



Title:	Time Series & PCA APPROVED
Long Title:	Time Series & PCA
Module Code:	STAT8008
Credits:	5
NFQ Level:	Advanced
Field of Study:	Statistics
Valid From:	Semester 1 - 2018/19 (September 2018)
Module Delivered in	2 programme(s)
Next Review Date:	March 2023
Module Coordinator:	David Goulding
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Module Description:	This module introduces learners to the concepts of data dimension reduction and principle component analysis. Furthermore, it provides the learner with the necessary tools to develop and critically evaluate time series models. The forecasting function of time series models is presented and evaluated, enabling the learner to create short and medium term forecasting models.
Learning Outcomes	
<i>On successful completion of this module the learner will be able to:</i>	
LO1	Perform PCA to reduce dimensionality of datasets.
LO2	Describe the assumptions underlying PCA & time series models.
LO3	Apply the theoretical principles that govern a time series.
LO4	Apply regression and time series models for prediction, and give an account of the paradigm under which the forecasts are being made, along with their reliability.
LO5	Perform diagnostic analysis and forecasts for both PCA and time series models, using statistical software.
Pre-requisite learning	
Module Recommendations	
<i>This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named CIT module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).</i>	
No recommendations listed	
Incompatible Modules	
<i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module. You may not earn additional credit for the same learning and therefore you may not enrol in this module if you have successfully completed any modules in the incompatible list.</i>	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements	
<i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.</i>	
No requirements listed	
Co-requisites	

No Co Requisites listed

Module Content & Assessment

Indicative Content

Principle Component Analysis

PC eigenvalues & eigenvectors, Scree plots, PC Loadings & Scores, Goodness of fit of PC models, Regression and prediction using PCs, Rotations, KMO & Bartlett's test of sphericity

Time series analysis

Decomposition (trend, periodicity, seasonality, white noise), Smoothing Techniques, Stationarity, Autocorrelation, Correlograms, Autoregressive (AR), Moving Average (MA) and mixed (ARIMA) models, R-Square, Stationary R-Square, BIC

Forecasting

Forecast Error, Confidence Intervals, MAE, MAPE, MPE, RMSE, Ljung-Box Statistic

Software analysis

R, Minitab, SPSS

Assessment Breakdown

	%
Course Work	100.00%

Course Work

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Practical/Skills Evaluation	Apply PCA to a real-world data set and perform a critical analysis of the results	1,2,5	30.0	Week 5
Short Answer Questions	Examination on time series analysis	1,3,4	20.0	Week 9
Practical/Skills Evaluation	Solve and analyse time series data sets and report on the results	1,3,4,5	40.0	Sem End
Presentation	Present findings of time series analysis of a data set.	1,3,4,5	10.0	Sem End

No End of Module Formal Examination

Reassessment Requirement

Repeat examination

Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.

The institute reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time				
<i>Workload Type</i>	<i>Workload Description</i>	<i>Hours</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	Module Content delivery	2.0	Every Week	2.00
Lab	Computer practical	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Work based on texts and class material	3.0	Every Week	3.00
Total Hours				7.00
Total Weekly Learner Workload				7.00
Total Weekly Contact Hours				4.00

Workload: Part Time				
<i>Workload Type</i>	<i>Workload Description</i>	<i>Hours</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	Module Content delivery	1.5	Every Week	1.50
Lab	Computer practical	1.5	Every Week	1.50
Independent & Directed Learning (Non-contact)	Work based on texts and class material	4.0	Every Week	4.00
Total Hours				7.00
Total Weekly Learner Workload				7.00
Total Weekly Contact Hours				3.00

Module Resources

Recommended Book Resources

- G. James, D. Witten, T. Hastie, R. Tibshirani 2013, *An Introduction to Statistical Learning with Applications in R*, 4th Edition Ed., Springer [ISBN: 9781461471370]
- Douglas C. Montgomery, Cheryl L. Jennings, Murat Kulahci 2015, *Introduction to Time Series Analysis and Forecasting*, 2nd Edition Ed., John Wiley & Sons [ISBN: 9781118745113]

Supplementary Book Resources

- Alvin C. Rencher, William F. Christensen 2012, *Methods of Multivariate Analysis*, 3rd Edition Ed., John Wiley & Sons [ISBN: 9781118391686]
- I.T. Jolliffe 2002, *Principal Component Analysis*, 2nd Edition Ed., Springer-Verlag New York [ISBN: 9780387954424]
- Bruce L. Bowerman, Richard T. O'Connell, Anne B. Koehler 2005, *Forecasting, time series, and regression: An Applied Approach*, 4th Edition Ed., Thomson Brooks/Cole Belmont, CA [ISBN: 978-053440977]

This module does not have any article/paper resources

Other Resources

- Online textbook: Rob J Hyndman and George Athanasopoulos *Forecasting: principles and practice* <http://otexts.com/fpp/>
- Online textbook: StatSoft *How To Identify Patterns in Time Series Data: Time Series Analysis* <http://www.statsoft.com/textbook/time-series-analysis/>

Module Delivered in

Programme Code	Programme	Semester	Delivery
CR_BBISY_8	<u>Bachelor of Business (Honours) in Information Systems</u>	8	Elective
CR_SDAAN_8	<u>Higher Diploma in Science in Data Science & Analytics</u>	2	Elective