Probability and Random Processes
ECS 315

Asst. Prof. Dr. Prapun Suksompong
(ผศ.ดร.ประพันธ์ สุขสมปอง)
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Introduction

Office Hours:
BKD, 6th floor of Sirindhralai building

Tuesday	9:00-10:00
Wednesday	14:20-15:20
Thursday	9:00-10:00

Course Website

prapun.com

Current version

Last-year version

Teaching

- For 1/2016, he te
  - ECS315 (P
  - ECS332 (P
- For 3/2015, he ta
  - ICT Eleme
    communica
- For 2/2015, he ta
  - ECS203 (B
  - ECS452 (D
- For 1/2015, he ta
  - ECS315 (P
  - ECS332 (P
  - ECS204 (B
- For 3/2014, he ta

Asst. Prof. Dr.Prapun Suksompong (ผศ.ดร.ประพันธ์ สุขสมปอง) is currently the Chairperson of Electronics and Communication Engineering (EC) Curriculum at Sirindhorn International Institute of Technology (SIIT), Thammasat University, Thailand. In 1997, he received the King's Scholarship to study in the School of Electrical and Computer Engineering (ECE) at Cornell university. He topped the Cornell ECE class of 2002, with the highest GPA among all engineering students. He then received the Cornell's fellowship for his graduate study. Prapun joined Prof. Toby Berger's group in 2003 and got his Ph.D. in 2008.

Right after his graduation, he started his teaching career at SIIT. His research interest is in the areas of communication theory, information theory, probability theory, and theoretical neuroscience. In 2012, he (along with two other faculty members in the Wireless Communication Research Group) received the 2011 SIIT Research Award. In 2014, he received the 2013 Outstanding Young Researcher Award (รางวัลนักวิจัยรุ่นใหม่ดีเด่นระดับคณะ ประเภทอาจารย์) from Thammasat University.

Aiam Prapun always highly values the teaching aspect of his career and his life. Many of his notes are available on his personal websites. In 2006, he received the Teaching Assistant of the Year Award from members of the Cornell IEEE Student Branch "for exemplary teaching in ECE". In 2010 and in 2014, he also received the Best Teaching Awards from SIIT.

For more information, here is his CV. (Download pdf version.)

Teaching

- For 1/2016, he teaches
  - ECS315 (Probability and Random Processes)
  - ECS332 (Principles of Communications)
- For 3/2015, he taught
  - ICT Elementary for Embedded Systems (Fourier transform and principles of communications)
- For 2/2015, he taught
  - ECS203 (Basic Electrical Engineering) (For non-major students)
  - ECS452 (Digital Communication Systems)
- For 1/2015, he taught
  - ECS315 (Probability and Random Processes)
  - ECS332 (Principles of Communications)
  - ECS204 (Basic Electrical Engineering Laboratory) (For non-major students)

Getting Info About This Course

Announcements

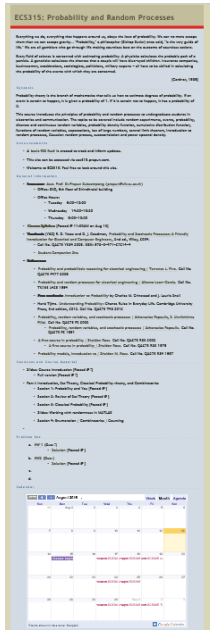
- The **syllabus** contains tentative information.
- I will announce **in class** and on the **website** if there is any change.
- You are **responsible** for making sure that you obtain this information.
- Come to classes **on time** and listen carefully for **announcement(s)**.
- For those who want a preview of the class materials, old slides along with the notes and HW from earlier years are available on my web site (**prapun.com**).

Course Website

- Announcements
- References
- Handouts (Posted before corresponding lectures)
- Annotated Notes/Slides (Posted after corresponding lectures)
- Calendar
  - Exams
  - HW due dates

Please check the course website regularly.

