AGSM MBA Programs 2016

QUANTITATIVE METHODS FOR BUSINESS DECISION MAKING

Session 1, 2016

AGSM @ UNSW Business School
COURSE
OVERVIEW

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We welcome ideas to improve these course materials. Please email suggestions to coursematerials@agsm.edu.au.
Course schedule

Session 1, 2016

Quantitative Methods for Business Decision Making

<table>
<thead>
<tr>
<th>Week no</th>
<th>Week begins</th>
<th>Unit</th>
<th>Assessment due (% weighting)</th>
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<tbody>
<tr>
<td>1</td>
<td>8 February</td>
<td>1</td>
<td>Participation is assessed throughout the session (15%) Weekly quizzes assessed throughout the session (20%)</td>
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<td>2</td>
<td>15 February</td>
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<td>7</td>
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<td>8</td>
<td>28 March**</td>
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<td>9</td>
<td>4 April</td>
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<td>11 April</td>
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<td>11</td>
<td>18 April</td>
<td>11</td>
<td>Assignment due on Monday 18 April by 9.30am Sydney time – Team Assignment (30%) Peer assessment due on Wednesday 20 April by 9.30am Sydney time</td>
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<td>25 April***</td>
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<td>13</td>
<td>2 May</td>
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<td>Examination**** on Thursday 5 May (35%)</td>
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* 25 March is Good Friday
** 28 March is Easter Monday
*** 25 April is Anzac Day
**** Examination is 2 hours plus 10 minutes’ reading time
Course information

Course-level aims and learning goals

The data advantage: hear it from the expert

‘Most great revolutions in science are preceded by revolutions in measurement. We have had a revolution in measurement over the past few years that has allowed businesses to understand in much more detail what their customers are doing, what their processes are doing and what their employees are doing. That tremendous improvement in measurement is creating new opportunities to manage things differently.

‘Our research has found a shift from using intuition toward using data and analytics in making decisions. This change has been accompanied by measurable improvement in productivity and other performance measures. Specifically, a one-standard-deviation increase toward data and analytics was correlated with about a 5 to 6 percent improvement in productivity and a slightly larger increase in profitability in those same firms. The implication for companies is that by changing the way they make decisions, they’re likely to be able to outperform competitors.’

Source: Professor Eric Brynjolfsson, the Schussel Family Professor of Management Science at the Massachusetts Institute of Technology’s Sloan School of Management, McKinsey Quarterly, May 2011.

This course

Given today’s digital revolution in data capture, the focus of this course is on building a better understanding of the statistical tools for displaying and analysing business data. The management competency at the heart of the course is known as statistical thinking. A manager with high competency in statistical thinking understands how and why business performance varies. The same manager allows the ‘data to speak’ and makes decisions based on a thorough examination of the available data. The business benefit is that the risk of unsatisfactory outcomes is reduced and a greater insight on how to improve the business is achieved.

The course covers a variety of topics from the description and visualisation of data, to testing differences between samples, and finally
to building models to identify the key factors that drive the up and down movement in business performance. Because statistical computations are cumbersome by hand, we use the Excel add-in StatTools™ to do most of the number crunching. This will leave us free to concentrate on what is most valuable to managers: the interpretation of the output and the implications for allocating resources and effort to achieve a business benefit.

This course also appeals to a wider group than managers. It equips professionals such as management accountants and performance analysts with a statistical capability allowing them to get more value out of the data they are reporting and analysing. Indeed, it can be argued that without an understanding of statistical methods, such professionals are limited in their roles.

The focus of this course is on using statistical methods for analysing data from a wide variety of business applications. These include operations, marketing, accounting, human resources and information technology. Managers are often confronted with data from their businesses. Statistical methods provide the best-practice rules to properly compare and contrast aspects of business performance.

Without the right toolkit for analysing data, managers are at risk of drawing the wrong conclusions and so Quantitative Methods for Business Decision Making is seen as a value-add course to other courses in your degree program that use data for decision-making.

