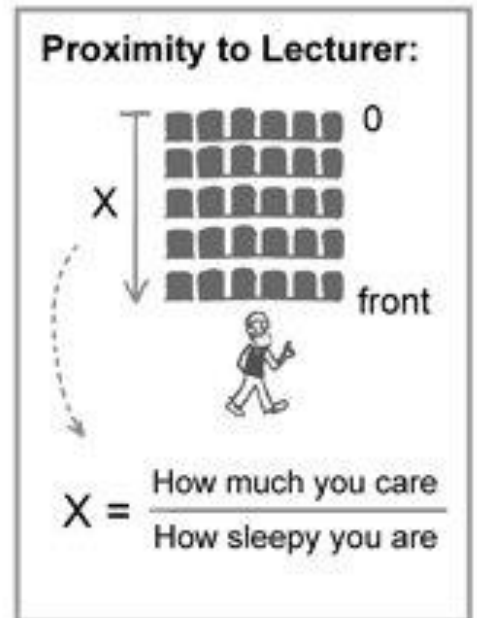
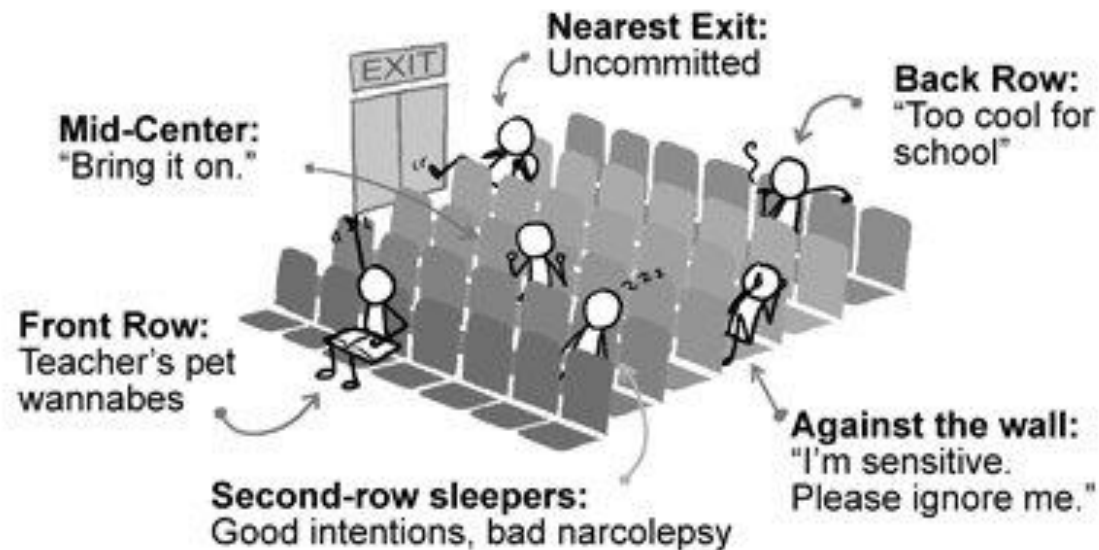


Eye Examination

- Are you sitting too far away?
- You should be able to read this line,
 - and this line,
 - and this line.

WHERE YOU SIT IN CLASS/SEMINAR

And what it says about you:



*How to make money in a ~~bar~~!
casino!?*

Game and Gambling

ECS 315

Asst. Prof. Dr. Prapun Suksompong

prapun@siit.tu.ac.th

Introduction



Office Hours:

BKD 3601-7

Monday 14:00-16:00

Wednesday 14:40-16:00

Probability and Random Processes

ECS 315

Asst. Prof. Dr. Prapun Suksompong

prapun@siit.tu.ac.th

Introduction



Office Hours:

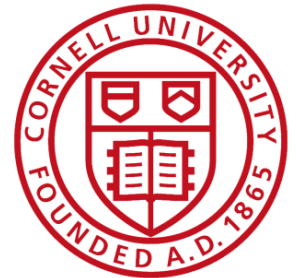
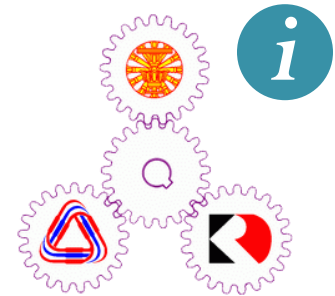
BKD 3601-7

Monday 14:00-16:00

Wednesday 14:40-16:00

Me?

- Ph.D. from **Cornell** University, USA
- In Electrical and Computer Engineering
- Minor: Mathematics (Probability Theory)
- Ph.D. Research: Neuro-Information Theory
- Current Research:
Wireless Communications
- 2009 and 2013 SIIT Best Teaching Awards
- 2011 SIIT Research Award
- 2013 TU Outstanding Young Researcher Award



prapun.com



Getting Info About This Course

- The **syllabus** contains tentative information.
- I will announce **in class** and on the **web site** 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 HWs from earlier years are available on my web site (**prapun.com**).

Course Web Site

prapun.com



Asst. Prof. Dr. Prapun Sukosompong (พ.ศ. ๒๕๒๖) is currently a faculty member at SIIT. He topped the Cornell ECE class of 2002, with the highest GPA among all engineering students. Right after his graduation, he started his teaching career at SIIT. His research interests include wireless communication systems and signal processing. In 2014, he received the 2013 Outstanding Young Researcher Award from SIIT.

Prapun always highly values the teaching aspect of his career and his life. Many of his notable achievements include several Teaching Awards from SIIT.

