COURSE SPECIFICATION DOCUMENT

Academic School/Department:	Science, Innovation & Technology
Programme:	Mathematics and Data Science
***FHEQ* Level:**	4
Course Title:	Probability and Statistics
Course Code:	MATH 4101
Total Hours:	160
Timetabled Hours:	45
Guided Learning Hours:	15
Independent Learning Hours:	100
Credits:	16 UK CATS credits 8 ECTS credits 4 US credits

Course Description:
This course in probability and statistics includes theoretical and applied approaches which are primarily designed for business, data science, social science and psychology majors. The course coverage will include: descriptive statistics, elementary probability theory, random variables and expectations, discrete probability distributions (Binomial and Poisson distributions), continuous probability distribution (Normal distribution), sampling distributions, estimation and hypothesis testing about the mean and proportions of up to two populations, Chi-square tests, One-way ANOVA and F Distribution, linear, multiple and non-linear regression and Non-parametric methods. SPSS lab sessions will be included targeting applications of statistical concepts to business, data science, social science and psychology. All practical work will be produced using SPSS statistical software.

Prerequisites:
None

Aims and Objectives:
The course aims to:

- Provide the necessary foundations in the theory and applications of principles of probability and statistics.
- Develop specific skills of data analysis targeting applications to specific majors that the students will be taking.
- Enable students to develop the right statistical vocabulary to be able to make a presentation and to understand and apply essential ideas and statistical concepts.
- Perform some useful statistical methods, such as using statistical tables and SPSS statistical software.
- Develop a critical mind to be able to discern which statistical methods are most appropriate in each situation.
- Identify the shortcomings of assumptions made and the pitfalls of the various statistical methods used.
- Interpret and explain meaningfully an SPSS statistical output.

Programme Outcomes:
MATH AI, BI, CI, DI

A detailed list of the programme outcomes is found in the Programme Specification. This is maintained by Registry and located at: http://www.richmond.ac.uk/programme-and-course-specifications/

Learning Outcomes:
By the end of this course, successful students should be able to:

- Understand the concept of probability, random variables, discrete and continuous probability distribution and their applications in solving problems.
- Understand how to organise raw data, use statistical software and interpret results.
- Understand the concept of sampling distributions and its role in data analysis.
- Perform chi square tests and hypothesis testing of up to two populations.
- Understand the principles of linear, multiple and non-linear regression analysis and how to estimate model parameters by using least square method and interpret model parameters using examples from specific students' majors.
- Have a broad understanding of the principles of hypothesis testing procedures, non- parametric methods, their viability and usefulness in applications.

Indicative Content:

- Introduction to statistical terms and definitions, types of data and its organisation.
- Measures of location and dispersion.
- Introduction to probability as a measurable quantity and probability distributions.
- Applications of discrete and continuous probability distributions.
- Sampling distributions of sample statistics and role in data analysis.
- Point and interval estimations of population means and proportions.
- Hypothesis and significance testing about the mean and proportion for one and two populations.
- Chi-square tests to cover goodness-of-fit test, test of independence, test of homogeneity and interpretation of test results from analyses using statistical software.
- One-way analysis of variance (ANOVA) to test homogeneity of means of at least three populations, and interpretation of ANOVA test results from analyses using statistical software.
- Linear, multiple and non-linear regression to estimate least square line and test significance of estimated parameters to draw relevant conclusions on nature of estimated model, and interpretation of linear regression output from analysis using a statistical software.
- Non-parametric methods and related tests.

Assessment:

This course conforms to the University Assessment Norms approved at Academic Board and located at: https://www.richmond.ac.uk/university-policies/

Teaching Methodology:

This course will be delivered face to face through a combination of lectures and interactive sessions. In addition to classroom activities, there are guided learning elements that are tutor led and arranged through Blackboard. These activities can be asynchronous online sessions, flipped classrooms, set readings with discussion boards or set guest lectures for example. Set activities are monitored by the instructor to ascertain student engagement. Students are encouraged to prepare for class and to play an active part, to raise questions, following-up ideas and interact with a wide range of provided material.

Where appropriate, students will be introduced to solution aids, such as handheld calculators, and mathematical tables.

Indicative Text(s):
Bryman, A. (2011) *Quantitative Data Analysis with IBM SPSS 17, 18 & 19.* Routledge
Illowsky, B. and Dean, S. (2023) *Introductory Statistics.* 2nd edn. RICE (OpenStax)

Mann, P.S. and Lacke, C. (2023) *Introductory Statistics.* 10th edn. Wiley

See syllabus for complete reading list.

Websites

SPSS tutorials, IBM corporation, https://www.spss-tutorials.com/basics/, sited July 2019 [also available on the University network under licence].

Change Log for this CSD:

Nature of Change	Date Approved & Approval Body(School or AB)	Change Actioned by Academic Registry
First edition	Nov 2024	