FACULTY OF APPLIED SCIENCES

BACHELOR OF SCIENCE IN COMPUTING

LEARNING MODULE OUTLINE

Academic Year	2024/2025	Semester	1
Module Code	COMP315		
Learning Module	Performance Evaluation		
Pre-requisite(s)	Nil		
Medium of Instruction	English		
Credits	3	Contact Hours	45 hrs
Instructor	Wilson Ho	Email	kcho@mpu.edu.mo
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MODULE DESCRIPTION

The aim of this module is to provide students with the main concepts and techniques needed to study the performance of computer systems, plan the capacity of computer systems, predict their future performance under different configurations, and design new applications that meet performance requirements. The module is mainly based on the use of analytic queuing network models of computer systems.

MODULE INTENDED LEARNING OUTCOMES (ILOS)

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

M1.	Apply different metrics and properties for assessing quality of computer systems; (EA2p)
M2.	Identify the quantitative aspects of the queuing network framework; (EA3p, EA4p)
M3.	Analyze the results in simple queuing stations systems; (EA3p, EA4p)
M4.	Formulate equations for single class Mean Value Analysis; (EA3p, EA4p)
M5.	Identify the important operation and management parts of software development system life cycle; (EP1p)
M6.	Understand the importance of customer and user needs during software development. (D1p)

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

PILOs		M1	M2	M3	M4	M5	M6
P1.	Select and apply proven methods, tools and techniques to the effective and efficient implementation of information systems;	✓	✓	✓	✓		
P2.	Evaluate computer systems in a local area network, and understand the additional requirements for connection to other networks through wide area networks;	✓	✓	✓	✓		
P3.	Be competent in system development in the Internet and the web platform;					✓	✓
P4.	Work independently to design and implement a relational database, with an emphasis on how to organise, maintain and retrieve information from a DBMS;						
P5.	Acquire essential knowledge in specific fields of computing disciplines including multimedia, security and artificial intelligence;						
P6.	Acquire the perceptive skills needed to understand information presented in the form of UML diagram, flow chart or other industry standard formats;						
P7.	Understand the need for and use of the necessary mathematical techniques;	✓	✓	✓	✓		
P8.	Work independently to develop an understanding of, and the knowledge and skills associated with the general support of computer systems and networks;					✓	✓
P9.	Work as an effective member of a team in the analysis, design and development of software systems;						
P10.	Use project planning and management techniques in systems development;						
P11.	Understand the fundamental and operational issues of computer systems in business environments;					✓	✓
P12.	Equip with adequate written, oral communication and interpersonal skills;						
P13.	Build the capacity and desire for lifelong learning and to learn advanced and emerging technologies on one's own;						
P14.	(For Enterprise Information Systems specialisation) Gain an in-depth understanding of the information technology related to enterprise information systems, with an emphasis on development of such systems to support business processes;						
P15.	(For Gaming Technology specialisation) Acquire the general and advanced knowledge of current technologies and operating environment in the gaming industry;						
P16.	(For Computer Education specialization) Acquire the general and practical knowledge of computer education and its practicing environment in secondary education.						

MODULE SCHEDULE, COVERAGE AND STUDY LOAD

Week	Content Coverage	Contact Hours
1	1. Computer System Lifecycle	3
	1.1 QoS in IT Systems	
	1.2 System Life Cycle	
2-3	2. Descriptive Models	6
	2.1 Modeling	
	2.2 Multiple Classes	
	2.3 Open and Closed Classes	
	2.4 Blocking	
	2.5 Software Contention	
4-5	3. Basic Performance Laws	6
	3.1 Utilization Law	
	3.2 Service Demand Law	
	3.3 The Forced Flow Law	
	3.4 Little's Law	
	3.5 Interactive Response Time Law	
	3.6 Bounds on Performance	
5-7	4. Performance Engineering Methodology	6
	4.1 Model-based Methodologies	
	4.2 Workload Model	
	4.3 Performance Model	
	4.4 Specifying Performance Objectives	
7-9	5. Evaluating Database Service	6
	5.1 Database Service Example	
	5.2 Building a Performance Model	
	5.3 Measurements Techniques	
	5.4 Obtaining Input Parameters	
9-11	6. Markov Models	6

	6.1 Model Construction	
	6.2 Model Solution and Interpretation	
	6.3 Model Assumptions and Limitations	
	6.4 Generalized Birth-Death Models	
11-13	7. Single Queue Systems	6
	7.1 The G/G/1 Queue	
	7.2 The M/M/1 Queue	
	7.3 The M/G/1 Queue	
	7.4 M/G/! with Vacations	
13-15	8. Single Class MVA	6
	8.1 MVA Development	
	8.2 The MVA Algorithm	
	8.3 Balanced Systems	

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**	**M6**
T1. Lectures	✓	✓	✓	✓	✓	✓
T2. In-class tutorials or exercises	✓	✓	✓	✓	✓	✓

ATTENDANCE

Attendance requirements are governed by the Academic Regulations Governing Bachelor'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 (%)	AHEP3 LOs	ILOs to be Assessed
A1. Assignments	30%	EP2p, EA3p, EA4p, D1p	M1, M2, M3, M4, M5, M6
A2. Test	20%	EA3p, EA4p, EP1p, D1p	M1, M2, M3, M4, M5, M6
A3. Examination	50%	EA3p, EA4p, EP1p, D1p	M1, M2, M3, M4, M5, M6

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 must take the re-sit examination even if the overall score for the module is 50 or above.

Students with a score of less than 35 in the final examination must take the re-sit examination even if the overall score for the module is 50 or above.

Students with an overall final grade of less than 35 are NOT allowed to take the re-sit examination.

REQUIRED READINGS

1. Boudec, J.L. (2022), Performance evaluation of computer and communication systems. EPFL Press.

REFERENCES

1. *Capacity Planning By Example*. Prentice Hall PTR.
2. Menasce, D.A., & Almeida, V.A.F. (2001), *Capacity Planning for Web Services: Metrics, Models, and Methods*. Prentice Hall PTR.
3. Gunter Bolch, Stefan Greiner, et al. (2006),Queueing Networks and Markov Chains. Wiley-Interscience.
4. Bolch Greiner de Meer Trivedi. (2006), Queueing Networks and Markov Chains. Wiley.

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/.