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

Teaching

- For 1/2014, he teaches
 - ECS315 (Probability and Random Processes)
 - ECS452 (Digital Communication Systems)
- In 2014, Dr. Prapun received the 2013 Best Teaching Award from SIIT.
- Slides for EC Talk: Introducing ECS 452, ECS 455, and tentative senior project topics
- For 2/2013, he taught
 - ECS204 (Basic Electrical Engineering Laboratory) (For non-major students)
 - ET601 (Computer Applications for Engineers) (For PEA students)
- In 2014, he received the 2013 Outstanding Young Researcher Award (รางวัลนักวิจัยดีเด่น)
- For 1/2013, he taught
 - ECS315 (Probability and Random Processes)
 - ECS203 (Basic Electrical Engineering) (For non-major students)
 - ECS452 (Digital Communication Systems)
- For 2/2012, he taught
 - ECS204 (Basic Electrical Engineering Laboratory) (For non-major students)
 - ECS455 (Mobile Communications)
 - SCS139 (Applied Physics II) (Last 5 weeks)
- For 1/2012, he taught
 - ECS315 (Probability and Random Processes)
 - ECS332 (Principles of Communications)
 - 3.2 Wireless Communication Engineering (as a co-lecturer)
- For 2/2011, he taught
 - ECS204 (Basic Electrical Engineering Laboratory) (For non-major students)
 - ECS455 (Mobile Communications)
 - IES302 (Engineering Statistics)
- For 1/2011, he taught
 - ECS315 (Probability and Random Processes)
 - ECS332 (Principles of Communications)
 - 3.2 Wireless Communication Engineering (as a co-lecturer)
 - TU130: A lecture on "Next-Generation Wireless Communication Systems"
- For 2/2010, he taught
 - ECS210 (Basic Electrical Engineering Laboratory)
 - ECS204 (Basic Electrical Engineering Laboratory) (For non-major students)
 - Lab C2 (Digital Communications II) for ECS450 (Signal Processing and Communications)
 - ECS455 (Mobile Communications)
- In 2010, Dr. Prapun received the 2009 Best Teaching Award from SIIT.
- For 1/2010, he taught
 - ECS203 (Basic Electrical Engineering) (For non-major students)
 - ECS315 (Probability and Random Processes)
 - ECS395 (Seminar)
 - 3.2 Wireless Communication Engineering (as a co-lecturer)
- For 2/2009, he taught
 - ECS455 (Mobile Communications)
 - ECS304 (Basic Electrical Engineering Laboratory) (For non-major students)
 - ECS303 (Basic Electrical Engineering) (For non-major students)
 - Lab C2 (Digital Communications II) for ECS450 (Signal Processing and Communications)

Teaching

- For 1/2014, he teaches
 - ECS315 (Probability and Random Processes)
 - ECS452 (Digital Communication Systems)
- In 2014, Dr. Prapun received the 2013 Best Teaching Award from SIIT.
- Slides for EC Talk: Introducing ECS 452, ECS 455, and tentative senior project topics
- For 2/2013, he taught
 - ECS204 (Basic Electrical Engineering Laboratory) (For non-major students)
 - ET601 (Computer Applications for Engineers) (For PEA students)
- In 2014, he received the 2013 Outstanding Young Researcher Award (รางวัลนักวิจัยดีเด่น) from Thammasat University
- For 1/2013, he taught
 - ECS315 (Probability and Random Processes)
 - ECS203 (Basic Electrical Engineering) (For non-major students)
 - ECS452 (Digital Communication Systems)
- For 2/2012, he taught
 - ECS204 (Basic Electrical Engineering Laboratory) (For non-major students)
 - ECS455 (Mobile Communications)
 - SCS139 (Applied Physics II) (Last 5 weeks)
- For 1/2012, he taught
 - ECS315 (Probability and Random Processes)



Course Web Site

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

Please check the course website regularly.

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



EC315: Probability and Random Processes

Everything in this, everything that happens around us, obeys the laws of probability. We can no more escape them than we can escape gravity. "Probability," a philosopher once said, "is the very guide of us - we as all gamblers who go through life making correct bets on the outcome of countless actions."

Some field of science is concerned with counting problems. A physicist calculates the probability path of a particle, a geneticist calculates the chance that a couple will have blue-eyed children, insurance companies, actuaries, sociologists, epidemiologists, political scientists, military experts - all have to be skilled in calculating the probability of the events with which they are concerned.

(Quines, 1988)

Topic:
Probability theory is the branch of mathematics that tells us how to estimate degrees of probability. If an event is certain to happen, it is given a probability of 1, if it is certain not to happen, it has a probability of 0.

This course introduces the principles of probability and random processes to undergraduate students of electrical and computer engineering. The topics to be covered include random events, random variables, discrete and continuous random variables, probability density function, cumulative distribution function, functions of random variables, expectations, law of large numbers, central limit theorem, introduction to random processes, Gaussian random process, autocorrelation and power spectral density.

Announcements:

- A Page 515 feed is created to track and inform updates
- This site can access via prapun.ecs315
- Message us @EC315 if you have any question about this site.

General Information:

- Instructor:** Dr. Prapun Susunkrit (prapun@siit.tu.ac.th)
- Office:** B023311
- Office Hours:** Monday 14:00-16:00, Friday 14:00-16:00
- Course Material:** Posted @ 17:00 on June 21st
- Class Information:**
- Textbook:** [1] R.G. Gallager, D. Stozil, and D.J. Costello, Probability and Stochastic Processes: A Friendly Introduction for EE and CS, Wiley, Hoboken, NJ, 2004.
- Prerequisite:** Discrete-time signals, linear algebra, calculus, probability, random variables, introduction to random processes, Gaussian random process, autocorrelation and power spectral density.

References:

- Other version of the textbook: Probability and stochastic processes: A friendly introduction for electrical and computer engineers. J. Roy, D. Yates, David J. Goodman, Cal No. Q4279 714 1994
- Probability and stochastic processes for electrical engineering. J. Terrence L. Flinn, Cal No. Q4279 871 2004
- Probability and random processes for electrical engineering. Alberto Leon-Garcia, Cal No. N414 454 1994
- Free textbooks:
 - Introduction to Probability by Charles M. Grinstead and Laurie Snell
 - Stochastic Processes by Roger Z. Durrant and William H. Truman, Principles of Communications, 6th International edition, John Wiley & Sons, Ltd, 2010
 - Probability, random variables, and stochastic processes. Athanasios Papoulis, S. Umashankar, Wiley, Cal No. Q4279 83 2002
 - Probability, random variables, and stochastic processes. Athanasios Papoulis, S. Umashankar, Wiley, Cal No. Q4279 71 1999
- A list of books in probability: Sheldon Ross, Cal No. Q4279 869 2002
 - A list of books in stochastic: Sheldon Ross, Cal No. Q4279 868 1978
- Probability models, introduction by Sheldon M. Ross, Cal No. Q4279 844 1978
- Probability models, introduction using calculus and methods. Richard C. Lipton, Cal No. N414 454 1994
- Stochastic processes. Sheldon M. Ross, Cal No. Q4279 869 2002
- Stochastic processes. Sheldon M. Ross, Cal No. Q4279 870 1992
- Probability theory and its applications in communication systems. Bernard Petrot, Cal No. Q4279 817 1996
- Stochastic processes. W. R. Probability and Random Processes, McGraw-Hill, New York, 1975, (Scientific Introduction 1943)
- Notes on an Introduction to Probability Theory and its Applications, vols. 1, 2, John Wiley, New York, 1950. (Definitive work on probability - requires mature mathematical knowledge)
- Introduction to Probability. T. A. Shoop, CRC Press, 2010.

