

Course Syllabus



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MATH 5351 Probability

Meeting Times: 11:00 am -12:20 pm T/Th in RBN 4019.

Last day to withdraw: Friday, October 30, 2026

Instructor: Nathan Smith

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Office Hours: TBA

Text: no text

Student Learning Outcomes: By the end of the course students should be able to:

1. Define and use the basic concepts from probability theory, including random variables, distribution and density functions, conditional probability, moments, expectations, generating functions, and the central limit theorem.
2. Identify, give density functions for, and apply the standard discrete and continuous random variables and random variables derived from these.
3. Apply the above to basic statistical inference.

Grading: Everybody gets an A, at least I hope so. We'll have 3 tests and a comprehensive final, each worth 1/5 of your grade. The remaining 1/5 of the grade will be based on homework assignments. Earning 90%, 80%, 70%, etc. will earn an A, B, C, etc.

Student Academic Conduct: It is your responsibility to learn the material in this course for your own benefit. You should not let this discourage you from working together on your homework but in the end what you turn in should reflect your understanding, not just be copied from someone else. *During the tests and the final exam a code of honor will apply under which students are to work alone and neither give help to others nor receive help from any sources.* Students are also expected to help enforce this code. Students are encouraged to obtain a copy of *A Student Guide to Conduct and Discipline at UT Tyler*, available in the Office of Student Affairs.

Artificial Intelligence UT Tyler is committed to exploring and using artificial intelligence (AI) tools as appropriate for the discipline and task undertaken. We encourage discussing AI tools' ethical, societal,

philosophical, and disciplinary implications. All uses of AI should be acknowledged as this aligns with our commitment to honor and integrity, as noted in UT Tyler's Honor Code. Faculty and students must not use protected information, data, or copyrighted materials when using any AI tool. Additionally, users should be aware that AI tools rely on predictive models to generate content that may appear correct but is sometimes shown to be incomplete, inaccurate, taken without attribution from other sources, and/or biased. Consequently, an AI tool should not be considered a substitute for traditional approaches to research. You are ultimately responsible for the quality and content of the information you submit. Misusing AI tools that violate the guidelines specified for this course (see below) is considered a breach of academic integrity. The student will be subject to disciplinary actions as outlined in UT Tyler's Academic Integrity Policy.

For this course, you may not use AI tools to produce anything turned in for a grade.

Course Outline:

1. Sigma algebras

1. Review of set nonsense, unions, intersections, complements, subtraction, cartesian products, disjointness (mutually exclusive)
2. distributive properties, DeMorgan's laws finite and infinite,
3. sigma field B on Ω has Ω as a member and is closed under complements and countable unions.

2. Probability spaces.

1. Probability function $B \rightarrow [0,1]$.
2. Outcomes, events, etc.
3. Examples of sample spaces finite, infinite, and product spaces

3. Combinatorics stuff

1. Factorials, permutations, combinations
2. order matters vs. repeats allowed square formulas

4. Conditional probability and independence, Bayes

1. conditional probability
2. law of total probability
3. Bayes' rule
4. independence

5. Random variables

1. Definitions and F
2. Discrete random variables and what f means here. Binomial, geometric, poisson
3. Continuous random variables and what f means here. Uniform, exponential, pareto, normal, gamma
4. Functions of r.v., change of variables
5. random vectors and joint densities
6. multivariable change of variables

6. Expectation

1. Definition and linearity

2. Variance and Standard Deviation
3. Covariance and Correlation
4. Markov and Chebychev inequalities, WLLN
5. Moment generating functions
7. Conditional densities and conditional expectation
8. sequences of random variables
 1. Convergence in distribution
 2. Convergence in probability
 3. Central Limit Theorem

UNIVERSITY POLICIES

In this course we will follow

- [university policies \(https://docs.google.com/document/d/e/2PACX-1vQXRIbySwSUh3-Ow_8tVR0BoV9Ck3bKN1yTVExKtxygUWZgQ1c1LGttITyN6DpgDVN_ucMP9O12M50G/pub\)](https://docs.google.com/document/d/e/2PACX-1vQXRIbySwSUh3-Ow_8tVR0BoV9Ck3bKN1yTVExKtxygUWZgQ1c1LGttITyN6DpgDVN_ucMP9O12M50G/pub).

Too, please be aware of UT Tyler

- [student resources \(https://docs.google.com/document/d/e/2PACX-1vRaJGg-hPnk5QtllDwceH5NWY94GijJFgVdtXwE1kjs_UGwXlv-cMpfErK84xN9kZLT21Co_GcBYfg7/pub\)](https://docs.google.com/document/d/e/2PACX-1vRaJGg-hPnk5QtllDwceH5NWY94GijJFgVdtXwE1kjs_UGwXlv-cMpfErK84xN9kZLT21Co_GcBYfg7/pub).