2024 / 25

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Ollscoil Teicneolaíochta an Oirdheiscirt

South East Technological University

Module Descriptor

Statistics and Probability (Computing and Mathematics)

Statistics and Probability (A13283)

Short Title: Statistics and Probability
Department: Computing and Mathematics
Credits: 5 **Level:** Introductory

Description of Module / Aims

This module covers topics in introductory statistics including descriptive statistics, probability distributions, point and interval estimation, and statistical inference with applications in computing.

Programmes

		stage/semester/status
STAT-0017	BSc (Hons) in Applied Computing (International) (WD_KACCM_BI)	2 / 4 / M
STAT-0017	BSc (Hons) in Applied Computing (WD_KACCM_B)	2 / 4 / M
STAT-0017	BSc (Hons) in Applied Computing (WD_KCOMP_B)	2 / 4 / M
STAT-0017	BSc (Hons) in Computer Forensics and Security (WD_KCOFO_B)	2 / 4 / M
STAT-0017	BSc (Hons) in Computer Science (WD_KCMSC_B)	2 / 4 / M
STAT-0017	BSc (Hons) in the Internet of Things (International) (WD_KINTT_BI)	2 / 4 / M

Indicative Content

- Descriptive Statistics: data types (nominal, ordinal, and cardinal); measures of centre and spread (mean, median, standard deviation, and percentiles); graphs (histograms, bar charts, box plots, pie charts, and scatter diagrams)
- Probability theory and applications: probability types (classical, empirical, and subjective); simple and compound events; conditional probability; Bayes theorem
- Probability models: binomial; Poisson; exponential and normal distribution
- Correlation and regression: simple linear regression; introduction to multiple regression; correlation and coefficient of determination; point estimation of predictions; interpolation and extrapolation; variable recoding
- Inferential statistics: sampling; confidence intervals about a mean or difference of two means; hypothesis tests on the means of one or two populations; paired tests; chi-squared tests
- Statistical software: usage of a statistical software package such as R; formulating input commands to generate graphs, tables, and summary statistics; performing probability model calculations; calculating confidence intervals and performing hypothesis tests for a range of problems in inferential statistics; ANOVA; multiple regression modelling; indicator variables; interpreting output from a statistical package; programming constructs and scripting
- Applications in computing: elementary modelling of time to failure of devices; reliability and application to data backups; password security analysis; queuing theory and application to process scheduling

Learning Outcomes

On successful completion of this module, a student will be able to:

1. Apply standard descriptive statistics procedures to summarise univariate data.
2. Compute probabilities using counting principles and probability models such as the binomial, Poisson, exponential, and normal.
3. Apply probability concepts to applications in computer science.
4. Construct a simple linear regression model and use it to make predictions.
5. Construct confidence intervals for a population mean or difference of two means.
6. Use a statistical software computer package to script input for data analyses and interpret output.
7. Communicate the results of statistical analyses correctly and effectively.

Learning and Teaching Methods

- Delivery of the module will be through a mixture of lectures and computer laboratory sessions.
- The lectures will develop theory, lead students through worked examples and introduce the context for the module material.
- The laboratory sessions will be used to discuss applications of the theory and to use statistical software.
- Extensive use of computers will be employed to perform statistical calculations and create graphics necessary for analysing data, conduct simulations to approximate long-run behaviour of random phenomena, and use scripts to facilitate batch processing of a data set.

Learning Modes

Learning Type	F/T Hours	P/T Hours
Lecture	36	
Practical	12	
Independent Learning	87	

Assessment Methods

	Weighting	Outcomes Assessed
Final Written Examination	60%	1,2,3,4,5
Continuous Assessment	40%	
In-Class Assessment	15%	1,2
Practical	25%	3,6,7

Assessment Criteria

<40%: Has no or only rudimentary knowledge of statistics and probability; student interprets graphical summaries or statistical results with difficulty or often incorrectly. Inability to, use statistical tables and formula to determine probabilities, implement least squares regression, or apply statistical tests.

40%–49%: Has general knowledge of statistics (central tendencies, etc.) and is able to interpret basic results correctly. Can construct appropriate answers to problems without necessarily obtaining the correct result.

50%–59%: All of the above but with appropriate use of standard notation and rigour.

60%–69%: All the above and in addition able to apply theory correctly to applied problems.

70%–100%: All the previous to an excellent level. Demonstrates an ability to put a solution into a context and assess whether such solutions are meaningful.

Supplementary Material(s)

- "The R Project for Statistical Computing." http://www.r-project.org/
- Anderson, D. *Introduction to Statistics: Concepts and Applications.* 3rd. NY: West Pub. Comp., 1994.
- Crawley, M. *Statistics an introduction using R.* USA: Wiley, 2005.
- Lipschutz, S. and J. Schiller. *Schaum's Outline of Introduction to Probability and Statistics.* NY: McGraw-Hill, 1998.
- Reilly, J. *Understanding Statistics: And Its Applications on Business, Science and Engineering.* Dublin: Folens, 1997.

Requested Resources

- Room Type: Computer Lab