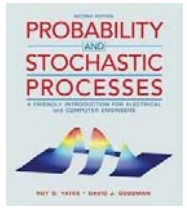
www2.siit.tu.ac.th/prapun/ecs315/



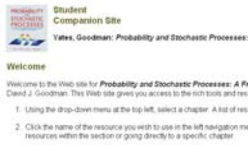
Course Website: Notes & Slides

- Some **PDF notes/slides** will be posted *before* the corresponding lectures.
  - Hard copies can also be purchased from the **copy center**.
- In lectures…
  - PDF notes/slides will be highlighted and annotated with examples / comments.
    - **Put all of your energy into understanding the material**.
  - The slides and annotated notes will be **posted *after*** the corresponding lectures.
- **Remind** (email) me the day after the lecture if the annotated notes/slides from the day before are still not posted on the web.

Course Organization



- **Course Website:**
  http://www2.siit.tu.ac.th/prapun/ecs315/
- **Lectures:**
  - **Wednesday 10:40-12:00 BKD 3510**
  - **Thursday 14:40-16:00 BKD 3510**
- Tutorial/Exercise/Make-up sessions:
  - **Friday 09:00-10:20 BKD 3510 (Shared with ECS332)**
- **Textbook:**
  - Probability and stochastic processes: a friendly introduction for electrical and computer engineers
    - By Roy D. Yates and David J. Goodman
    - 2nd Edition
    - ISBN 978-0-471-27214-4
    - Library Call No. QA273 Y384 2005
    - Student Companion Site:
      http://bcs.wiley.com/he-bcs/Books?action=index&itemId=0471272140&bcsId=1991


Student Companion Site
Yates, Goodman: Probability and Stochastic Processes:
Welcome

The Friday Sessions

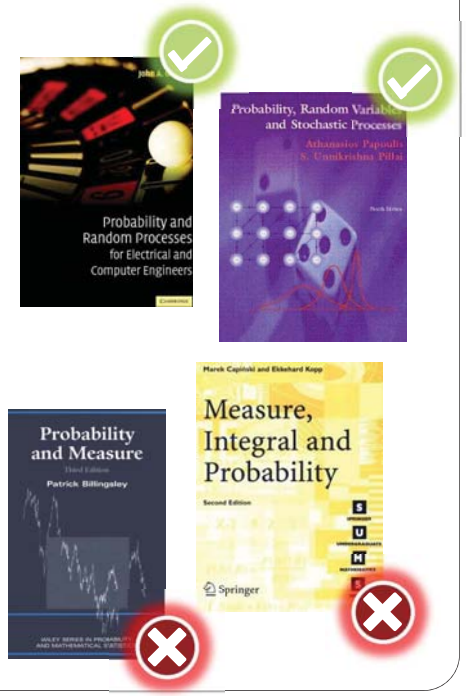
- We will use most of them.
- The first four sessions (see calendar) will be used for make-up ECS315 **and ECS332** classes.
  - These are normal lectures.
- Later, we will start using them as tutorial sessions.
  - Will be conducted in Thai to help those who have problem with English.
    - Hopefully, you will ask more questions as well.
  - After the midterm, those whose scores are below the median will be required to attend.
- They can also be used for pre-announced in-class exercises as well.

ECS 315: Course Outline

1. Introduction, Set Theory, Classical Probability
2. Counting Methods and Combinatorics
3. Probability Foundations
4. Event-based Independence, Conditional Probability
5. Discrete Random Variable
6. Real-Valued Functions of a Random Variable
7. Expectation, Moment, Variance, Standard Deviation
8. **MIDTERM: 13 Oct 2016 TIME 13:30 - 16:30**
9. Continuous Random Variables
10. Families of Continuous Random Variables
11. Multiple Discrete Random Variables
12. Multiple Continuous Random Variables
13. Conditioning by a Random Variable
14. Limiting Theorems
15. Transform Methods
16. Mixed Random Variables, Random Vectors, Random processes, Poisson Processes, Power Spectral Density
17. **FINAL: 22 Dec 2016 TIME 13:30 - 16:30**

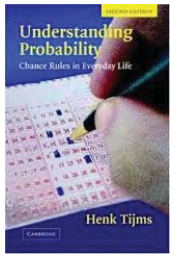
More references

- Use ones that say probability and random (or stochastic) processes
- If it has the word "statistics" in the title, it may not be rigorous enough for this class
  - Many chapters will overlap our class content. In which case, it provide a nice reading with beautiful/colorful figures.
- If it has the word "measure" or "ergodic" in there, it is probably too advanced.