Handouts and Course Material:

- Part I: Classical Probability
- Part II: Introduction to Theory, Classical Probability Theory, Posted @ 17:00 on June 21st
- References: [1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31] [32] [33] [34] [35] [36] [37] [38] [39] [40] [41] [42] [43] [44] [45] [46] [47] [48] [49] [50] [51] [52] [53] [54] [55] [56] [57] [58] [59] [60] [61] [62] [63] [64] [65] [66] [67] [68] [69] [70] [71] [72] [73] [74] [75] [76] [77] [78] [79] [80] [81] [82] [83] [84] [85] [86] [87] [88] [89] [90] [91] [92] [93] [94] [95] [96] [97] [98] [99] [100] [101] [102] [103] [104] [105] [106] [107] [108] [109] [110] [111] [112] [113] [114] [115] [116] [117] [118] [119] [120] [121] [122] [123] [124] [125] [126] [127] [128] [129] [130] [131] [132] [133] [134] [135] [136] [137] [138] [139] [140] [141] [142] [143] [144] [145] [146] [147] [148] [149] [150] [151] [152] [153] [154] [155] [156] [157] [158] [159] [160] [161] [162] [163] [164] [165] [166] [167] [168] [169] [170] [171] [172] [173] [174] [175] [176] [177] [178] [179] [180] [181] [182] 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[847] [848] [849] [850] [851] [852] [853] [854] [855] [856] [857] [858] [859] [860] [861] [862] [863] [864] [865] [866] [867] [868] [869] [870] [871] [872] [873] [874] [875] [876] [877] [878] [879] [880] [881] [882] [883] [884] [885] [886] [887] [888] [889] [890] [891] [892] [893] [894] [895] [896] [897] [898] [899] [900] [901] [902] [903] [904] [905] [906] [907] [908] [909] [910] [911] [912] [913] [914] [915] [916] [917] [918] [919] [920] [921] [922] [923] [924] [925] [926] [927] [928] [929] [930] [931] [932] [933] [934] [935] [936] [937] [938] [939] [940] [941] [942] [943] [944] [945] [946] [947] [948] [949] [950] [951] [952] [953] [954] [955] [956] [957] [958] [959] [960] [961] [962] [963] [964] [965] [966] [967] [968] [969] [970] [971] [972] [973] [974] [975] [976] [977] [978] [979] [980] [981] [982] [983] [984] [985] [986] [987] [988] [989] [990] [991] [992] [993] [994] [995] [996] [997] [998] [999] [1000]

Course Website: Notes & Slides

- **PDF notes** will be posted *before* the corresponding lectures.
 - Hard copies can also be purchased from the **copy center**.
- In lectures...
 - PDF notes will be highlighted and annotated with examples / comments.
 - Some lectures may use slides or MATLAB demo.
 - The slides and annotated notes will be **posted after** the corresponding lectures.
- I also frequently use Microsoft **OneNote** on my convertible tablet instead of the whiteboard. The files will be exported as pdf and posted *after* the corresponding lectures.
- **Remind** me the day after the lecture if the 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:**

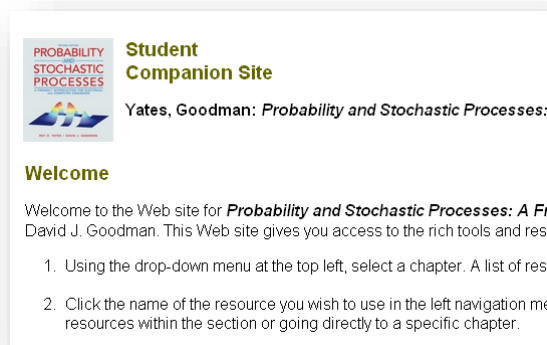
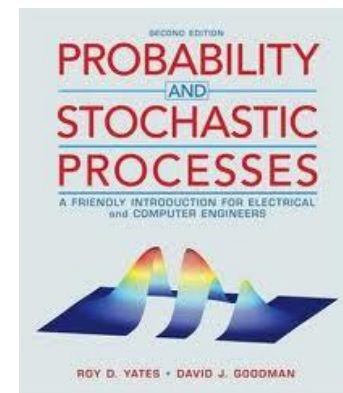
- Tuesday 13:00-14:20 BKD 2601
- Thursday 13:00-14:20 BKD 2601

- Tutorial/make-up sessions: Thursday 14:40-16:00 BKD 2601

- **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. QA273Y384 2005
 - Student Companion Site:

<http://bcs.wiley.com/he-bcs/Books?action=index&itemId=0471272140&bcsId=1991>



Tutorial

- There are many parts of the class which we usually assumed that you know from high school course(s).
 - Combinatorics (factorial, permutation, combination, etc.)
 - Calculus.
- In my experience, many students feel uncomfortable with these topics.
- In the beginning of the semester, the tutorial will be a review of these prerequisite topics.
- Of course, it is also a good time for asking question.
- Later, we start working on HW, old exam questions, and extra practice problems.
- After the midterm, those whose scores are below the median will be required to attend.

Course Outline

1. Introduction, Set Theory, Classical Probability
2. Counting Methods and Combinatorics
3. Probability Foundations
4. Discrete Random Variable
5. Real-Valued Functions of a Random Variable
6. Expectation, Moment, Variance, Standard Deviation
7. Multiple Random Variables
8. **MIDTERM: 7 Oct 2014 TIME 13:30 - 16:30**
9. Function of Multiple Random Variables
10. Continuous Random Variables
11. Mixed Random Variables
12. Conditional Probability: Conditioning by a Random Variable
13. Transform methods
14. Limiting Theorems
15. Random processes, Poisson Processes, Power spectral density
16. **FINAL: 16 Dec 2014 TIME 13:30 - 16:30**



Probability

“Les questions les plus importantes de la vie ne sont en effet, pour la plupart, que des problèmes de probabilité.”

“The **most important questions** of life are, for the most part, really only problems of **probability**.”

THÉORIE
ANALYTIQUE
DES PROBABILITES;
PAR M. LE COMTE LAPLACE,

Chancelier du Sénat Conservateur, Grand-Officier de la Légion d'Honneur;
Membre de l'Institut impérial et du Bureau des Longitudes de France;
des Sociétés royales de Londres et de Göttingue; des Académies des
Sciences de Russie, de Danemarck, de Suède, de Prusse, de Hollande,
d'Italie, etc.

PARIS,
M^{me} V^o COURCIER, Imprimeur-Libraire pour les Mathématiques,
quai des Augustins, n^o 57.
1812.

Pierre Simon Laplace (1749 - 1827)

“On voit, par cet Essai, que la théorie des probabilités n'est, au fond, que le bon sens réduit au calcul; elle fait apprécier avec exactitude ce que les esprits justes sentent par une sorte d'instinct, sans qu'ils puissent souvent s'en rendre compte.”

