FLORIDA POLYTECHNIC UNIVERSITY

Syllabus: STA3039 Advanced Probability and Statistics

Spring semester 2026

Course Information

- **Course Number and Title:** STA3033 Advanced Probability and Statistics
- **Credit Hours:** 3
- **Current Academic Term:** Spring 2026

Instructor Information

- **Instructor:** Dr. A.J. Alnaser
- **Office:** IST-2012
- **Office Hours:** TBA
- **E-mail:** aalnaser@floridapoly.edu

Course Details

- **Class Meeting Day, Time & Location:** TBA

- **Course Website:** Canvas course site

- **Official Catalog Course Description**:
  Continuation and expansion of topics introduced in STA 3032, with emphasis on the exponential and Poisson distributions, confidence intervals, and hypothesis testing, correlation, and regression models and diagnostics. Probabilistic models using Markov chains and stochastic processes will be studied. Applications may include queuing theory, Brownian motion, or simulation methods. Modern computational methods for working with data will be introduced.

  - **Course Pre-Requisites:** STA 3032 Probability and Statistics
  - **Communication/Computation Skills Requirement (6A-10.030)**: No

- **Required Texts**:
  - **Thulin** – *Modern Statistics with R* https://www.modernstatisticswithr.com/
  - **Pishro-Nik** – *Introduction to Probability, Statistics, and Random Processes* *https://www.probabilitycourse.com/*
  - **Kerns (IPSUR)** – *Introduction to Probability and Statistics Using* *https://www.atmos.albany.edu/facstaff/timm/ATM315spring14/R/IPSUR.pdf*
  - **Equipment and Materials**: R-Studio

- **Course Objectives**: This course introduces probability theory and stochastic processes. The courses goals are:
  1. To provide the students with a fundamental understanding of probabilistic methods.
  2. To familiarize the students with the stochastic processes.
  3. To familiarize the students with the stochastic simulation techniques.
  4. To familiarize the students with the applications of probabilistic and stochastic methods in modern applied mathematics and engineering problems.
  5. To introduce the student to data collection methods, summary statistics, visual summaries, and exploratory data analysis

6. Understanding basic inference and the ideas of bootstrap and permutation methods
7. To introduce prediction methods mainly in the form of linear regression and inference for regression.

- **Course Learning Outcomes:** The following topics will be used to measure the student learning outcome "Demonstrate fluency in mathematics concepts," which corresponds to the Mathematics Reasoning Competency:

1. Check for independence of events by using Bayes' theorem to compute conditional probability.
2. Utilize and identify scenarios modeled using the Poisson process.
3. Find the transition probability matrix Discrete-time Markov Chains (DTMCs)
4. Create and interpret a model with single and multiple predictors and check assumptions.
5. Conduct hypothesis test using randomization.

Additionally:

a. Interpret visualized data.
b. Classify the different types of data and sampling methods.
c. Use R to run basic simulations of probabilistic scenarios.
d. Identify classes of states in Markov chains and characterize the classes.
e. Develop probability distributions given a description of a random experiment.

- **Alignment with Program Outcomes:**

Course Learning Outcome	**Learning Level (Anderson/ Krathwohl)**	**Program Learning Outcome (ABET/Applied Mathematics)**
1. Check for independence of events by using Bayes' theorem to compute conditional probability	Applying	ABET: 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. Applied Math: 4. Use principles of mathematical modeling and computers to simulate, model, and analyze data and physical processes.
2. Utilize and identify scenarios modeled using the Poisson process.	Analyzing	ABET: 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. Applied Math: 4. Use principles of mathematical modeling and computers to simulate, model, and analyze data and physical processes.
3. Find the transition probability matrix Discrete-time Markov Chains (DTMCs)	Applying	ABET: 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. Applied Math: 4. Use principles of mathematical modeling and computers to simulate, model, and analyze data and physical processes.
4. Create and interpret a model with single and multiple predictors and check assumptions.	Applying	ABET: 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. Applied Math: 4. Use principles of mathematical modeling and computers to simulate, model, and analyze data and physical processes.
5. Conduct hypothesis test using randomization.	Analyzing	ABET: 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. Applied Math: 4. Use principles of mathematical modeling and computers to simulate, model, and analyze data and physical processes.