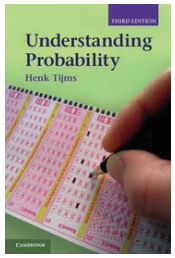


Recommended Reading

- Understanding Probability: Chance Rules in Everyday Life
- By Henk Tijms
- Call No. QA273 T48 2012
- Cambridge University Press
- "Part One" provides many motivating examples and problems from everyday life
- "Part Two" teaches clearly and simply the mathematics of probability theory.
- Sample materials are available at the author's website: http://personal.vu.nl/h.c.tijms/
- http://www.cambridge.org/aus/catalogue/catalogue.asp?isbn=9781107658561&ss=exc

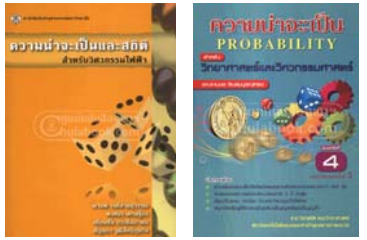


2nd Edition (2007)
3rd Edition (2012)



More Reference (in Thai)

- ความน่าจะเป็นและสถิติสำหรับวิศวกรรมไฟฟ้า
  - ผู้แต่ง: มานพ วงศ์สายสุวรรณ และคณะ
  - ISBN : 9789740324164
- ความน่าจะเป็น :สำหรับวิทยาศาสตร์และวิศวกรรมศาสตร์ (PROBABILITY)
  - ผู้แต่ง : สายชล สินสมบูรณ์ทอง
  - ISBN : 9789740329053
- ทฤษฎีความน่าจะเป็น - Probability Theory
  - ผู้เขียน: ผู้ช่วยศาสตราจารย์วัลลภ เฉลิมสุวิวัฒนาการ
  - ISBN 9789749918760



Calendar

Canceled classes

M	T	W	R	F
15-Aug-16	16-Aug-16	17-Aug	18-Aug-16	19-Aug-16
22-Aug-16	23-Aug-16	24-Aug	25-Aug-16	26-Aug-16
29-Aug-16	30-Aug-16	31-Aug	1-Sep-16	2-Sep-16
5-Sep-16	6-Sep-16	7-Sep-16	8-Sep-16	9-Sep-16
12-Sep-16	13-Sep-16	14-Sep-16	15-Sep-16	
19-Sep-16	20-Sep-16	21-Sep-16	22-Sep-16	23-Sep-16
26-Sep-16	27-Sep-16	28-Sep-16	29-Sep-16	30-Sep-16
3-Oct-16	4-Oct-16	5-Oct-16	6-Oct-16	7-Oct-16
10-Oct-16	11-Oct-16	12-Oct-16	13-Oct-16	Oct-16
17-Oct-16	18-Oct-16	19-Oct-16	20-Oct-16	21-Oct
24-Oct-16	25-Oct-16	26-Oct-16	27-Oct-16	28-Oct-16
31-Oct-16	1-Nov-16	2-Nov-16	3-Nov-16	4-Nov-16
7-Nov-16	8-Nov-16	9-Nov-16	10-Nov-16	11-Nov-16
14-Nov-16	15-Nov-16	16-Nov-16	17-Nov-16	18-Nov-16
21-Nov-16	22-Nov-16	23-Nov-16	24-Nov-16	25-Nov-16
28-Nov-16	29-Nov-16	30-Nov-16	1-Dec-16	2-Dec-16
5-Dec-16	6-Dec-16	7-Dec-16	8-Dec-16	9-Dec
12-Dec-16	13-Dec-16	14-Dec-16	15-Dec-16	Dec-16
19-Dec-16	20-Dec-16	21-Dec-16	22-Dec-16	23-Dec-16

Make-up classes

Lectures

Tutorials

Exams

Please Double-Check Exam Dates!

Grading System

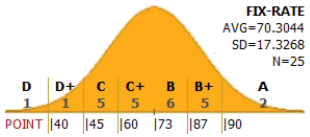
- Coursework will be weighted as follows:

Assignments	5%
In-Class Exercises	5%
Class Discussion/Participation	10%
Midterm Examination	40%
Final Examination (comprehensive)	40%

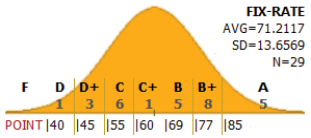
- Mark your calendars now!
- Late HW submission will be rejected.

Please Double-Check Exam Dates!