“One sees, from this Essay, that **the theory of probabilities** is basically just **common sense** reduced to **calculus**; it enables us to appreciate with exactness that which accurate minds feel with a sort of instinct, often without being able to account for it.”

THÉORIE

ANALYTIQUE

DES PROBABILITES;

PAR M. LE COMTE LAPLACE,

Chancelier du Sénat Conservateur, Grand-Officier de la Légion d'Honneur;
Membre de l'Institut impérial et du Bureau des Longitudes de France;
des Sociétés royales de Londres et de Göttingue; des Académies des
Sciences de Russie, de Danemarck, de Suède, de Prusse, de Hollande,
d'Italie, etc.

Pierre Simon Laplace (1749 - 1827)

PARIS,

M^{me} V^o COURCIER, Imprimeur-Libraire pour les Mathématiques,
quai des Augustins, n^o 57.

1812.

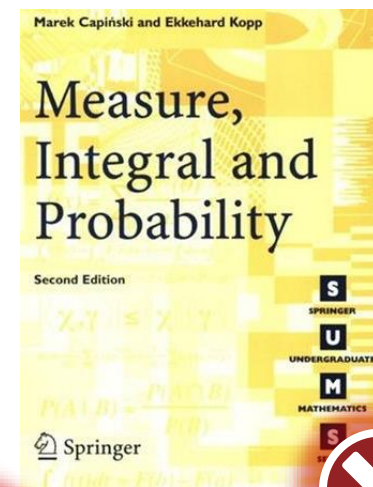
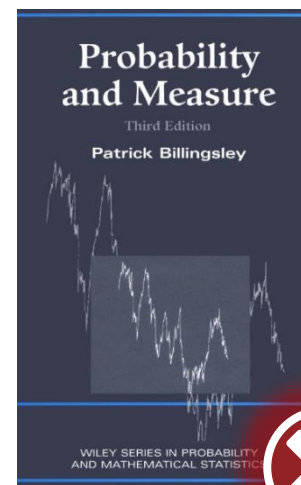
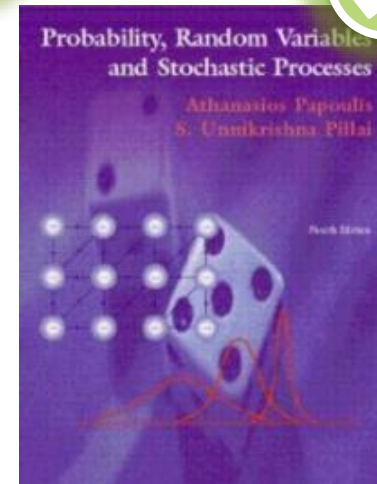
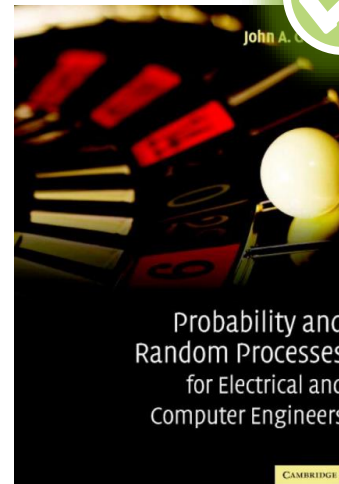
Levels of Study in Probability Theory

- **Probability theory** is the branch of mathematics devoted to analyzing problems of chance.
 - Art of Guessing
- 1. High School: classical
- 2. Undergraduate: calculus ←———— We are here!
- 3. Graduate: measure-theoretic



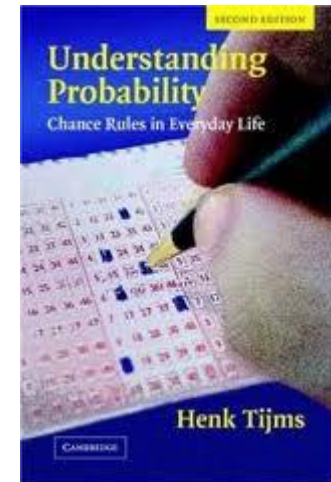
More references

- 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.



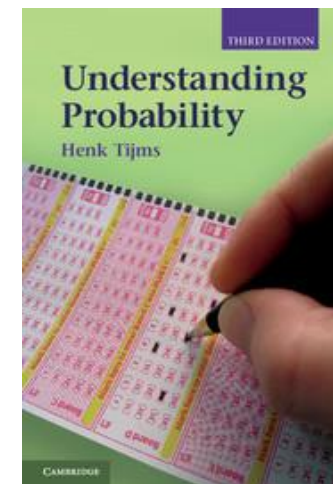
Recommended Reading

- 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>



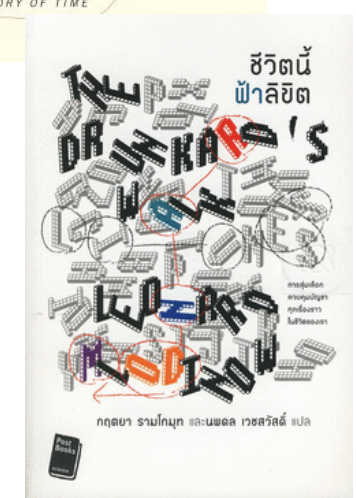
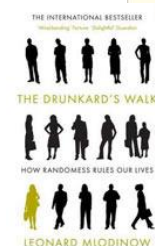
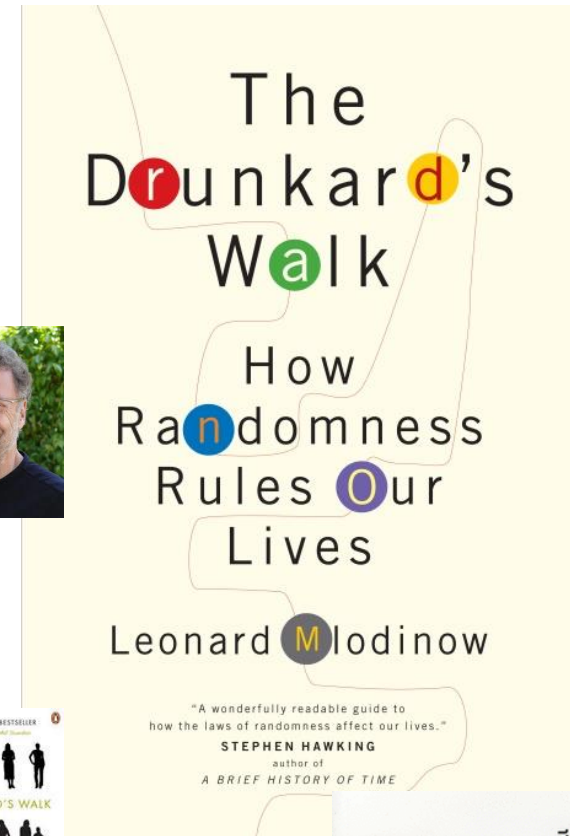
2nd Edition (2007)

