



MODULE SPECIFICATION

KEY FACTS

Module name	Statistical Reasoning, Communication & Ethics
Module code	AS3208
School	Cass Business School
Department or equivalent	UG Programme
UK credits	15
ECTS	7.5
Level	6
Delivery location (partnership programmes only)	

MODULE SUMMARY

Module outline and aims

Many real-world decisions are based on statistical reasoning; this applies to areas as diverse as finance, insurance, public policy, medicine and the law. However, statistics are often used in a way that is incorrect or misleading, which can have a damaging effect on society. Attending this module will help you recognise such situations, understand why they occur, and help you communicate statistical information effectively and honestly. Furthermore, you will develop an understanding of how statistical reasoning fits within more complex real-world situations, in which political, economic and moral considerations that go beyond calculation of statistical measures are important.

The aims of the module are:

- To develop a deeper understanding of fundamental ideas in statistics.
- To explain common statistical fallacies and errors in the human perception of risk and uncertainty, as evidenced in practice.
- To develop ways of communicating uncertainty and the results of statistical analyses without misleading the audience.
- To appraise the extent to which erroneous or misleading statistical claims occur in public and corporate life.
- To explore the limits of objective statistical analyses in complex real-world problems

- To highlight the ethical questions and dilemmas that pervade both the application of statistical methods and the framing of policy problems

Content outline

The module will cover the following topics.

- 1 Statistics in Public Life: Sampling biases and cherry picking; means and medians, rankings and comparisons. Examples from politics and the popular press.
- 2. Meeting Thomas Bayes: Conditional probability and Bayes Theorem; the Prosecutor's Fallacy. Miscarriage of justice in the Sally Clarke case. Aleatory and epistemic uncertainty; probability interpretations.
- 3. Probability Judgements: Heuristics and biases; absolute and relative risk; natural frequencies. Examples from the communication of insurance and health risks.
- 4. Correlation, Regression and Causality: Association and causality; confounding; Simpson's paradox; the Berkeley gender bias case. Linear regression; statistical controls; regression to the mean.
- 5 Statistical Testing A: Experimental vs observational studies; randomised controlled trials. Hypothesis tests; p-values and associated fallacies. Multiple comparisons; the replication crisis in science.
- 6 Statistical Testing B: Effect size and power; the costs of different errors. Applying Bayesian thinking; reporting bias; the missing medical trials scandal.
- 7 Financial Models: Value-at-Risk; parameter and model uncertainties; endogenous risk; robustness; data quality. The failure of risk models in the 2008-09 financial crisis.
- 8 Professionalism and Communication: Communicating prediction uncertainty. Overconfidence and hindsight. Communicating caveats; stating opinions and offering advice. Telling stories with data: from Florence Nightingale to Hans Rosling.
- 9 Disagreements about Uncertainty: Risk morality and politics; the limits of cost-benefit analysis; the perception of risk. Plural rationalities; cultural theory of risk. Contesting climate change.
- 10 Seminar: Case studies presented include: The L'Aquila earthquake; The LIBOR manipulation scandal; The MMR vaccine controversy; Opinion poll and the 2015 UK election; Climategate

The only pre-requisite is an introductory course to probability and statistics, covering the fundamentals of probability and statistical testing. Only elementary mathematics will be used; in particular calculus is not needed. Sufficient background for the module is provided by any of the following modules:

- AS1101/ MA1615 Probability & Statistics 1
- IF1202 Introduction to Statistics
- MA1608 Introduction to Probability & Statistics and MA2611 Applications of Probability and Statistics
- BS1003 Financial Mathematics & Business Statistics

WHAT WILL I BE EXPECTED TO ACHIEVE?

On successful completion of this module, you will be expected to be able to:

Knowledge and understanding:

- Appreciate some of the deeper conceptual issues in the foundations of statistics
- Understand and identify common errors in probabilistic and statistical reasoning
- Appreciate the way that such errors have wide ranging implications in real life
- Demonstrate a deeper understanding of the limitations of statistical models and analyses

Skills:

- Assess the way that abstract probabilistic thinking translates into everyday life
- Evaluate the correctness of the conclusions drawn from statistical analysis in simple situations
- Assess the appropriateness of statistical arguments in practical situations
- Communicate statistical ideas in a clear and engaging way

Values and attitudes:

- Appreciate the importance of honesty and professionalism when communicating risk and uncertainty

- Demonstrate a healthy degree of scepticism towards unfounded or inadequately supported statistical claims
- Appreciate the ethical issues that pervade how statistics is conducted and used

HOW WILL I LEARN?

