FACULTY OF APPLIED SCIENCES

MASTER OF SCIENCE IN BIG DATA AND INTERNET OF THINGS

LEARNING MODULE OUTLINE

Academic Year	2024/2025	Semester	1
Module Code	COMP6115		
Learning Module	Advanced Topics in Probability and Statistics		
Pre-requisite(s)	Nil		
Medium of Instruction	English		
Credits	3	Contact Hours	45 hrs
Instructor	Dr. Chi-Kin Lam	Email	cklamsta@mpu.edu.mo
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MODULE DESCRIPTION

This module provides an understanding and appreciation of the essential statistical concepts, as well as equips students with the ability to construct and evaluate statistical models using popular computing software, such as R. Topics include probability for statistics, concepts of statistical inference, regression modelling, Analysis of variance, survival analysis, and drawing conclusions from data. Emphasis will be on exposing students to the core concepts and illustrating them largely through examples.

MODULE INTENDED LEARNING OUTCOMES (ILOS)

On completion of this learning module, students will be able to:

M1.	Demonstrate an understanding of the probability concepts and models as tools for studying random phenomena and for statistical inference, and the statistical concepts underlying methods. (AHEP4-M1)
M2.	Analyze data using appropriate, modern statistical methods (AHEP4-M2)
M3.	Conduct statistical analysis using R and other statistical software (AHEP-M3)
M4.	Develop the ability to interpret results and critically evaluate the methods used (AHEP4-M4)
M5.	Demonstrate the capability to deploy established approaches accurately to analyze and solve real-life problems using a reasonable level of skill in calculation and manipulation of statistical models. (AHEP-M5)

These ILOs aims to enable students to attain the following Programme Intended Learning Outcomes (PILOs):

PILOs	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
P1. Master the principles of system engineering and relevant enabling technologies for building of IoT solutions						

P2.	Critically evaluate scientific methodologies and mathematical models for Big Data and its applications	✓	✓		✓	✓	✓
P3.	Master the advanced software and programming tools and techniques for IoT solutions and Big Data			✓			
P4.	Explain the processes involved in IoT solutions and Big Data analytics in a typical business setting						
P5.	Explain different application domains and analyze their requirements for IoT and Big Data						
P6.	Apply knowledge in advanced communication and multimedia technologies for the design and implementation of IoT solutions						
P7.	Apply knowledge in applied statistics, machine learning, leading-edge technologies and programming techniques for Big Data	✓	✓	✓	✓	✓	✓
P8.	Design and carry out an advanced project following an ethical and professional methodology						
P9.	To demonstrate advanced knowledge and R&D techniques in Big Data and IoT						
P10.	To investigate and develop new, emerging ICT technology for Big Data and IoT						
P11.	To develop a global vision on the critical development and new application of Big Data and IoT						
P12.	To communicate technically and effectively in both speaking and writing						
P13.	To have a positive attitude towards society and the environment.						
P14.	To adhere to high moral standards and commit to excellence in life-long learning.						

MODULE SCHEDULE, COVERAGE AND STUDY LOAD

Week	Content Coverage	Contact Hours
1 - 2	1. Random variables and Expectation	4.5
	1.1. Random variables	
	1.2. Jointly distributed random variables	
	1.3. Expectation	
	1.4. Variance and covariance	
2 – 3	2. Special random variables	4.5
	2.1. The Bernoulli and binomial random variables	
	2.2. Poisson random variable	
	2.3. Uniform random variable	
	2.4. Normal random variables	
	2.5. Exponential random variables	
	2.6. Gamma distribution	
4 – 5	3. Distributions of sampling statistics	6
	3.1. The sample mean and variance	

	3.2. The central limit theorem	
	3.3. Sampling distributions from a normal population	
6 – 7	4. Parameter estimation	6
	4.1. Maximum likelihood estimators	
	4.2. Interval estimates	
	4.3. Estimating the difference in means of two normal populations	
8 – 9	5. Hypothesis testing	6
	5.1. Significance levels	
	5.2. Tests concerning the mean of a normal population	
	5.3. Testing the equality of means of two normal populations	
10 – 11	6. Regression	6
	6.1. Least squares estimators of the regression parameters	
	6.2. Distribution of the estimators	
	6.3. Statistical inference about the regression parameters	
12 – 13	7. Analysis of variance	6
	7.1. One-way analysis of variance	
	7.2. Two-factor analysis of variance	
14 – 15	8. Survival analysis	6
	8.1. Survival function	
	8.2. Cencering	
	8.3. Cox model	

TEACHING AND LEARNING ACTIVITIES

In this learning module, students will work towards attaining the ILOs through the following teaching and learning activities:

Teaching and Learning Activities	**M1**	**M2**	**M3**	**M4**	**M5**
T1. Lectures	✓	✓	✓	✓	✓
T2. Labs/Practices	✓	✓	✓	✓	✓

ATTENDANCE

Attendance requirements are governed by the Academic Regulations Governing Master's Degree Programmes of the Macao Polytechnic University. Students who do not meet the attendance requirements for the learning module shall be awarded an 'F' grade.

ASSESSMENT

In this learning module, students are required to complete the following assessment activities:

Assessment Activities	Weighting (%)	AHEP4 LOs	ILOs to be Assessed
A1. Assignment(s)	40%	AHEP4-M1, AHEP4-M2, AHEP4-M3, AHEP4-M4, AHEP4-M5	P2, P3, P7
A2. Test(s)	20%	AHEP4-M1, AHEP4-M2, AHEP4-M3, AHEP4-M4,AHEP4-M5	P2, P7
A3. Examination	40%	AHEP4-M1, AHEP4-M2, AHEP4-M3, AHEP4-M4, AHEP4-M5	P2, P7

The assessment will be conducted following the University's Assessment Strategy (see www.mpu.edu.mo/teaching_learning/en/assessment_strategy.php). Passing this learning module indicates that students will have attained the ILOs of this learning module and thus acquired its credits.

Students with an overall score of less than 35 in the coursework will fail the module even if the overall score for the module is 50 or above.

Students with a score of less than 35 in the final examination will fail the module even if the overall score for the module is 50 or above.

REQUIRED READINGS

There is no official required readings for this module. Module notes are distributed in the class.

REFERENCES

1. Ross, Sheldon M. *Introduction to Probability and Statistics for Engineers and Scientists*. Academic press, 2020.

STUDENT FEEDBACK

At the end of every semester, students are invited to provide feedback on the learning module and the teaching arrangement through questionnaires. Your feedback is valuable for instructors to enhance the module and its delivery for future students. The instructor and programme coordinators will consider all feedback and respond with actions formally in the annual programme review.

ACADEMIC INTEGRITY

The Macao Polytechnic University requires students to have full commitment to academic integrity when engaging in research and academic activities. Violations of academic integrity, which include but are not limited to plagiarism, collusion, fabrication or falsification, repeated use of assignments and cheating in examinations, are considered as serious academic offenses and may lead to disciplinary actions. Students should read the relevant regulations and guidelines in the Student Handbook which is distributed upon the admission into the University, a copy of which can also be found at www.mpu.edu.mo/student_handbook/.