3rd Edition (2012)



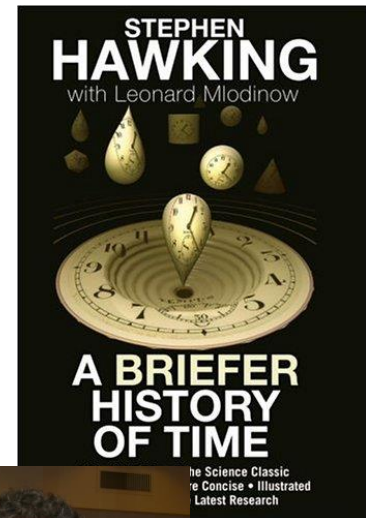
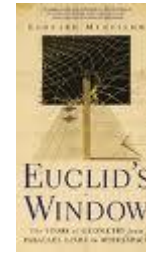
The Drunkard's Walk

- The Drunkard's Walk: How Randomness Rules Our Lives
- By Leonard Mlodinow
- Deals with randomness and people's inability to take it into account in their daily lives.
- A bestseller, and a “NY Times notable book of the year”
- Named “one of the 10 best science books of 2008” on Amazon.com.



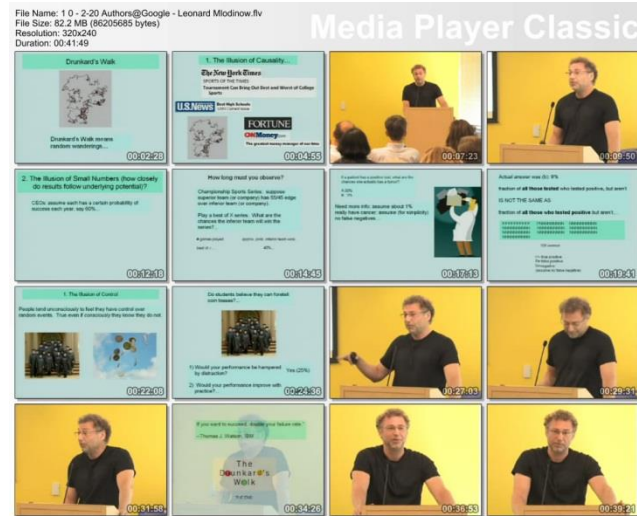
Leonard Mlodinow

- Euclid's Window: the Story of Geometry from Parallel Lines to Hyperspace
- Feynman's Rainbow: a Search for Beauty in Physics and in Life
- A Briefer History of Time
 - with Stephen Hawking
 - an international best-seller that has appeared in 25 languages.
- The Drunkard's Walk: How Randomness Rules our Lives
- Apart from books on popular science, he also has been a **screenwriter** for television series, including **Star Trek: The Next Generation** and **MacGyver**.

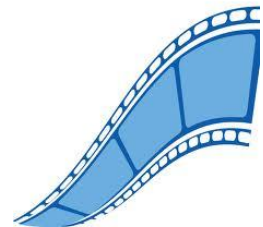


Watch Mlodinow's talk

- Delivered to Google employees
- About his book ("The Drunkard's Walk")



<http://www.youtube.com/watch?v=F0sLuRsu1Do>

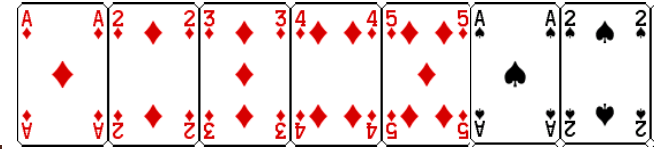


Examples

Prelude to the Theory of Probability

Game 1:

Seven Card Hustle

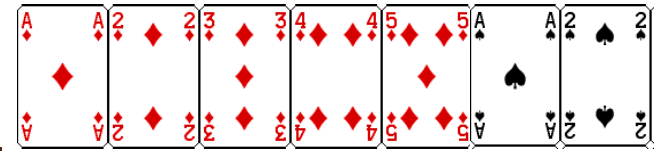


The Seven Card Hustle

- Take five **red** cards and two **black** cards from a pack.
- Ask your friend to shuffle them and then, without looking at the faces, lay them out in a row.



- Bet that they can't turn over three red cards.
- Explain how the bet is in their favor.
 - The first draw is 5 to 2 (five red cards and two black cards) in their favor.
 - The second draw is 4 to 2 (or 2 to 1 if you like) because there will be four red cards and two black cards left.
 - The last draw is still in their favor by 3 to 2 (three reds and two blacks).
- The game seems heavily in their favor, but **YOU**, are willing to offer them **even money** that they can't do it!



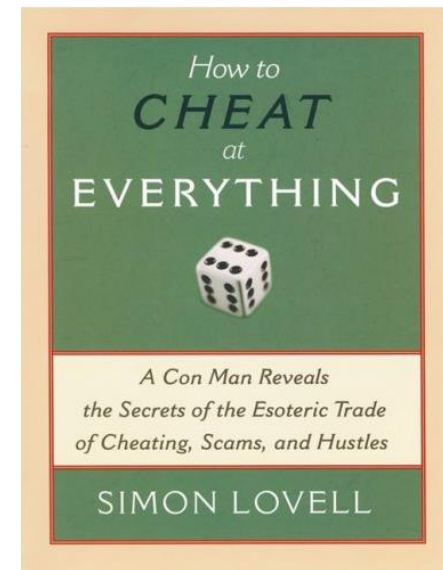
The Seven Card Hustle

- Take five red cards and two black cards from a pack.
- Ask your friend to shuffle them and then, without looking at the faces, lay them out in a row.



- Bet that they can't turn over three red cards.
- Explain how the bet is in their favor.
- The game seems heavily in their favor, but **YOU**, are willing to offer them **even money** that they can't do it!

Even odds or even money means 1-to-1 odds.