This course is suitable to be undertaken later rather than earlier in your degree program.

Course learning outcomes

After you have completed this course you should be able to:

1. appreciate that the collection and statistical analysis of data improves business decisions and reduces the risk of implementing solutions that waste resources and effort

2. select and deploy the correct statistical method for a given data analysis requirement; in particular, develop expertise in describing data, process management, hypothesis testing and model building

3. achieve a practical level of competence in building statistical models that suit business applications

4. recognise, develop and distinguish between models for cross-sectional analysis at a single point in time and models for time series analysis at multiple points in time

5. run a statistical software package that integrates with Excel and interpret its output
6. increase your capability as a manager to ‘think statistically’ using data and use this capability to support your business intuition

7. build sufficient skills to provide leadership in statistical methods for the staff in your area of responsibility.

**Structure**

**Unit 1, Describing and visualising data**, introduces you to the basic graphical and statistical methods used to analyse one variable, in laymen’s terms a column of data in a spreadsheet. It also introduces you to StatTools™, the statistical package used throughout the course to do the number crunching. These basic skills are not only very important in the course, but are directly transferable to the design of management reports back in the workplace. The Unit introduces the key concept of variation in data, how to summarise and visualise it with the aim of identifying patterns.

**Unit 2, The normal distribution**, introduces you to arguably the most prevalent probability distribution in statistics, the normal distribution or bell-shaped curve as it is often called. Most statistical methods are based on the concept of probability, so the Unit begins with the concept of a continuous probability distribution. It extends this concept to the normal distribution and examines the empirical rules that describe how data appears when it is normally distributed. While more theoretical than other Units, this Unit provides the fundamentals for the business applications of statistical tools throughout the course. The Unit introduces the key concept of the Central Limit Theorem which allows us to draw conclusions about the business and its activities based on taking samples and recording data. Many management problems involve sampling, such as studying samples of customers or calls from a service desk or invoice errors and inferring what might be happening in the bigger picture.

**Unit 3, Monitoring business processes: Part 1**, introduces the methods for monitoring the performance of business processes. Since companies are composed of processes that deliver and support products and services, collecting data in terms of quality, cost and speed of these processes is an important business activity. Part 1 examines methods when the data is continuous such as lead time or financial data or in the case of product parameters, measures of weight, length and density.

**Unit 4, Monitoring business processes: Part 2**, extends the methods for continuous data to discrete and categorical data. Examples include monitoring defects, production and sales volumes, customer complaints, work injury rates and yes/no outcomes. The data in such cases will appear as counts, proportions or percentages.
Unit 5, *Hypothesis testing and confidence intervals*, allows a manager to compare the performance of different machines, people systems, offices and other elements. The Unit introduces the concept of **statistical significance**, a concept that is central to determining through objective means whether one set of numbers is more often than not higher or lower than another set of numbers. The methods in the Unit are often applied to root-cause analysis to validate through data whether suspected root causes of poor business performance are actual root causes. Hypothesis testing is akin to problem-solving with data, rather than relying on intuition only, and increases the likelihood that the manager will select the best option when resolving an important business issue.

Unit 6, *Simple linear regression models: Part 1*, examines the situation where there is a single independent variable influencing a single dependent variable. The key issue is to find out to what extent the independent variable contributes to explaining the variation in the dependent variable. A practical context is attempting to investigate the relationship between bottom-line results and employee engagement scores. The Unit introduces the key concepts of correlation and line of best fit. The Unit also addresses the situation where the independent variable is a categorical variable such as a ‘Yes-No’ occurrence. For example, the manager may be interested in discovering whether customer satisfaction differs for a new customer (coded New=Yes) versus an existing customer (coded New=No).

Unit 7, *Simple linear regression models: Part 2*, extends the previous Unit to cases where there are unusual data known as outliers and leverage points. These are known in business as anomalies or special causes and their presence can impact a regression model in adverse ways. The Unit also introduces the role of transformations, especially the use of the logarithmic function. A price-elasticity problem common in economics is used to illustrate the impact of transformations.

