New College of the Humanities

Linear Algebra and Probability for Data Science Course Descriptor

Course Title	Linear Algebra and Probability for Data Science	Faculty	EDGE Innovation Unit (London)
Course code	NCHNAP562	Course Leader	Professor Scott Wildman (interim)
Credit points	15	Teaching Period	This course will typically be delivered over a 6-week period.
FHEQ level	5	Date approved	June 2020
Compulsory/ Optional	Compulsory		
Pre-requisites	None		
Co-requisites	None		

COURSE SUMMARY

This course offers an introduction to the basics of statistics, probability, and linear algebra. It covers random variables, frequency distributions, measures of central tendency, measures of dispersion, moments of a distribution, discrete and continuous probability distributions, chain rule, Bayes' rule, correlation theory, basic sampling, matrix operations, trace of a matrix, norms, linear independence and ranks, inverse of a matrix, orthogonal matrices, range and null-space of a matrix, the determinant of a matrix, positive semidefinite matrices, eigenvalues, and eigenvectors.

COURSE AIMS

- Train learners in the key concepts of linear algebra, calculus, statistics and probability and the tools available to solve them.
- Train learners in the study of vectors, matrices and determinants and their role in solving a wide range of data science related problems.
- To give learners the theoretical background and tools to engage in the analysis of numerical data, apply mathematical methods and identify optimal solutions.

LEARNING OUTCOMES

On successful completion of the course, learners will be able to:

KNOWLEDGE AND UNDERSTANDING

K1b	Have knowledge and critical understanding of the theory and practical application of linear equations, calculus, vectors, matrices, linear transformations, statistical modelling and probability.
K2b	Have knowledge and critical understanding of how to solve linear equations.
K3b	Have knowledge and understanding of the theoretical foundations of statistics and probability, and their practical applications for solving data science problems.

SUBJECT SPECIFIC SKILLS

S1b	Develop mathematical models to solve data science problems
S2b	Solve linear equations and use statistics and probability in data analysis.

TRANSFERABLE AND PROFESSIONAL SKILLS

T1b	Develop logical analysis and conceptual thinking.
T2b	Critically evaluate and use self-initiative.
T3bi	Manipulate, structure and transform data.
T3bii	Demonstrate an effective technical proficiency of written English that uses a wide range of literacy skills and vocabulary selected appropriately to communicate to specialist and non-specialist audiences.

TEACHING AND LEARNING

This is an e-learning course, taught throughout the year.

This course can be offered as a standalone short course.

Teaching and learning strategies for this course will include:

- On-line learning
- On-line discussion groups
- On-line assessment

Course information and supplementary materials will be available on the College's Virtual Learning Environment (VLE).

Learners are required to attend and participate in all the formal and timetabled sessions for this course. Learners are also expected to manage their self-directed learning and independent study in support of the course.

ASSESSMENT

FORMATIVE

Learners will be formatively assessed during the course by means of set assignments. These will not count towards the final degree but will provide learners with developmental feedback.

SUMMATIVE

Assessment will be in two forms:

AE	Assessment Type	Weighting	Online submission	Duration	Length
1	Set exercise 1	50%	Yes	-	2,500 words excluding data tables
2	Set exercise 2	50%	Yes	-	2,500 words excluding data tables

FEEDBACK

Learners will receive formal feedback in a variety of ways: written (via email or VLE correspondence) and indirectly through online discussion groups. Learners will also attend a formal meeting with their Academic Mentor (and for apprentices, including their Line Manager). These bi- or tri-partite reviews will monitor and evaluate the learner's progress.

Feedback is provided on summatively assessed assignments and through generic internal examiners' reports, both of which are posted on the VLE.

INDICATIVE READING

Note: Comprehensive and current reading lists for courses are produced annually in the Course Syllabus or other documentation provided to learners; the indicative reading list provided below is used as part of the approval/modification process only.

BOOKS

- Strang, G., (2019), *Introduction to Linear Algebra*, Wellesley, Mass.: Wellesley-Cambridge
- Graham, R., Knuth, D. and Patashnik, O., (1994), *Concrete Mathematics: A Foundation for Computer Science*, Reading, Mass.; Wokingham: Addison-Wesley
- Attword, G., Dyer, G., and Skipworth, G., (2014), *Statistics*, New York: McGraw-Hill Education

JOURNALS

Learners are encouraged to consult relevant journals on linear algebra, statistics and probability.

ELECTRONIC RESOURCES

Learners are encouraged to consult relevant electronic resources on linear algebra, statistics and probability.

INDICATIVE TOPICS

- Linear algebra and transformations
- Vectors and matrices
- Statistics and Probability

Title: NCHNAP562 Linear Algebra and Probability for Data Science **Approved by: Academic Board** **Location: Academic Handbook/Programme specifications and Handbooks/ Undergraduate Apprenticeship Programmes/BSc (Hons) Data Science Programme Specification/Course Descriptors**					
Version number	Date approved	Date published	Owner	Proposed next review date	Modification (As per AQF4) & category number
2.1	May 2022	May 2022	Scott Wildman	September 2026	Category 1: Corrections/clarifications to documents which do not change approved content.
2.0	January 2022	April 2022	Scott Wildman	September 2025	Category 3: Changes to Learning Outcomes
1.0	June 2020	June 2020	Scott Wildman	June 2025	