[Lovell, 2006]

The Seven Card Hustle: Sol

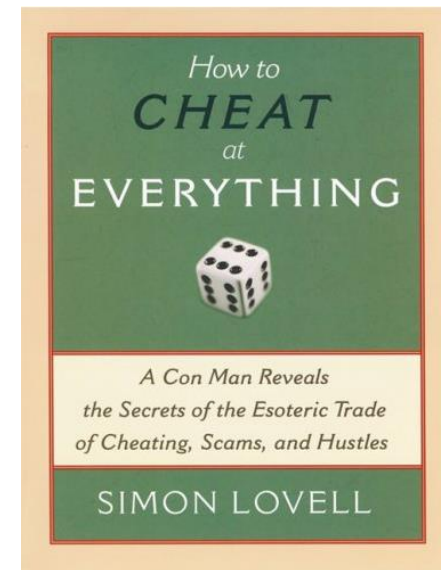
The correct probability that they can do it is

$$\frac{\cancel{5} \times 4 \times \cancel{3}}{7 \times \cancel{6} \times \cancel{5}} = \frac{2}{7}$$

Do not worry too much about the math here. Some of you may be able to calculate the probability using knowledge from your high school years. We will review all of this later.

Alternatively,

$$\frac{\binom{5}{3}}{\binom{7}{3}} = \frac{5!}{\cancel{3!}2!} \times \frac{\cancel{3!}4!}{7!}$$
$$= 5 \times 4 \times 3 \times \frac{1}{7 \times 6 \times 5}$$
$$= \frac{2}{7}$$



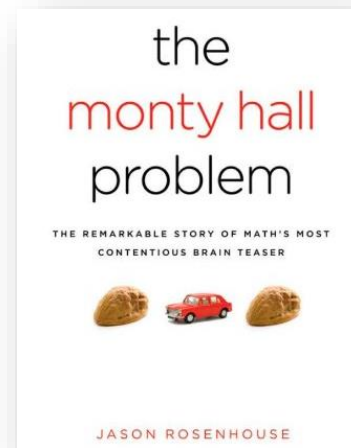
[Lovell, 2006]

Game 2:

Monty Hall Problem

Monty Hall Problem (MHP): Origin

- Problem, paradox, illusion
- Loosely based on the American television game show *Let's Make a Deal*. (Thai CH7 version: ประตูดวง.)
- The name comes from the show's original host, **Monty Hall**.
- One of the most interesting mathematical brain teasers of recent times.



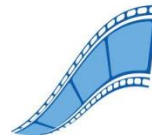


Monty Hall Problem: Math Version

- Originally posed in a letter by Steve Selvin to the American Statistician in 1975.
- A well-known statement of the problem was published in **Marilyn vos Savant's** "*Ask Marilyn*" column in *Parade* magazine in 1990:

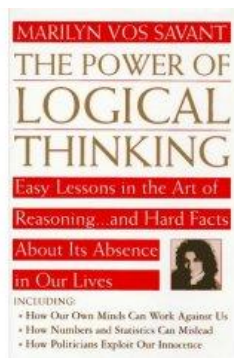


“Suppose you're on a game show, and you're given the choice of three doors: Behind one door is a car; behind the others, goats. You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 3, which has a goat. He then says to you, "Do you want to pick door No. 2?" Is it to your advantage to switch your choice?”



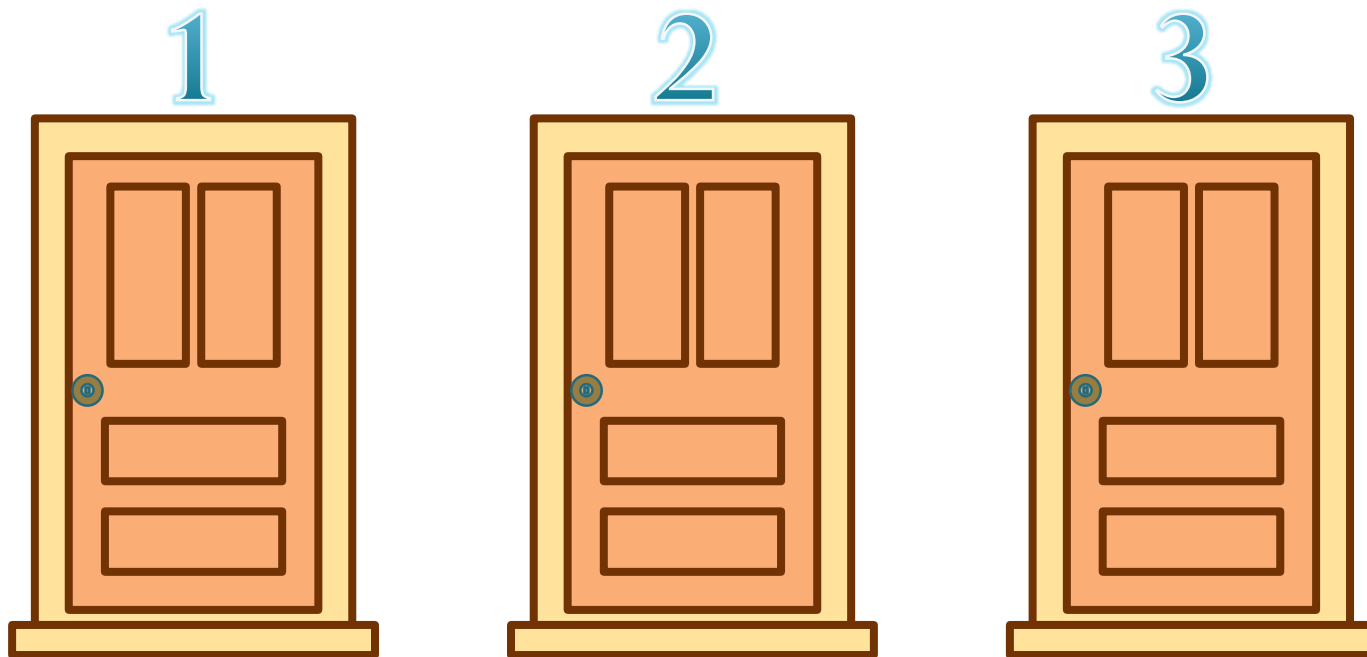
Marilyn vos Savant

- Vos Savant was listed in each edition of the **Guinness Book** of World Records from 1986 to 1989 as having the “**Highest IQ.**”
- Since 1986 she has written “Ask Marilyn”
 - Sunday column in Parade magazine
 - Solve puzzles and answer questions from readers



MHP: Step 0

- There are three closed doors.
- They look identical.