Unit 8, *Multiple linear regression models: Part 1*, examines the situation where there are multiple independent variables influencing a single dependent variable. The key issue is to find out to what extent each independent variable contributes to explaining the variation in the dependent variable. A practical context is attempting to explain bottom-line results from knowledge of customer preferences and employee engagement levels. The Unit introduces the key concept of multicollinearity where the independence assumption of independent variables is violated. The Unit starts with a polynomial regression model to demonstrate how curvilinear models may be constructed.

Unit 9, *Multiple linear regression models: Part 2*, extends the basic model of multiple regression to cover (a) analysis of leverage points and outliers and (b) variable selection methods. The latter methods produce the most powerful model with the least number of variables. The Unit introduces the key concept of model parsimony, or ‘explaining the most with the least’. Managers find model parsimony a useful
concept when the cost of data collection is high, since it means they can identify and monitor the most important data for their business without wasting resources on collecting data that is not useful for decision-making.

Units 10 and 11, *Time series models: Parts 1 and 2*, extend regression analysis to cover time series models. These Units are particularly relevant for managers tracking their company’s performance, both in financial and non-financial terms, over time. A direct application of time series models is sales forecasting particularly where trends and seasonality are present. The Units introduce the key concept of autocorrelation, meaning today’s results are impacted by yesterday’s results. The Units improve the capability of managers in the area of understanding and forecasting Key Performance Indicators (KPIs). Unit 10 covers the situation where no trend and seasonality are present, while Unit 11 covers the more complex situation where they are present.

Unit 12, *Exam review questions*, provides an opportunity for students to reflect on the key concepts in Units 1–11. It provides a lengthy list of exam practice questions and solutions. These will provide an opportunity for students to more thoroughly understand the expectations of the final exam and test their knowledge of the course content.

**Program quality assurance**

A number of international standards are embedded in the program to ensure the courses you study are high quality. At present this includes specific design to meet AACSB accreditation standards (through measurement of students’ program-level learning outcomes), and the United Nations Principles for Responsible Management Education (UNPRME). EQUIS accreditation is also held by UNSW Business School.

**Program-level learning goals and outcomes assessed for AACSB accreditation**

The Course Learning Outcomes are what you should be able to do by the end of this course if you participate fully in learning activities and successfully complete the assessment items.

The Course Learning Outcomes will also help you to achieve at least some of the overall Program Learning Goals that are set for all postgraduate coursework students in AGSM programs.
However, course-level learning outcomes are not sufficient to fully describe a student’s skills as they complete the qualification, and so we add an additional set of Program Learning Goals. These specify what we want you to have achieved by the time you successfully complete your degree. As an example, for the Teamwork learning goal we specify: ‘Our graduates will be effective team participants’.

You demonstrate that you have met these Program Learning Goals by achieving specific Program Learning Outcomes that are directly related to each goal. These indicate what you are able to do by the end of your degree. In the case of the Teamwork goal, the related outcome includes: ‘participate collaboratively and responsibly in teams’. Note that the ability to meet these program-level learning goals and outcomes will be measured in each capstone course for your degree program.

The Program Learning Goals (and related outcomes) used across the three MBAX streams of Change, Social Impact and Technology are as follows.

1. **Knowledge:**

   Our graduates will have current disciplinary or interdisciplinary knowledge applicable in local and global contexts.

   Learning outcome: Students should be able to identify and apply current knowledge of disciplinary or interdisciplinary theory and professional practice to business in local and global environments.

2. **Critical thinking and problem-solving:**

   Our graduates will have critical thinking and problem-solving skills applicable to business and management practice or issues.

   Learning outcome: Students should be able to identify, research and analyse complex issues and problems in business and/or management, and propose appropriate and well-justified solutions.

3. **Communication:**

   Our graduates will be effective communicators in professional contexts.

   Learning outcome for 3a – Written Communication: Students should be able to produce written documents that communicate complex disciplinary ideas and information effectively for the intended audience and purpose.

