

# MAT 271E Probability and Statistics (Unique Number: 11665)

Fall 2020

**Instructor:** Asst. Prof. Sanem Kabadayi

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**Web page:** <http://web.itu.edu.tr/kabadayi>

**Course site:** <https://ninova.itu.edu.tr/Sinif/1260.57977>

**Course time and location:** Tuesday 1:30-4:30 PM (online)

**Description:** Introduction to probability and statistics. Combinatorial methods; product rule, permutation, combination. Probability; probability axioms, conditional probability, Bayes formula. Random variable; distribution function, probability function, Chebyshev inequality. Discrete and continuous distributions; uniform, Bernoulli, Poisson, geometric, normal, exponential distributions. Generating functions. Decision theory. The notion of estimation. Hypothesis testing. Correlation.

**Prerequisites:** You must be able to compute integrals and double integrals to handle continuous random variables that we will see in the second part of the course. So, you must have taken MAT 102/MAT 102E. Otherwise, you will have difficulty with this course.

**Required text:** *Probability and Stochastic Processes*, Roy D. Yates and David J. Goodman, John Wiley and Sons, 2005. For each lecture, you should read the relevant sections in the textbook as listed in the weekly course schedule on the last page of this syllabus.

## Other recommended texts:

- *Introduction to Probability*, Dimitri P. Bertsekas and John N. Tsitsiklis, Athena Scientific, 2008.
- *Introduction to Probability and Statistics for Engineers and Scientists*, Sheldon Ross, Academic Press, 2020.
- *Probability and Random Processes for Electrical Engineering*, Alberto Leon-Garcia, Person, 2008.

**Homework (Take-home exams):** There will be five homework assignments (5 x Take-home exams). You are expected to make an honest, independent attempt to solve and turn in your answers to each homework question. You must turn in your complete solutions to the homework on time. Probability is a subject that you learn by solving problems, not just by listening to a lecturer. Therefore, doing the homework assignments is crucial to performing well in this class. If you are having considerable difficulty with the early assignments, this is a sign that you may be in over your head - you should contact me immediately. The assignments will require a substantial time commitment over several days (several hours per week outside of class should be expected). Be sure to budget sufficient time to complete assignments before the deadline. You may not copy solutions from a classmate or from the Internet. This is considered cheating! Homework is individual. There are no group assignments in this course.

**Attendance:** It is imperative that you attend the online lectures and pay attention. You are not allowed to work on your laptop or read anything not related to the class during the lecture. You are required to attend 70% of the lectures in order to be allowed to take the final exam. (Since this semester has 14 weeks, you have to attend at least 10 lectures). Those who do not meet the attendance requirement will fail the course with a grade of VF (Article 23, Undergraduate Education Regulations, <http://www.sis.itu.edu.tr/tr/yonetmelik/lisansyonetmelik.html>). If you do miss class, it is your responsibility to find out (from a classmate) what you missed, including class notes, announcements, and worksheets. No make-up exams will be given. Absences from the midterm or final will result in a grade of zero for that exam. The midterm will be on **Tuesday, December 1, 2020**.

**Evaluation:** The distribution of percentages for the course grade will be as follows:

Homework (5 Take-Home Exams)	20 %
Midterm	40 %
Final	40 %

**Eligibility to take the final exam:** In addition to meeting the attendance requirement, students must meet the following criteria to take the final exam:

- Students must turn in at least 4 out of 5 homework assignments and get a grade higher than 30 on each homework.
- Average of homework assignments must be at least 35.
- Midterm grade must be at least 35.
- Students must have a mid-semester average (weighted average of homework and midterm) grade of at least 35/100.

The average mid-semester grade is computed using the formula below:

$$\text{Avg. mid-semester grade} = (0.20 \times \text{Assign.} + 0.40 \times \text{Midterm}) * 100 / 60$$

Any student who gets a grade lower than the required grade on any of these assessments will fail the course with a grade of VF and not be allowed to take the final exam.