MHP: Step 0

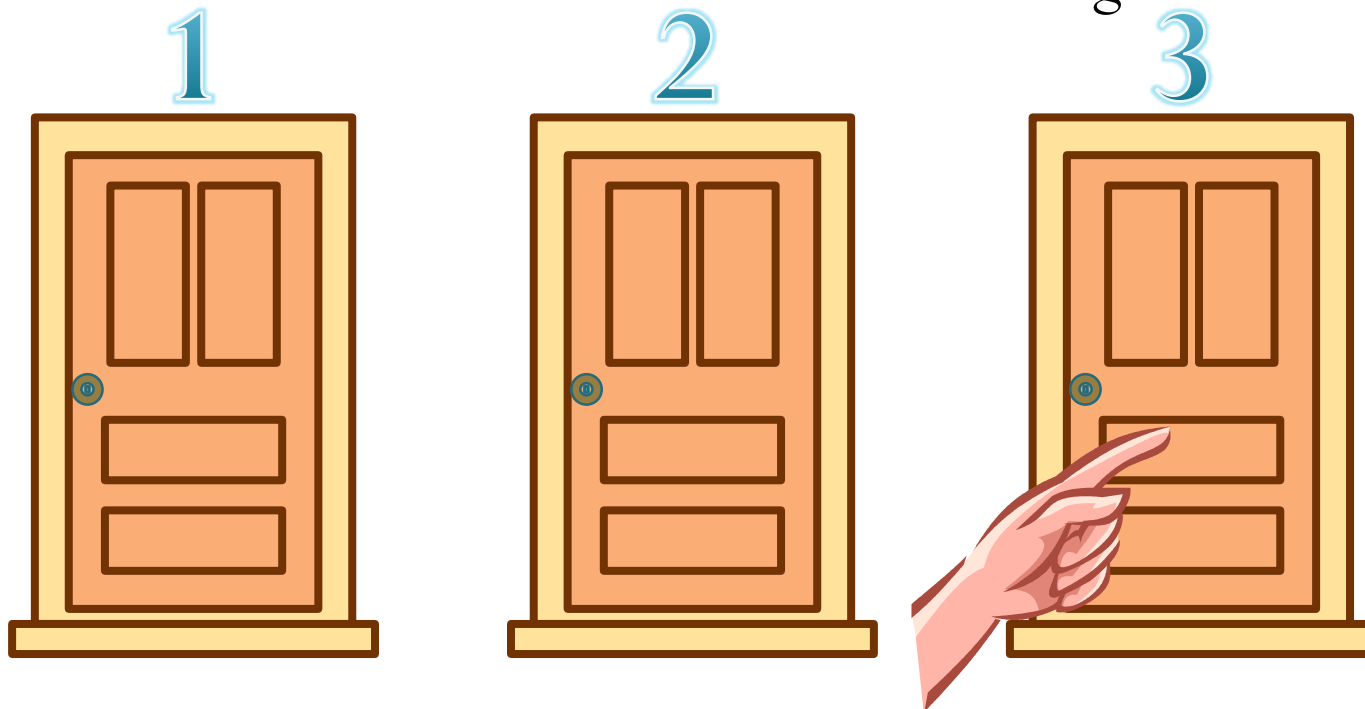
- Behind one of the doors is the star prize - a car.
 - The car is initially equally likely to be behind each door.
- Behind each of the other two doors is just a goat.



MHP: Step 1

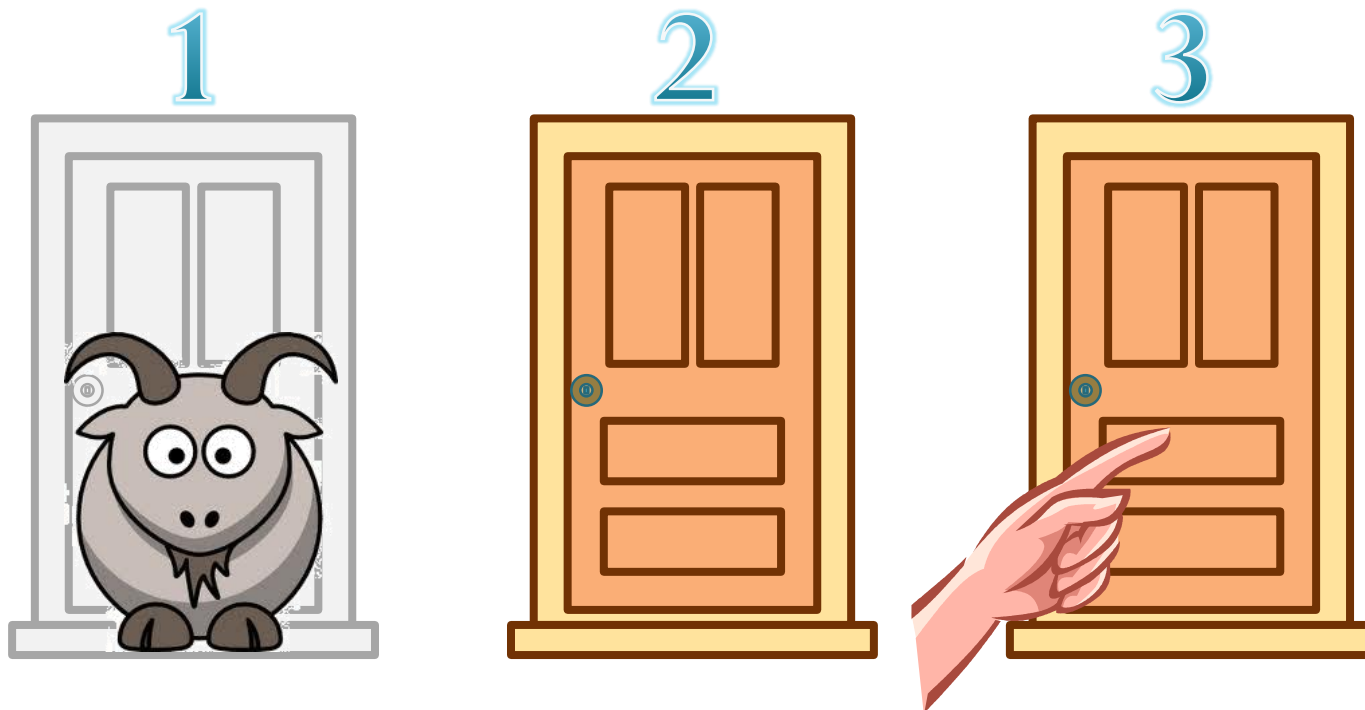
- Obviously we want to win the car, but do not know which door conceals the car.
- We are asked to choose a door.
- That door remains closed for the time being.

