EE 351K Probability, Statistics, and Random Processes **Spring 2016**
Unique ID: [16410 / 16415 / 16420]
Instructors: [Ari Arapostathis / Gustavo de Veciana / Sanjay Shakkottai]

Overview: This course is an introduction to probability, statistics and random processes for engineers. It will focus on the fundamentals and applications of probability models and associated computations in computer and communication systems, algorithms (e.g. web search), and logistics, etc.

Coordinated Class: There are three sections for this class. The instructors are: Profs. Ari Arapostathis, Gustavo de Veciana, and Sanjay Shakkottai. The lectures for all three sections will essentially cover the same material (with minor differences in examples, and differences in focus and teaching style). The homework and exams are common for all three sections. To serve the student body best our office hours will be common for all three sections. You are encouraged to create study groups within and across sections. That said, you should get to know your instructor as is finally responsible for your section and tracking your progress.

Pre-requisites: EE 313 with a grade of C or better.

Textbook: *Introduction to Probability,* Dimitri Bertsekas and John Tsitsiklis, Athena Scientific, 2nd edition, 2008. Homework may be derived from the text and the associated material (e.g. instructor manual).

Class Hours: You are assigned to one of three sections based on your registration, and we expect that you will primarily follow the lectures in your assigned section. However, you are allowed to attend any of the other sections (e.g. make up missed class, additional clarifications in case some concepts are not clear); you do not need to request explicit permission from instructors to do so.

Ari Arapostathis – Tuesday and Thursday, 9:30 AM - 11:00 AM in UTC 4.122
Gustavo de Veciana – Tuesday and Thursday, 11:00 AM - 12:30 PM in UTC 1.118
Sanjay Shakkottai – Tuesday and Thursday, 12:30 PM - 2:00 PM in PAR 203

Online Platform: Homework and related class material will be posted on Canvas: `http://canvas.utexas.edu`. We will be using Piazza – an online discussion platform – for posting and answering questions regarding class and homework and using Gradescope for electronic submission and grading of homeworks.

Office Hours: Office hours for all instructors and TAs will be posted and possibly updated, based on student needs, on Canvas.

Course Policy – General: Attendance is expected. You are responsible for material covered in the reading assignments (even if not covered in class) as well as material covered in class that is not in the book.

You may discuss homework problems with other students, but you are not allowed to copy from others. University disciplinary procedures will be invoked if any form of cheating is detected.

Homework: Homework will be assigned weekly. You will need to scan your homework and submit it electronically via Gradescope by the appropriate deadline. Late homework will not be accepted.

You will need to create Gradescope account (you should have received an email regarding this) and details on the (pdf) scanning and uploading the homework will be provided in the first homework.

There are 12 homework sets. The lowest scoring homework will be dropped when computing your overall grade.

Mid-Term Exams: There will be two *evening* mid-term exams that will be common across all three sections. There will be no regularly scheduled class on exam days.

(i) Exam 1 – *Thursday, February 18 at 7 PM* in JES A121A

(ii) Exam 2 – *Thursday, March 31 at 7 PM* in JES A121A

These exams are closed book, however you are allowed to bring one cheat-sheet (8.5 x 11 inch paper). You can write on both sides. The material on the cheat sheet needs to be handwritten, and you need to turn these in along with your exam.

If you think you might miss an exam, you need to let the instructor know prior to the exam. The instructor will determine if the absence is excused on a case-by-case basis (e.g. medical condition with doctor's note, required participation in an official University event). If you have an excused absence for an exam, your exam score will be calculated as the weighted average of the other mid-term exam and final scores. Unexcused absence will result in zero points for the exam.

Grading:

(i) Homework: 15%

(ii) Exam 1: 25%

(iii) Exam 2: 25%

(iv) Final Exam: 35%

The overall course grade will be based on a curve. We expect roughly 25% of the students to get an A, 25% a B, 35% a C, 15% a D, and possibly some will fail. However we reserve the right to move these based on the degree to which we feel students have mastered the material and the quality of their work. Further, we might give $+/-$ grades for students on the curve decision boundaries.

Notices from the University: If you have any questions regarding the notices below, please contact appropriate offices as detailed below.

"*Privacy in Canvas:* Information in Canvas is protected by your UTEID login. Please be aware that I will use a merged Canvas site for all sections of the course that I am teaching this semester. This will allow students in other sections to see that you are enrolled in the course and send you email from within Canvas. However, they will not actually learn your email address and no other personal data will be revealed through Canvas. If you have any concerns, please contact the ITS Help Desk at 475-9400 for help removing your name from view of other students."

"*Academic adjustment:* The University of Texas at Austin provides, upon request, appropriate academic adjustments for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4241 TDD or the College of Engineering Director of Students with Disabilities at 471-4321."

EE 351K Detailed Course Schedule – Spring 2016

Date	Topic	Reading	HW-due
Tu 1/19	L1: Course introduction, probability and set theory	1.1	
Th 1/21	L2: Probability models and axioms	1.1-1.2	
Tu 1/26	L3: Conditioning and Bayes' rule	1.3-1.4	1
Th 1/28	L4: Independence	1.5	
Tu 2/2	L5: Counting	1.6	2
Th 2/4	L6: Discrete RVs and PMFs	2.1-2.2	
Tu 2/9	L7: Derived discrete RVs, expectation, and joint PMFs	2.3-2.5	3
Th 2/11	L8: Conditioning, independence	2.6-2.7	
Tu 2/16	L9: Problem solving and applications		4
Th 2/18	**Evening Midterm 1, 7:00 - 8:15 PM, covers L1 – L8**		
Tu 2/23	L10: Continuous RVs	3.1-3.3	
Th 2/25	L11: Multiple continuous RVs, introduction to conditioning	3.4-3.5	
Tu 3/1	L12: Conditioning, problem solving and applications	3.5	5
Th 3/3	L13: Derived distributions – single and multiple RVs, convolution	4.1	
Tu 3/8	L14: Covariance, sums of RVs, conditional expectation	4.2-4.3	6
Th 3/10	L15: Conditional expectation as a RV, random sums of RVs	4.3, 4.5	
Tu 3/15	**Spring Break**		
Th 3/17			
Th 3/22	L16: Moment Generating Functions (MGFs), Bivariate Gaussian	4.4, notes	7
Tu 3/24	L17: Inequalities, Weak Law of Large Numbers	5.1-5.3	
Th 3/29	L18: Central Limit Theorem, pollster problem	5.4	8
Th 3/31	**Evening Midterm 2, 7:00 - 8:15 PM, covers L1 – L16**		
Tu 4/5	L19: Bayesian estimation: MAP and ML	8.1 - 8.2	
Th 4/7	L20: Problem solving and applications (hypothesis testing, MAP, ML)	8.1 - 8.2	
Tu 4/12	L21: Least Mean Squares Estimation (LMSE)	8.3	9
Th 4/14	L22: Linear LMSE, regression (through empirical distribution)	8.4, 9.2	
Tu 4/19	L23: Point estimation (mean/variance), confidence intervals	9.1	10
Th 4/21	L24: Random Processes: Bernoulli Process and Poisson Process	6.1	
Tu 4/26	L25: Discrete-time Markov Chains (DTMC), classification of states	7.1-7.2	11
Th 4/28	L26: Steady-state behavior	7.3	
Tu 5/3	L27: Absorption probability, expected time recurrence equations	7.4	
Th 5/5	L28: Selected topics		12
	Final Exam Date and Time TBD (Registrar's website)		