Course Policies:

Attendance

Students in face-to-face courses are expected "to attend all of their scheduled University classes and to satisfy all academic objectives as defined by the instructor" (University Policy, FPU-5.0010AP) (see also University Policy).

[Falsifying attendance for yourself or for another student is an act of academic dishonesty and subject to academic discipline.]

A+ Attendance will be used to track attendance.

Students Feeling Sick

Students should not come to class if they are feeling ill, particularly if experiencing symptoms of COVID-19, or if you have been directed by a health professional to quarantine. Students who are experiencing an emergency situation that aligns with an academic exercise of consequence (e.g./a Common Exam) should work with CARE Services at care@floridapoly.edu

Late Work/Make-up work:

The instructor will only allow make-up exams in extreme circumstances provided you have sufficient documentation for your absence. If you will miss an exam because you are participating in a university-sponsored activity, the instructor must be informed in writing before the exam and be provided with documentation.

Grading Scale:

A	B+	B	B-	C+	C	D	F
90%	87%	83%	80%	77%	70%	60%	0%

Assignment/Evaluation Methods:

Homework	Labs		Two Midterm Exams	Comprehensive Final
10%	10%		25%+25%	25%

The Midterm exams and the Final Exam will be common, and the date will be fixed at the beginning of the semester.

Homework and Quizzes policy

1. Homework submission should be legible and well organized. Illegible and ill-organized homework will get no credit. The usage of word processors (e.g. MS word, LaTeX, Page, etc.) are strongly recommended.
2. Homework and Quizzes will be collected in PDF format through the Canvas course webpage. Multiple submission is allowed but only the latest one will be graded.
3. All Homework assignments will be **DUE on the specified dates BY 11:59 PM.**
   Late submission penalty
   × 0.8 for < 24 hours late
   × 0 for >24 hours late

Classroom Rules: It is important for us to work together to create a learning environment in which every student get the most out of every class. Therefore, **Laptops/tablets should only be used for class purpose** cell phones **MUST** be on silent/mute mode and should not be used to the extent that they disturb other students or distract from class participation.

Course Schedule

Week	Topics	Primary Texts/Resources
1	Review key concepts from Term 1	Summary from Thulin/Pishro-Nik

Week	Topics	Primary Texts/Resources
2	Categorical data & Chi-square tests	Thulin Ch. 13, Kerns Ch. 12
3	Introduction to multiple regression	Thulin Ch. 14
4	Model selection, diagnostics	Thulin Ch. 14
5	Logistic regression	Thulin Ch. 15
6	Simulation-based inference	Thulin Ch. 16
7	Maximum likelihood estimation (MLE)	Pishro-Nik Ch. 9, supplement with R
8	Gamma, Beta, and other continuous distributions	Pishro-Nik Ch. 5, Kerns Ch. 6
9	Moment generating functions & transformations	Pishro-Nik Ch. 6
10	Covariance matrices & multivariate normal	Pishro-Nik Ch. 7
11	Law of Large Numbers & convergence	Pishro-Nik Ch. 8
12	Poisson process: motivation, definitions, derivation	Pishro-Nik Ch. 10
13	Interarrival and waiting times, exponential links	Pishro-Nik Ch. 10
14	Discrete-Time Markov Chains (DTMCs) intro	Pishro-Nik Ch. 11
15	DTMC long-term behavior, stationary distributions	Pishro-Nik Ch. 11
16	Applications, review final review	

Academic Support Resources

- **Library**: Students can access the Florida Polytechnic University Library through the University website and Canvas, on and off campus. Students may direct questions to library@floridapoly.edu.
- **Peer Learning Strategists (PLS)**: Are specially trained student leaders who help their peers strategize approaches to course content and work through solution methods. PLS work in collaboration with the courses they support so the content and methods are aligned with your instructors' expectations. Students can meet with a PLS in The Learning Center, which is located on the first floor of the Innovation, Science and Technology (IST) building in room 1019.
- **Academic Success Coaches**: All students at Florida Poly are assigned an Academic Success Coach. Your Academic Success Coach can assist you with academic success strategies. Please visit the Student Success Center on the second floor of the IST building to meet with an Academic Success Coach.
- **Writing Center:** Located on the second floor of the IST (2059/2061), the Writing Center helps students to develop their writing and presentation skills. Consultations are available in person and virtually. For more detail, visit **https://floridapoly.edu/writingcenter**.