The module will be delivered through nine three-hour lectures and one three-hour seminar with student presentations.

During lectures, the material will be introduced using real-life examples and case studies. Our focus will be on interpretation and application of ideas in the real world and not on mathematical manipulation. Within lectures, we will engage in discussion, in-class activities and simple experiments.

To understand the content of the module, you will have to carry out some reading of suggested sources, going slightly beyond what is discussed in lectures.

In the seminar you will present in groups on a particular real-life case study related to the module's content.

Teaching component	Teaching type	Contact hours (scheduled)	Self-directed study hours (independent)	Placement hours	Total student learning hours
Lecture	Lecture	27	100	0	127
Student presentations	Seminar	3	20	0	23
Totals		30	120	0	150

WHAT TYPES OF ASSESSMENT AND FEEDBACK CAN I EXPECT?

Assessments

The module will be assessed by a formal examination (80% of the module mark) and coursework (20% of the module mark).

The coursework will be carried out in groups and will have two parts:

- a) A group presentation, where you will present a particular real-life case study related to the module's content
- b) A group written assignment, where you develop the ideas discussed in the presentation further.

Assessment component	Assessment type	Weighting	Minimum qualifying mark	Pass/Fail?
Coursework	Group presentation and written assignment	20	0	N/A
Examination	Written exam	80	0	N/A

Assessment criteria

Assessment criteria are descriptions of the skills, knowledge or attributes you need to demonstrate in order to complete an assessment successfully and Grade-Related Criteria are descriptions of the skills, knowledge or attributes you need to demonstrate to achieve a certain grade or mark in an assessment. Assessment Criteria and Grade-Related Criteria for module assessments will be made available to you prior to an assessment taking place. More information will be available in the UG Assessment Handbook and from the module leader.

Feedback on assessment

Following an assessment, you will be given your marks and feedback in line with the University's Assessment Regulations and Policy. More information on the timing and type of feedback that will be provided for each assessment will be available from the module leader.

Assessment Regulations

The Pass mark for the module is 40%. Any minimum qualifying marks for specific assessments are listed in the table above. The weighting of the different components can also be found above. The Programme Specification contains information on what happens if you fail an assessment component or the module.

INDICATIVE READING LIST

- Agresti, A, and Finley, B. (2013), *Statistical Methods for the Social Sciences*, Pearson.
- Bazerman M, D. Moore (2009) *Judgment in Managerial Decision-Making*. John Wiley & Sons, 7th Edition
- Blastland, M. and Spiegelhalter, D. (2013). *The Norm Chronicles: Stories and Numbers about Danger*. Profile Books.
- Goldacre, B. (2013). *Bad Pharma: How Medicine is Broken, and How We Can Fix It*. Fourth Estate.
- Huff, D. (1991). *How to Lie with Statistics*. New ed. Penguin Business.
- Kahneman, D. (2012). *Thinking fast and slow*. Penguin.
- Plous, S. (1993). *The psychology of judgment and decision-making*. McGrawHill
- Schneps, L. and Colmez, C. (2013). *Math on Trial: How Numbers Get Used and Abused in the Courtroom*. Basic Books.
- Silver, N. (2012). *The Signal and the Noise*. Penguin.
- Stock, J. H. and Watson M. (2011), *Introduction to Econometrics* (3rd ed.), Pearson.
- Verweij, M. (2011). *Clumsy solutions for a wicked world*. Palgrave Macmillan
- Reinhardt, A. (2015), *Statistics Done Wrong: The Woefully Complete Guide*, No Starch Press.

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Appendix: see

http://www.hesa.ac.uk/component/option,com_studrec/task,show_file/Itemid,233/mnl,12051/href,JACS3.html/ for the full list of JACS codes and descriptions

CODES

HESA Cost Centre	Description	Price Group
122	Mathematics	C

JACS Code	Description	Percentage (%)
N323	The application of statistical concepts within the financial industry.	100