   Learning outcome for 3b – Oral Communication: Students should be able to produce oral presentations that communicate complex disciplinary ideas and information effectively for the intended audience and purpose.

4. **Teamwork:**

   Our graduates will be effective team participants.

   Learning outcome: Students should be able to participate collaboratively and responsibly in teams, and to reflect on their own teamwork, and on the team’s processes and ability to achieve outcomes.
5. Ethical, social and environmental responsibility:
Our graduates will be aware of ethical, social, cultural and environmental implications of business issues and practice.

Learning outcome for 5a – Ethical, social and environmental responsibility: Students should be able to identify and assess ethical, environmental and/or sustainability considerations in business decision-making and practice.

Learning outcome for 5b – Social and cultural awareness: Students should be able to consider social and cultural implications of business.

6. Leadership:
Our graduates will have an understanding of effective leadership.

Learning outcome: Students should be able to reflect upon their own personal leadership style and on the leadership needs of business and of teams.

Associated standards committees and accreditation agencies
AACSB: [http://www.aacsb.edu](http://www.aacsb.edu)
Association to Advance Collegiate Schools of Business

EQUIS: [https://www.efmd.org/accreditation-main/equis](https://www.efmd.org/accreditation-main/equis)
European Quality Improvement System

UNPRME: [http://www.unprme.org](http://www.unprme.org)
UN Principles of Responsible Management Education

Resources

Learning resources
You have four major resources to help you learn:

1. The course materials, comprising the weekly study units with references, insights and commentary. You will do much of your learning outside the classroom by working through the course materials, and by completing the exercises as they arise.

2. Your online or face-to-face classes with your facilitator. The facilitator's job is to guide your learning by conducting class discussion, answering questions that might arise after you have done the week's work, providing insights from his or her practical experience and understanding of theory, providing you with feedback on your assignments, and directing discussions and debates that will occur between you and your co-participants in the classroom.
3. Your co-participants. Your colleagues in the classroom are an invaluable potential source of learning for you. Their work and life, and their willingness to question and argue with the course materials, the facilitator and your views, represent a great learning opportunity. They bring much valuable insight to the learning experience.

4. In addition to course-based resources, please also refer to the AGSM Learning Guide (available in Moodle) for tutorials and guides that will help you learn more about effective study practices and techniques.

Course materials
The course materials comprise this Course Overview, the Assessment Details and 12 Units.

Other resources
To successfully undertake this course you will need:

- this Study Guide.
- the StatTools™ software (http://www.palisade.com/stattools), an Excel add-in, is included with the course material. Students using work computers should seek the appropriate permissions from their IT departments to install StatTools™.
- a Microsoft Windows compatible PC (preferably a laptop in face-to-face classes). Latest compatibility details are available here: http://kb.palisade.com/index.php?pg=kb.page&id=128
- Windows 7 and Windows 8 are compatible and recommended.
- Excel 2003 or later, purchased by you (preferably Excel 2007 or later).
- a list of data files included with the course material.
- internet access.

Microsoft Office 365 (which includes Excel) is available as a four-year subscription. Visit https://www.it.unsw.edu.au/ and under ‘Students & Staff’, click on ‘Software Distribution’. You will be presented with a list of software available to students. Click on ‘Microsoft Office’ and then follow the link to Microsoft Office online, which will enable purchase of MS Office 365 University at a significantly reduced price. For future reference, the Microsoft Customer Support Team can be contacted on 132 058.

StatTools™ software add-in
The practical work in the course revolves around using an Excel add-in,
StatTools™. You will be provided with a zipped file containing it. StatTools™ is used in almost every Unit, so the earlier it is installed and tested on your own computer the better. For installation instructions, please consult Software Installation Instructions.pdf, also in the zipped file.

**StatTools™ help desk support**

The developers of StatTools™, Palisade [www.palisade.com](http://www.palisade.com), are not obligated to provide live support services for students.

