

National University of Singapore  
NUS Business School  
Department of Analytics and Operations

DSC 4213 Analytical Tools for Consulting

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Session: Semester 2, 2017-18

### 1. Brief description of the module

Decisions supported by timely data analysis are the norm in the current “Big Data” era. Many industries including (but not limited to) supply chain management, marketing, finance, human resources, and sports, rely on analytics-savvy analysts/consultants to improve efficiency, profitability, customer satisfaction, and performance. This course aims to equip students with a scientific/analytical mindset to carry out and to think critically when conducting such decision analysis.

Through class discussion and case analysis, enrolled participants will gain exposure to

- **Statistical and Data Mining Tools:** Applications of regression analysis, logistic regression, and count regression.
- **Demand Estimation:** Applications of choice modelling and advanced time series forecasting for demand
- **Decision and Risk Analyses:** i.e. systematic assessment of Strategies, Risks, and Payoffs using Decision Trees, Sensitivity Analyses and Markov processes.
- **Simulation:** for hard-to-analyse applications e.g. Hedging decisions, Market Share Dynamics, Buy / Sell now or later? Fund returns scenarios, ...

*Microsoft Excel* (e.g. SOLVER, PivotTable) and R language will be used as analytical enablers throughout the module.

### 2. Objectives

Students are expected to become proficient in the extensive use of the decision models discussed in the business environment. The module will enable students to consider the data dimension in making decisions at all levels in the corporate setting.

### 3. Tentative schedule

Week	Title	Topics covered
1	Introduction to the module	1. Course introduction 2. Review of Excel 3. Review of R
2	Linear regression	1. OLS Estimation & model interpretation 2. Model building and cross-validation

		3. Non-linear effects of covariates
3	Generalized linear model	1. Model specification & ML estimation 2. Binomial regression – logit and probit regression 3. Poisson regression for count data 4. Model selection
4	Demand estimation 1	1. Choice models 2. Multinomial logit model 3. Multivariate probit model
5	Demand estimation 2	1. Time series models for counts 2. Copula modeling
6	Censored demand estimation	1. Definition of censoring 2. Estimation method for censored demand
7	Markov chain and simulation	1. Model definition 2. Structure analysis and Estimation
8	Hidden Markov models	1. Model definition 2. Forward and backward algorithm 3. Applications
9	State space models	1. Model definition 2. Filtering and smoothing algorithms 3. Applications
10	Dynamic programming	1. Applications 2. Solving strategies
11	Markov decision process 1	1. Definition 2. Key characteristics
12	Markov decision process 2	1. Find the optimal policy 2. Real applications
13	Project presentation	Student presentation

#### 4. Reading list

- Data Analysis, Optimization and Simulation Modeling by Albright and Winston, 6<sup>th</sup> edition.
- Cases illustrating the use of these tools in a diverse range of applications will be discussed in class

#### 5. Assessment

The module is designed with 100% continuous assessment. Students' performance will be evaluated by the following components.

<b>Individual + group assignments</b>	<b>20%</b>
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<b>Class participation</b>	<b>10%</b>
<b>End-of-semester team project and presentation</b>	<b>30%</b>
<b>Take-home projects</b>	<b>40%</b>

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Academic integrity and honesty is essential for the pursuit and acquisition of knowledge. The University and School expect every student to uphold academic integrity & honesty at all times. Academic dishonesty is any misrepresentation with the intent to deceive, or failure to acknowledge the source, or falsification of information, or inaccuracy of statements, or cheating at examinations/tests, or inappropriate use of resources.

Plagiarism is 'the practice of taking someone else's work or ideas and passing them off as one's own' (The New Oxford Dictionary of English). The University and School will not condone plagiarism. Students should adopt this rule - You have the obligation to make clear to the assessor which is your own work, and which is the work of others. Otherwise, your assessor is entitled to assume that everything being presented for assessment is being presented as entirely your own work. **In case of any doubts, you should consult your instructor.**

Additional guidance is available at:

<http://www.nus.edu.sg/registrar/adminpolicy/acceptance.html#NUSCodeofStudentConduct>

Online Module on Plagiarism:

<http://emodule.nus.edu.sg/ac/>