Prescription: 430 Statistics and Financial Mathematics for Business

Elective prescription

Level	4
Credit	20
Version	3
Aim	Students will be able to summarise, analyse, interpret and present data, make predictions and apply financial mathematics to aid business decision making.
Prerequisites	nil
Recommended prior Knowledge	A minimum of 14 numeracy credits at level 1 or higher in Mathematics on the Directory of Assessment Standards or equivalent knowledge, and a working knowledge of spread sheets

Assessment weightings

Learning outcomes	Assessment weighting %
1. Students will calculate summary statistics and present data using computer software, and interpret results.	17
2. Students will use methods of correlation and regression to analyse and interpret a given data set and make predictions.	10
3. Students will use computer software to plot time series, identify their features, then produce and explain forecasts.	15
4. Students will demonstrate the correct use of random sampling techniques to select samples, and identify potential sources of bias.	10
5. Students will describe the Consumer Price Index (CPI), and use index numbers to compare time series, and to remove the effect of price changes from (deflate) financial time series.	10
6. Students will apply financial mathematics to lump sums and annuities.	13
7. Students will apply probability distributions, estimate population means and proportions, interpret confidence intervals and calculate sample sizes to achieve the required margin of error.	15
8. Students will identify types of process variation and create and interpret control charts to achieve quality control.	10
Total	**100**

All learning outcomes must be evidenced; a 10% aggregate variance is allowed.

Assessment notes

1. Assessment materials must reflect relevant and current legislation, standards, regulations and acknowledged good industry/business practices.
2. The size of the data sets has not been specified as this is at the discretion of the assessment designer.
3. Computer software must be used for assessing learning outcomes one, two and three. The use of computer software for assessment of the other learning outcomes is recommended but is at the discretion of the assessment designer.
4. For learning outcome one, key element c) evidence is required that the student has selected an appropriate graph type at least once during assessment. Two dimensional frequency tables are the same as contingency tables or cross tabulations; any of these terms can be used. It is recommended that pivot tables are used to create frequency tables.
5. For learning outcome two key element d) calculation and interpretation of a residual plot for all observations is required.
6. It is recommended that real New Zealand data which is linked to Statistics New Zealand is used for learning outcome three and five.
7. It is recommended that the annuities element in learning outcome six is taught and assessed using spreadsheet functions.
8. Learning outcome seven includes confidence intervals; however the Central Limit Theorem is assumed to be underpinning knowledge and does not need to be assessed. It is expected that confidence intervals for both means and proportions will be assessed, at least in part.
9. Learning outcome eight requires that students produce control charts and interpret the out of control indicators.

Learning outcome one

Students will calculate summary statistics and present data using computer software, and interpret results.

Key elements:

a) Data types:
- categorical
- numerical:
  - continuous
  - discrete.

b) Statistical measures:
- mean
- median
- quartiles
- range
- inter-quartile range
- standard deviation.

c) Present data in graphical and tabular formats:
- Types, at least one of:
  - two dimensional frequency table
  - pivot table

  and at least two of:
  - histogram
  - box plot
  - column/bar
  - pie chart
  - any other appropriate graph.
- appropriate presentation:
  - select an appropriate graph type
  - labelling.

d) Interpretation:
- features, at least one of:
  - shape/skewness
  - outliers
  - mode
- comparison of two or more data sets.

Learning outcome two

Students will use methods of correlation and regression to analyse and interpret a given data set and make predictions.

Key elements:

a) Scatter plot.

b) Correlation coefficient:
- value:
  - interpretation.

c) Coefficient of determination:
- value:
  - interpretation.

d) Simple linear regression:
- equation of line of best fit
- interpretation of equation coefficients
- prediction
  - reliability of predicted value ($\hat{y}$)
- interpretation of residuals ($y - \hat{y}$).

Learning outcome three

Students will use computer software to plot time series, identify their features, then produce and explain forecasts.

Key elements:

a) Plots and features:
- components:
  - trend
  - seasonal
  - cyclical
  - irregular

b) Forecasts:
- trend component:
  - moving averages.
- seasonal component:
  - indices
  - multiplicative and/or additive
  - adjustment.

Learning outcome four

Students will demonstrate the correct use of random sampling techniques to select samples, and identify potential sources of bias.

Key elements:

a) Random sampling at least two of:
- simple
- systematic
- stratified
- cluster.

b) Sources of bias
- errors
- non-random sampling.

Learning outcome five

Students will describe the Consumer Price Index (CPI), and use index numbers to compare time series, and to remove the effect of price changes from (deflate) financial time series.

Key elements:

a) CPI:
- purpose

and three of:
- selection process
- base weights
- commodity groups
- review/updated
- Laspeyres index.

b) Time series:
- conversion to index
- change of base to enable comparison of two or more time series.

c) Remove the effect of price changes from financial time series. Series may include but are not limited to:
- salary or wages
- value of exports
- retail sales.

Learning outcome six

Students will apply financial mathematics to lump sums and annuities.

Key elements:

a) Simple and compound interest for lump sum amounts:
- Present Value
- Future Value
- nominal and effective interest rates.

b) Simple ordinary annuities:
- Present Value
- Future Value
- payment.

Learning outcome seven

Students will apply probability distributions, estimate population means and proportions, interpret confidence intervals and calculate sample sizes to achieve the required margin of error.

Key elements:

a) Probability distributions:
- normal distribution:
  - probabilities
  - inverse probabilities
  - t-distribution.

b) Estimating the population mean:
- calculate a confidence interval
- assess a claim
- calculate a sample size.

c) Estimating the population proportion, at least one of:
- calculate a confidence interval
- assess a claim
- calculate a sample size.

Learning outcome eight

Students will identify types of process variation and create and interpret control charts to achieve quality control.

Key elements:

a) Process variation:
- controlled
- uncontrolled.

b) Control charts:
- mean control chart:
  - control limits
  - out of control indicators.
- range or standard deviation control chart:
  - control limits
  - out of control indicators.

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Introduced	1	2006	31 March 2014
Review	2	March 2012	31 December 2016
Revision	3	July 2015	31 December 2020