Students can access the knowledge base of problems if they have issues installing or running StatTools™: [http://kb.palisade.com/](http://kb.palisade.com/) or alternatively email support is available by contacting support@palisade.com

**Apple Mac users**

At the time of writing, no StatTools™ version was available for the Mac desktop operating system.

OS X (10.6 and later) – Windows installation instructions

Your Mac should be able to run Boot Camp which will enable you to install and run Microsoft Windows and MS Office (for Windows). Please see the Apple support website for further details: [http://support.apple.com/kb/HT1899](http://support.apple.com/kb/HT1899)

Note that you need to have an original full version of the appropriate Microsoft Windows operating system on disk to be able to use Boot Camp. It will not work with upgrade versions. Copies of MS Windows are not available from the university.

Once you have Boot Camp, Microsoft Windows and Microsoft Office/Excel for Windows installed, you are ready to install StatTools™.

**Tablet compatibility**

Windows 8 Pro tablets should be compatible with StatTools™ provided a compatible version of Microsoft Excel is installed.

StatTools™ is not available for Android or iOS based tablets.

**Diagnostics software add-in**

The practical work in the course also revolves around using another product, Diagnostics, which is also an Excel add-in, but this is not needed until Unit 7. You will be given a reminder in class when it is necessary to install it. For installation instructions, please consult Software Installation Instructions.pdf in your Moodle course site.
Additional resource (optional)

The course Study Guide is self-contained and the course has been designed so that students should only need to use the guide and not any external material.

For those students wanting an introductory text that may assist them in the earlier parts of the course, the recommended additional resource is:


Skills you will need

Knowledge of Microsoft Excel

Throughout this course, we shall use Excel and the Excel add-in StatTools™ to perform calculations on data sets. The course assumes a basic knowledge of Excel, especially how to copy and paste cells, construct basic formulae and draw graphs.

Knowledge of mathematics

Statistical methods are based upon mathematics and in particular algebra. While advanced mathematics is kept to a minimum to enable students to concentrate on data analysis and interpretation at the managerial level, students do need to be comfortable with the mechanics of how equations work. Equations are the way in which statistical models are described. Also, some mathematical proofs of the theory are included in the Units for interested students, but are not examinable.

The following resources are recommended for students who need extra assistance in mathematics.

http://mathcentre.ac.uk/

The Harvard Maths Skills tutorial available in Moodle via the 2015 AGSM Learning Guide


*Algebra 1*, available as a digital download or a series of DVDs from The Great Courses: http://www.thegreatcourses.com/courses/algebra-i.html
Other resources

BusinessThink

BusinessThink is UNSW’s free, online business publication. It is a platform for business research, analysis and opinion. If you would like to subscribe to BusinessThink, and receive the free monthly e-newsletter with the latest in research, opinion and business, go to http://www.businessthink.unsw.edu.au.

eLearning

To access Moodle, go to: https://moodle.telt.unsw.edu.au/login/index.php
Login with your student zID (username) and zPass (password).

Moodle eLearning support
Should you have any difficulties accessing your course online, please contact the eLearning support below:
For login issues:

UNSW IT Service Centre
Hours: Monday to Friday: 8am – 8pm
Saturday and Sunday: 11am – 2pm
Email: ITServiceCentre@unsw.edu.au
Phone: Internal: x51333
External: 02 9385 1333
International: +61 2 9385 1333

For help with technical issues and problems:

External TELT Support
Hours: Monday to Friday: 7.30am – 9.30pm
Saturdays and Sundays: 8.30am – 4.30pm
Email: externalteletsupppport@unsw.edu.au
Phone: Internal: x53331
External: 02 9385 3331
Administrative support

If you have administrative queries, they should be addressed to:

Student Experience
AGSM MBA Programs
UNSW Business School
SYDNEY NSW 2052
Phone: +61 2 9931 9400
Email: studentexperience@agsm.edu.au

Additional student resources and support

The University and the UNSW Business School provide a wide range of support services for students, including:

- **Business School Education Development Unit (EDU)**
  The EDU provides academic writing, study skills and maths support specifically for Business students. Services include workshops, online resources, and individual consultations.
  EDU Office: Level 1, Room 1033, Quadrangle Building.
  Phone: +61 2 9385 5584; Email: edu@unsw.edu.au

- **UNSW Learning Centre**
  [http://www.lc.unsw.edu.au](http://www.lc.unsw.edu.au)
  Provides academic skills support services, including workshops and resources, for all UNSW students. See website for details.

