


Philadelphia University	 PHILADELPHIA UNIVERSITY <small>THE WAY TO THE FUTURE</small>	Approval date:
Faculty of Science		Issue:
Department of Math		Credit hours: 3
Academic year 2023/2024		Course Syllabus

Course information

Course#	Course title	Prerequisite
250333	Applied Probability	Prob. Theory 250232
Course type <input type="checkbox"/> University Requirement <input type="checkbox"/> Faculty Requirement <input checked="" type="checkbox"/> Major Requirement <input checked="" type="checkbox"/> Elective <input type="checkbox"/> Compulsory		Class time W 17:15-18:30 Room # MS Teams

Instructor Information

Name	Office No.	Phone No.	Office Hours	E-mail
Feras Awad	822	2132	SM 11:15–12:30 ST 12:45–14:00	fawad@philadelphia.edu.jo

Course Delivery Method

Course Delivery Method			
<input type="checkbox"/> Physical	<input checked="" type="checkbox"/> Online	<input type="checkbox"/> Blended	
Learning Model			
Precentage	Synchronous	Asynchronous	Physical
	50%	50%	0%

Course Description

Markov Chains: What Is a Stochastic Process? What Is a Markov Chain? n -Step Transition Probabilities, Classification of States in a Markov Chain, Steady-State Probabilities and Mean First Passage Times, Absorbing Chains. **Queuing Theory:** Some Queuing Terminology, Modeling Arrival and Service Processes, Birth–Death Processes, The M/M/1/GD/ ∞/∞ Queuing System, and the Queuing Formula $L=\lambda W$, The M/M/1/GD/ c/∞ Queuing System, The M/M/s/GD/ ∞/∞ Queuing System. **Simulation:** Basic Terminology. An Example of a Discrete-Event Simulation, Random Numbers and Monte Carlo Simulation, An Example of Monte Carlo Simulation, Simulations with Continuous Random Variables, An Example of a Stochastic Simulation, Statistical Analysis in Simulations.

Course Learning Outcomes

Number	Outcomes	Corresponding Program outcomes
Knowledge		
K1	Distinguish the Markov chain processes and their properties.	K_{p1}, K_{p3}
K2	Realize the steady-state behavior of Markov chains.	K_{p1}
K3	Modeling queuing systems and analyze their steady state behavior.	K_{p1}
K4	Understand the basic concepts and main steps in the simulation process.	K_{p1}, K_{p3}
Skills		
S1	Use computer software like GeoGebra and Google Sheets to do calculations.	S_{p4}
S2	Conduct probabilistic simulation models.	S_{p2}, S_{p3}
Competencies		
C1	Thinking reasonably and the ability to make decisions.	C_{p1}
C2	Work in a team to implement one of the tasks of the course.	C_{p2}

Learning Resources

Course textbook	Winston, W. L. (2004) Introduction to Probability Models: Operations Research, Volume II (4 th ed.). Cengage Learning.
Supporting References	<ul style="list-style-type: none"> • Taha, H. (2017) Operations Research: An Introduction (10th ed.). Pearson. • Ross, S. (2019) Introduction to Probability Models (12th ed.). Elsevier India. • Ibe, O. (2005) Fundamentals of Applied Probability and Random Processes (1st ed.). Academic Press. • Kao, E. (2019) An Introduction to Stochastic Processes (1st ed.). Dover Publications. • Hiller, F. (2019) Introduction to Operations Research (10th ed.). McGraw-Hill.
Supporting websites	<ul style="list-style-type: none"> ✓ GeoGebra: https://www.geogebra.org/ ✓ Google Sheets: http://sheets.new/
Teaching Environment	<input type="checkbox"/> Classroom <input type="checkbox"/> laboratory <input checked="" type="checkbox"/> Learning platform <input type="checkbox"/> Other

Meetings and Subjects Timetable

Week	Topic	Learning Methods	Tasks	Learning Material
1	Explanation of the study plan for the course, and what is expected to be accomplished by the students. Markov Chains: What Is a Stochastic Process?	Lecture		Course Syllabus Chapter 17
2	What Is a Markov Chain?	Lecture		Chapter 17
3	<i>n</i> -Step Transition Probabilities.	Lecture		Chapter 17
4	Classification of States in a Markov Chain.	Lecture	Quiz	Chapter 17

5	Steady-State Probabilities and Mean First Passage Times.	Lecture		Chapter 17
6	Absorbing Chains.	Lecture		
7	Computer Session: Excel and/or Google sheets	Lecture	Computer Task	
8	Queuing Theory: Some Queuing Terminology.	Lecture	Midterm Exam	Chapter 20
9	Modeling Arrival and Service Processes.	Lecture		
10	Birth–Death Processes.	Lecture		
11	The M/M/1/GD/ ∞/∞ Queuing System and the Queuing Formula $L=\lambda W$.	Lecture	Quiz	Chapter 20
12	The M/M/1/GD/c/ ∞ Queuing System.	Lecture		Chapter 20
13	The M/M/s/GD/ ∞/∞ Queuing System.	Lecture		Chapter 20
14	Computer Session: Excel and/or Google sheets	Lecture	Computer Task	Chapter 20
15	Simulation: Basic Terminology. Random Numbers and Monte Carlo Simulation.	Lecture	Computer Project	Chapter 21
16	Final Exam	Lecture		

* Includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

Course Contributing to Learner Skill Development

Using Technology
<ul style="list-style-type: none"> Use GeoGebra to solve an experimental probabilistic problem. Use Google Sheets to do the calculations in Markov Process and Queuing Systems.
Communication Skills
<ul style="list-style-type: none"> Design a program to solve an interactive probabilistic problem and present it to the students and explaining its mechanism.
Application of Concepts Learnt
<ul style="list-style-type: none"> Making a simulation of one of the queuing models learned in the course.

