied.

Step 1 Statement of null and alternative hypothesis.

Step 2 State, where appropriate, the degrees of freedom, and the critical value.

Step 3 Calculate the test value from data supplied or found from the data given.

Step 4 Compare the calculated test value with the critical value found at Step 2. If the test value is numerically larger, state significant and reject null hypothesis. If the test value is numerically smaller, state not significant and accept null hypothesis.

Step 5 Draw conclusion - this **must** relate to the subject of the examination question.

The 5 steps need not be in the order Shown, but for full marks in Examination questions all 5 steps must be given or implied.

The use of a confidence interval for solving a significance test question needs to be carefully considered particularly in a one tailed test situation.

5.2 Type I and Type II errors

5.2.1 Understand the principles involved in Type I and Type II errors

5.2.2 Indicate the type of error that may be involved in the results of a significance test.

5.3 Significance tests and confidence intervals ($n > 30$)

5.3.1 Recognise that for a large sample test the critical values are found from the normal distribution table.

5.3.2 Find a confidence interval for a mean (the relevant formula is *not* given in the formulae list).

5.3.3 Find a confidence interval for a proportion (the relevant formula is *not* given in the formulae list).

5.3.4 Understand the concept of a confidence interval.

5.3.5 Find the sample number required to obtain a confidence interval of a given size for a stated probability.

5.3.6 Differentiate between a one tailed and two tailed test.

5.3.7 Conduct a single mean test (the relevant formula is given in the formulae list).

5.3.8 Conduct a single proportion test (the relevant formula is given in the formulae list).

5.3.9 Conduct a two mean test (the relevant formula is given in the formulae list).

5.3.10 Conduct a two proportion test (the relevant formula is given in the formulae list).

Note: The formulae show that a pooled estimate of p is expected.

5.4 Significance tests and confidence intervals ($n < 30$)

5.4.1 Recognise that for small sample tests the critical values are found from the t distribution tables.

5.4.2 Recognise that when mean and variance are estimated from the data the t distribution is required.

5.4.3 Find a confidence interval for a mean (the relevant formula is **not** given in the formulae list, nor are the degrees of freedom given).

5.4.4 Conduct a single mean t test (the relevant formulae are given in the formulae list, but **not** the formula for degrees of freedom).

5.4.5 Differentiate the circumstances when a paired comparison t test and a two means t test should be employed.

5.4.6 Conduct a paired comparison test (the relevant formula are **not** given in the formulae list, but the formulae for a single mean t test can easily be adapted for a paired comparison t test).

5.4.7 Conduct an independent samples t test
- a two mean t test (the relevant formulae are given in the list, but **not** the formula for degrees of freedom).

5.5 Chi-square tests

5.5.1 Recognise when a chi-squared test is needed.

5.5.2 Conduct a test of a contingency table (the relevant formula for the chisquared test is given in the formulae list, but **not** the formula for degrees of freedom).

5.5.3 Test for randomness (the relevant formula for the chi-squared test is given in the formulae list, but **not** the formula for degrees of freedom).

5.5.4 Test for the goodness of fit when previous percentages are given (the relevant formula for the chi-squared test is given in the formulae list, but not the formula for degrees of freedom).
Goodness of fit test of normal or other distributions is **not** expected.

5.6 Quality Control

5.6.1 Understand the advantages to management of setting up a quality control procedure.

5.6.2 Understand the uses of control charts for mean and range.

Note: The construction of a range chart is **not** expected.

5.6.3 Construct a mean chart using the normal distribution 0.025 point for the warning line and 0.001 point for the action line.

Note: The formulae list does not provide the A numbers; candidates will be expected to use the normal tables provided.

5.6.4 Plot sample means on a control chart and interpret the results.

5.6.5 Use the normal distribution to evaluate the probability of a single observation lying outside warning/action limits.

5.6.6 Use the normal distribution to evaluate the probability of the mean of a sample lying outside the warning/action limits, if the mean is set incorrectly.