- **Library training and search support services**
  [http://info.library.unsw.edu.au/web/services/services.html](http://info.library.unsw.edu.au/web/services/services.html)

- **UNSW Counselling and Psychological Services**
  Provides support and services if you need help with your personal life, getting your academic life back on track or just want to know how to stay safe, including free, confidential counselling.
  Office: Level 2, East Wing, Quadrangle Building;
  Phone: +61 2 9385 5418.

- **Student Equity & Disabilities Unit**
  [http://www.studentequity.unsw.edu.au](http://www.studentequity.unsw.edu.au)
  Provides advice regarding equity and diversity issues, and support for students who have a disability or disadvantage that interferes with their learning.
  Office: Ground Floor, John Goodsell Building;
Continual course improvement

Our courses are revised each time they run, with updated course overviews and assessment tasks. All courses are reviewed and revised every three years and significant course updates are carried out in line with industry developments.

The AGSM surveys students via the UNSW CATEI system each time a course is offered. The data collected provides anonymous feedback from students on the quality of course content and materials, class facilitation, student support services and the program in general. This student feedback is taken into account in all course revisions.

**Student evaluations from the last presentation of the course**

In 2015 we were generally pleased with the student responses. One particular aspect identified by students in 2015 related to assessment techniques used for the course.

**Coordinator’s response**

The assessments have now been reviewed and brought into line with other courses in the AGSM. In particular, the exam weighting has been lowered, interactive quizzes have been introduced, and one of the assessment items has been removed. We believe this will lead to an improvement in student outcomes.
Course staff

Course coordinator

Each course has a Course Coordinator who is responsible for the academic leadership and overall academic integrity of the course. The Course Coordinator selects content and sets assessment tasks, and takes responsibility for specific academic and administrative issues related to the course when it is being offered. Course Coordinators oversee Class Facilitators and ensure that the ongoing standard of facilitation in the course is consistent with the quality requirements of the program.

The Course Coordinator is:

Dr Andreas Kiermeier
BInfSc (Hons) (Adelaide), PhD (Adelaide)
Email: andreas.kiermeier@agsm.edu.au

Andreas is a professional statistician with 20 years of experience. He specialises in statistical training, data analysis, sampling and risk assessment, and since 2013, runs his own business providing statistical and process improvement consulting services.

Andreas completed a PhD in applied statistics and has worked as a university lecturer, statistical consultant and as a food-safety risk assessor. Between 2007 and 2013 he led a team of 25 food-safety and food-innovation researcher scientists with the South Australian Research and Development Institute. In 2013, he started his own consulting business and now provides statistical consulting services to Australian and international organisations. He has served on two FAO/WHO expert consultations.

Andreas has a wealth of teaching experience. Since 1999 he has taught undergraduate and postgraduate courses at The University of Adelaide. He has been a facilitator with the Australian Graduate School of Management since 2004, and he designs and runs tailored training courses in statistics, sampling, and process improvement in Australia and overseas.

Class facilitator

The role of your Class Facilitator is to support the learning process by encouraging interaction amongst participants, providing direction in understanding the course content, assessing participant progress through the course and providing feedback on work submitted. Class Facilitators comprise academics and industry practitioners with relevant backgrounds.
You will be notified of your Class Facilitator's name and contact details in your class confirmation email sent by AGSM Student Experience. Details will also be available in the gallery section of your online class for face-to-face and distance classes.

Course authors
Dr Paul Walsh, is the author of this course.

Acknowledgement
Earlier versions of some units were written by a number of staff from UNSW. Contributors included Chris Carter and Simon Sheather.