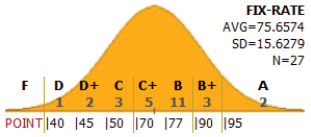
Grading System



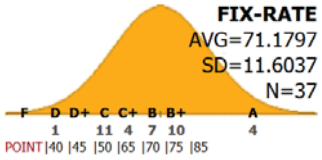
2010: CLASS GPA: 2.74



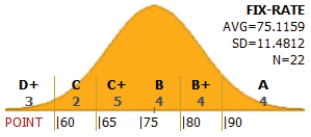
2013: CLASS GPA: 2.86



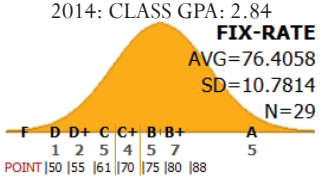
2011: CLASS GPA: 2.74



2014: CLASS GPA: 2.84



2012: CLASS GPA: 2.86



2015: CLASS GPA: 2.88

In-Class Exercises

- Most in-class exercises will occur without prior warning or announcement.
  - Focus on the current topic under discussion.
- Done in group to reduce pressure and provide opportunity
  - for those who think they understand the course material to explain to their friends and see whether they really know the material under consideration

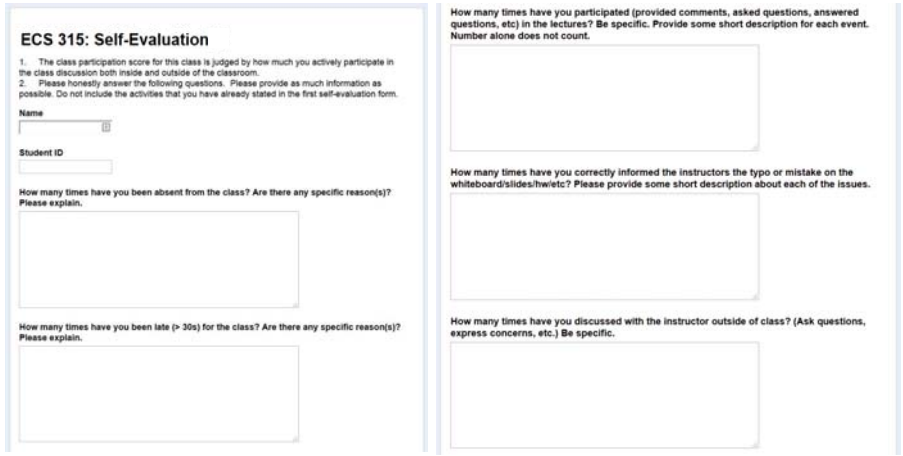
  and
  - for those who are falling behind to get an alternative explanation from their peers
- Note that you can't be in exactly the same group every time.
  - Have to change your group members every time.
  - If you are with a friend before, then next time, form a group with someone else.

Class Participation

- NOT the same as class attendance!
- If you come only to **receive**, you will fall **asleep**.
  - Do not simply sit quietly in the class.
- Need **interaction** between lecturer and students.
- **Ask question** when there is something that you don't understand.
  - Don't be shy!
  - It is very likely that your friends don't understand it as well.
- If you already understand what I'm presenting, SHOW ME!
  - Point out the errors/typos.
  - I will raise many issues/questions in class. Try to comment on them.

Class Participation (2)

- Record what you have done.
  - Submitted before the midterm and before the final.



ECS 315: Self-Evaluation

1. The class participation score for this class is judged by how much you actively participate in the class discussion both inside and outside of the classroom.
2. Please honestly answer the following questions. Please provide as much information as possible. Do not include the activities that you have already stated in the first self-evaluation form.

Name

Student ID

How many times have you been absent from the class? Are there any specific reason(s)? Please explain.

How many times have you been late (> 30s) for the class? Are there any specific reason(s)? Please explain.

How many times have you participated (provided comments, asked questions, answered questions, etc) in the lectures? Be specific. Provide some short description for each event. Number alone does not count.

How many times have you correctly informed the instructors the typo or mistake on the whiteboard/slides/hw/etc? Please provide some short description about each of the issues.

How many times have you discussed with the instructor outside of class? (Ask questions, express concerns, etc.) Be specific.

Policy

Based on the clock on my computer. (This should be approx. the same as your phone's and computer's clocks if they are synchronized properly.)