**Announcements on course site and by e-mail:** You are expected to check the Ninova web site and your ITU e-mail for homework and announcements. In addition, you are responsible for all announcements that may be made on the course web site and in class (that may or may not be included in this syllabus).

**E-mail etiquette:** Your full name must appear in the e-mail. The e-mail subject must be “MAT 217E”. Do not send the same e-mail repeatedly. Your e-mails may be in English or Turkish. Regardless of which language you use, use proper grammar, lowercase/uppercase letters, and punctuation. Your e-mails should not look like chat messages.

**Academic honesty:** You are expected to read the Undergraduate Education Regulations (<http://www.sis.itu.edu.tr/tr/yonetmelik/lisansyonetmelik.html>) and ITU Academic Honesty Pledge (<http://www.sis.itu.edu.tr/tr/yonetmelik/AkademikOnurSozuEsaslar.html>) and behave accordingly. Cheating on the exams or on homework will result in disciplinary action. Every piece of work that you turn in with your name on it must be yours and yours alone. No coworking is allowed on any test or homework. You must not turn in work that is not yours. Specifically, you are not allowed to copy someone else’s homework. This is plagiarism. You must not enable someone else to turn in work that is not his or hers. Do not share your work with anyone else.

**Final:** The final exam will be given during the final exam period (January 25-February 7, 2021), at the time and location determined by the University.

**Where does this course fit in?** This course is a prerequisite for BLG 443E Discrete Event Simulation ([http://ssb.sis.itu.edu.tr:9000/pls/PROD/itu\\_icerik.p\\_download?file=BLG443E](http://ssb.sis.itu.edu.tr:9000/pls/PROD/itu_icerik.p_download?file=BLG443E)), which is an elective.

**Tentative course schedule (subject to change):**

	Date	Subject	Book Chapter
1	20-Oct	Introduction to probability, set theory, axioms of probability	1.1-1.4
2	27-Oct	Conditional probability, total probability, Bayes' theorem, independence, repeated experiments	1.5-1.7
3	3-Nov	Independence in modeling, reliability problems, counting Discrete random variables (RVs): definition, PMFs	1.8-1.10 2.1-2.2
4	10-Nov	Discrete random variables (RVs): families, CDFs, expectation, functions of discrete RVs	2.3-2.7
5	17-Nov	Discrete random variables (RVs): variance, conditional PMFs Multiple disc. RVs: joint&marginal PMFs	2.8-2.9, 4.1-4.3
6	24-Nov	Multiple disc. RVs: functions, covariance, conditioning, indep., more than 2 RVs	4.6-4.10
7	1-Dec	Continuous RVs: probability density function, CDF, expected values, common RVs, Gaussian RVs, mixed RVs, derived RVs (EXAM)	3.0-3.7
8	8-Dec	Continuous RVs: derived RVs, conditioning Multiple cont. RVs: joint&marginal PDFs, functions	3.7-3.8 4.1,4.4-4.6
9	15-Dec	Multiple cont. RVs: conditioning, expected values, independence, covariance, bivariate Gaussian / Sums of RVs: expected values of sums	4.7-4.11 6.1
10	22-Dec	Sums of RVs: convolution, moment generating function	6.2-6.6
11	29-Dec	Sums of RVs: Central limit theorem, Sample Mean: Markov, Chebyshev, Chernoff	6.6-6.8 7.1-7.4
12	5-Jan	Central limit theorem, Statistical inference: hypothesis testing	7.1-7.4 8.1-8.2
13	12-Jan	Statistical inference: MAP, maximum likelihood Estimation of an RV: MMSE, linear estimation	8.1-8.2 9.1-9.2
14	19-Jan	Estimation of an RV: MAP, ML	9.3
	25-Jan - 7-Feb	Final (Tentative)	

**Last day for add/drop:** The add/drop period ends on Friday, October 23, 2020. You may withdraw from the course between October 26, 2020 and November 2, 2020. There is no way to drop or withdraw from a course after November 2, 2020!