Assessment Methods and Grade Distribution

Assessment Methods	Grade Weight	Assessment Time (Week No.)	Link to Course Outcomes
Mid Term Exam	30%	8	K1, K2
Various Assessments *	30%	Continuous	S1, S2, C1, C2
Final Exam	40%	16	K1, K2, K3, K4
Total	100%		

* Includes: quiz, in class and out of class assignment, presentations, reports, videotaped assignment, group or individual projects.

Alignment of Course Outcomes with Learning and Assessment Methods

Number	Learning Outcomes	Learning Method*	Assessment Method**
Knowledge			
K1	Distinguish the Markov chain processes and their properties.	Lecture	Exam
K2	Realize the steady-state behavior of Markov chains.	Lecture	Exam

K3	Modeling queuing systems and analyze their steady state behavior.	Lecture	Exam
K4	Understand the basic concepts and main steps in the simulation process.	Lecture	Exam
Skills			
S1	Use computer software like GeoGebra and Google Sheets to do calculations.	Case Study	Computer Task
S2	Conduct probabilistic simulation models.	Case Study	Computer Task
Competencies			
C1	Thinking reasonably and the ability to make decisions.	Discussion	Quiz
C2	Work in a team to implement one of the tasks of the course.	Case Study	Group Project

* Includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

** Includes: quiz, in class and out of class assignment, presentations, reports, videotaped assignment, group or individual projects.

Course Polices

Policy	Policy Requirements
Passing Grade	The minimum passing grade for the course is (50%) and the minimum final mark recorded on transcript is (35%).
Missing Exams	<ul style="list-style-type: none"> • Missing an exam without a valid excuse will result in a zero grade to be assigned to the exam or assessment. • A Student who misses an exam or scheduled assessment, for a legitimate reason, must submit an official written excuse within a week from an exam or assessment due date. • A student who has an excuse for missing a final exam should submit the excuse to the dean within three days of the missed exam date.
Attendance	The student is not allowed to be absent more than (15%) of the total hours prescribed for the course, which equates to six lectures days (M, W) and seven lectures (S, T, T). If the student misses more than (15%) of the total hours prescribed for the course without a satisfactory excuse accepted by the dean of the faculty, s/he will be prohibited from taking the final exam and the grade in that course is considered (zero), but if the absence is due to illness or a compulsive excuse accepted by the dean of the college, then withdrawal grade will be recorded.
Academic Honesty	Philadelphia University pays special attention to the issue of academic integrity, and the penalties stipulated in the university's instructions are applied to those who are proven to have committed an act that violates academic integrity, such as: cheating, plagiarism (academic theft), collusion, and violating intellectual property rights.

Program Learning Outcomes to be Assessed in this Course

Number	Learning Outcome	Course Title	Assessment Method	Target Performance level
S_p4	Use technology and computer software in various fields of mathematics.	Applied Probability	Computer Task	100% of the students get 60% or more on the rubric

Description of Program Learning Outcome Assessment Method

Number	Detailed Description of Assessment
Sp4	The student chooses a probability model to solve using Monte Carlo method and implement it using GeoGebra or Excel in the 14 th week.

Assessment Rubric of the Program Learning Outcome

	Poor (1 pt.)	Fair (2 pts)	Good (3 pts)	Excellent (4 pts)
	Student is very confused and does not understand the topic, nor is able to clearly grasp how to apply it or when to use it.	Student has a decent grasp of the process but makes some major mistakes.	Student is almost perfect in their understanding of the topic, with some minor confusion or mistakes.	Student understands the concept perfectly.
Problem Analysis How much did the student understand the problem and develop a plan for the solution?	Student does not understand the problem and cannot identify the necessary data and create a plan to solve.	Student understands the problem, but cannot identify the data or create a plan to solve	Student understands the problem but can only identify some of the necessary data or creates a slightly inaccurate plan to solve.	Student understands problem, identifies necessary data to solve and creates an accurate plan to solve it.
Computations Accuracy How much the results are correct?	The program is producing incorrect results.	The program produces correct results but does not display them correctly.	The program produces correct results but does not display all of it correctly.	The program works and meets all the specifications.
Trials and Efficiency How many trials can the program do at each run, and how long it takes to execute?	Program takes long time to execute 1 trial at each run.	Program takes long time to execute but the user can implement 1 or 10 trials each time.	Program takes small execution time to implement 10 to 1000 trials at each run.	Program is fast in execution more than 1000 trials at each run.
Output Formatting, Graphics, Animation How much the student represents the simulation using animations?	Results are displayed without animations.	Results are displayed with limited animations and less formatting.	Results are displayed with well animations but less formatting.	Results are perfectly formatted and visualized.