- We will start the class on time and will finish on time.
  - I recommend arriving at least 3 minutes before the start time.
  - Raise your hand and tell me immediately if I go over the time limit.
    - Does NOT mean that I will leave the room immediately after lecture.
    - I will stay and answer questions.
- Mobile phones *must* be turned off or set in silent mode.

- Attendance will be taken/given irregularly and randomly.
- Cheating will not be tolerated.
- Feel free to stop me when I talk too fast or too slow.

Policy (con't)

- I will surely make some **mistakes** in lectures / HW / exams.
  - Some amount of class participation scores will be reserved to reward the **first** student who informs me about each of these mistakes.
    - Grammatical errors are best informed/corrected after class.
- Points on HW / exercises / exams are generally based on your entire solution, not your final answer.
  - You may get full credit even when you have the wrong final answer.
  - You may get **zero** even when you write down a right answer without justification.

Help and Office Hours

- Get some help!
  - Do not wait until the final exam time or after the grade is out.
  - Right after lecture is always a good time to ask question.
- Office Hours
  - Tentative Time: T 9-10, W 14:20-15:20, R 9-10
  - Appointment can be made.
  - Feel free to come to my office and chat!
  - Don't be shy.

Asst.Prof.Dr.Prapun Suksompong - 1/2016

	9.00-10.20	10.40-12.00	13.00-14.20	14.40-16.00	16.00-17.00
MON			JAE	MEETING	
TUE	Office Hour				
WED		ECS315 BKD 3510	ECS332 BKD 3510	Office Hour	
THR	Office Hour	ECS332 BKD 3510		ECS315 BKD 3510	
FRI	ECS315 BKD 3510		Network Group BKD Front	Meeting Building	

Office Hours:
BKD, 6th floor of Sirindhralai building

Tuesday	**9:00-10:00**
Wednesday	**14:20-15:20**
Thursday	**9:00-10:00**

Difficulty in ECS315

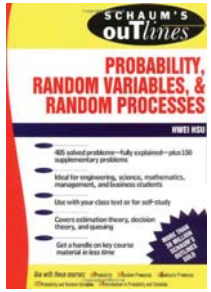
- Combinatorics (counting)
  - Solving word problems
  - Not the main focus of this class but unavoidable if you want to solve/consider interesting questions
- Calculus
  - Can be messy
- Concept of probability
  - Most students do not learn probability until two or three exposures to it.
- Large number of definitions, formulas and equations
  - No need to remember a lot of formulas if you understand them

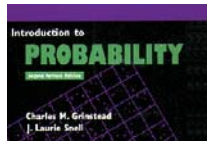
Remarks

- Get as much **legitimate** help as you can
- **Participate actively in class** and outside of class
  - Record what you have done.
- If you feel that the class is very easy, you might overlook something.
- If you feel that the class is very difficult, you are probably not the only one who feel that way.
  - Don't give up. Chat with me.
  - It takes me a long time to feel comfortable with these materials; yet, I still make mistakes.
- My notation can be different from the textbook.
  - Every notation has some advantages and disadvantages.

Need More Examples or Practice?

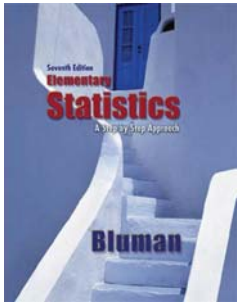
- Textbook in the library: Schaum's outline of theory and problems of probability, random variables, and random processes / Hwei P. Hsu. Call No. QA273.25 H78 1997
- Free pdf textbook: Introduction to Probability by Grinstead and Snell http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/book.html

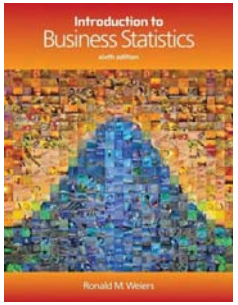


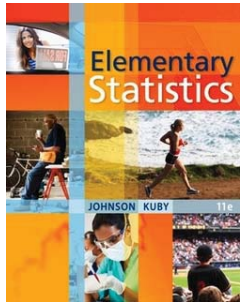


Easier References

For those who feels that this course is difficult, here are some easier references.







More beautiful pictures. Less technical.
Less applicable for content after the midterm.