Civility and Collegiality

Faculty and students come to the university for the same reason, which is to participate in a highly professional educational environment. To that end, both students and faculty are expected to treat each other with mutual regard and civility. In more general terms, collegiality means respecting the right of both faculty and students to participate fully and fairly in the educational enterprise.

University Policies

Reasonable Accommodations

The University is committed to ensuring equal access to all educational opportunities. The University, through the Office of Disability Services (ODS), facilitates reasonable accommodations for students with disabilities and documented eligibility. It is the student's responsibility to self-identify as a student with disabilities and register with ODS to request accommodations.

If you have already registered with ODS, please ensure that you have requested an accommodation letter for this course through the ODS student portal and communicate with your instructor about your approved accommodations as soon as possible. Arrangements for testing accommodations must be made in advance. Accommodations are not retroactive.
If you are not registered with ODS but believe you have a temporary health condition or permanent disability requiring an accommodation, please contact ODS as soon as possible.

The Office of Disability Services (ODS):
DisabilityServices@floridapoly.edu
(863) 874-8770
The Access Point
ODS website: www.floridapoly.edy/disability

Accommodations for Religious Observances, Practices and Beliefs

The University will reasonably accommodate the religious observances, practices, and beliefs of individuals in regard to admissions, class attendance, and the scheduling of examinations and work assignments. (See University Policy.)

Title IX

Florida Polytechnic University is committed to ensuring a safe, productive learning environment on our campus that prohibits sex discrimination and sexual misconduct, including sexual harassment, sexual assault, dating violence, domestic violence and stalking. Resources are available if you or someone you know needs assistance. Any faculty or staff member you speak to is required to report the incident to the Title IX Coordinator. Please know, however, that your information will be kept private to the greatest extent possible. You will not be required to share your experience. If you want to speak to someone who is permitted to keep your disclosure confidential, please seek assistance from the Florida Polytechnic University Ombuds Office, BayCare's Student Assistance Program, 1-800-878-5470 and locally within the community at Peace River Center, 863-413-2707 (24-hour hotline) or 863-413-2708 to schedule an appointment. The Title IX Coordinator is available for any questions to discussion resources and options available.

Academic Integrity

The faculty and administration take academic integrity very seriously. Violations of academic integrity regulation include actions such as cheating, plagiarism, use of unauthorized resources (including but not limited to use of Artificial Intelligence tools), illegal use of intellectual property, and inappropriately aiding other students. Such actions undermine the central mission of the university and negatively impact the value of your Florida Poly degree. Suspected violations will be fully investigated, possibly resulting in an academic integrity hearing and sanctions against the accused student if found in violation. Sanctions range from receiving a zero on the exam or assignment, to expulsion from the university. Repeat offenders are subject to more severe sanctions and penalties. Do not compromise your integrity for a perceived short-term gain.

Recording Lectures

Students may, without prior notice, record video or audio of a class lecture for a class in which the student is enrolled for their own personal educational use.

Recordings may not be used as a substitute for class participation or class attendance. Recordings may not be published or shared in any way, either intentionally or accidently, without the written consent of the faculty member. Failure to adhere to these requirements is a violation of state law (subject to civil penalty) and the student code of conduct (subject to disciplinary action).

Recording class activities other than class lectures, including but not limited to lab sessions, student presentations (whether individually or part of a group), class discussion (except when incidental to and incorporated within a class lecture), and invited guest speakers ***is prohibited****.*