“Pick one of these doors”



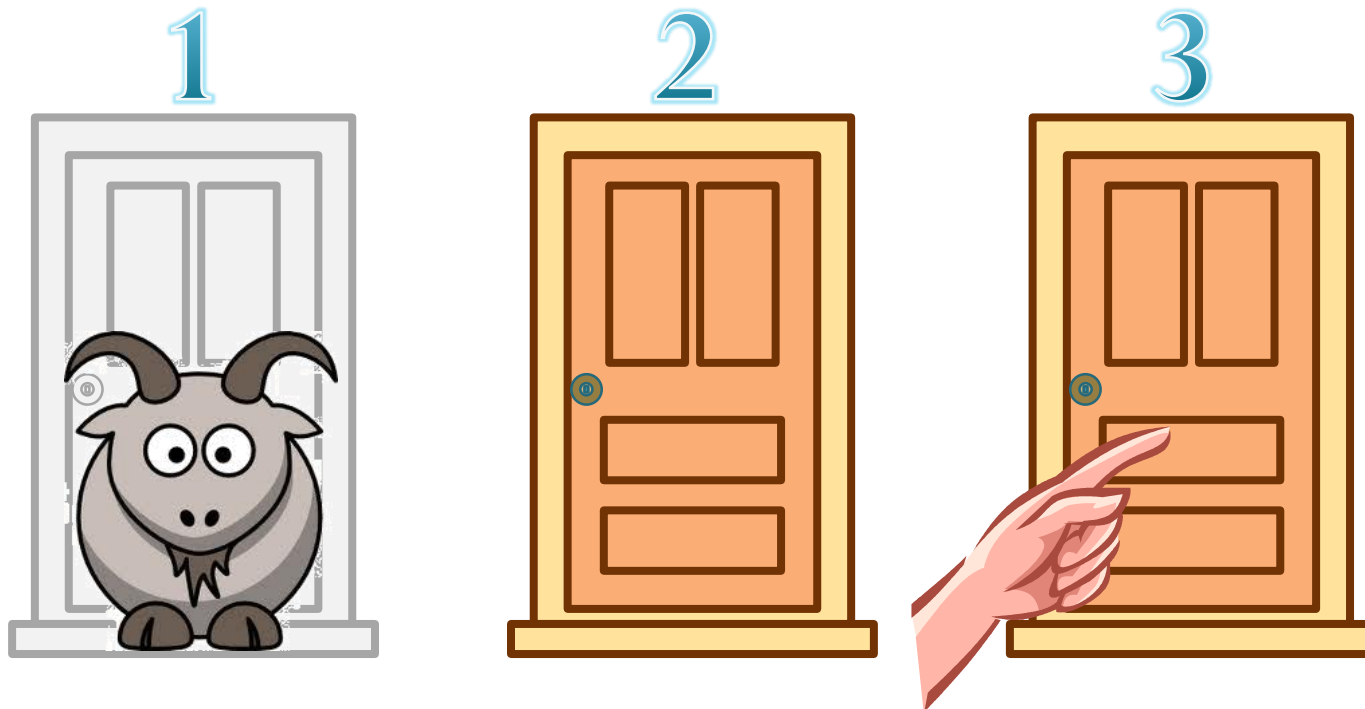
MHP: Step 2

- The host of the show (Monty Hall), who knows what is behind the doors, now opens a door different from our initial choice.
 - He carefully picks the door that conceals a goat.
 - We stipulate that if Monty has a choice of doors to open, then he chooses randomly from among his options.



MHP: Step 3

- Monty now gives us the options of either
 1. sticking with our original choice or
 2. switching to the one other unopened door.
- After making our decision, we win whatever is behind our door.



Monty Hall Problem

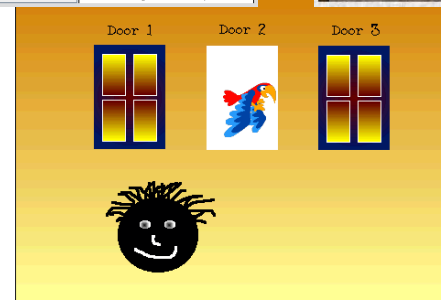
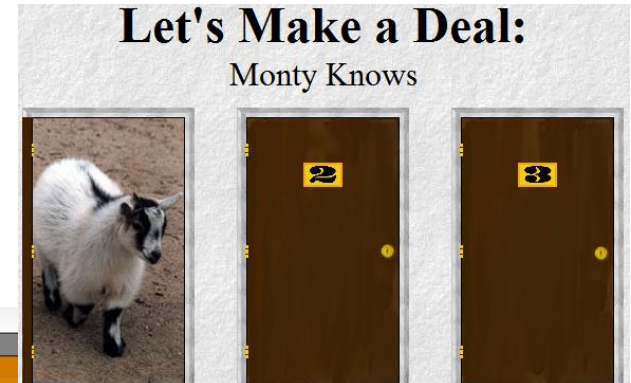
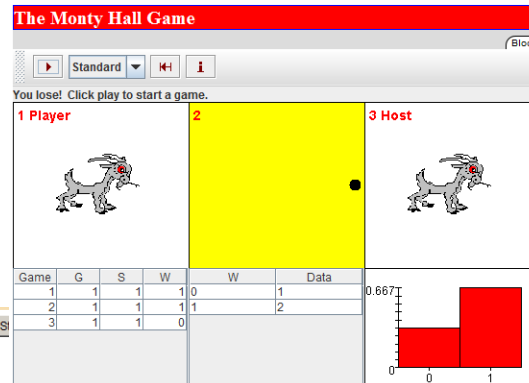
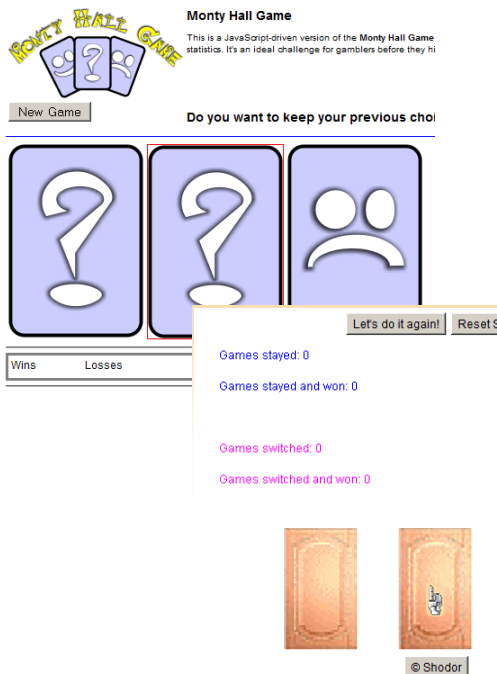
Assuming that our goal is to **maximize** our **chances** of **win**ning the car, what decision should we make?

- Will you do better by **stick**ing with your first choice, or by **switch**ing to the other remaining door?
- Make no difference?

Let's **play!**

Interactive Monty Hall

- <http://montyhallgame.shawnolson.net/>
- <http://www.shodor.org/interactivate/activities/SimpleMontyHall/>
- <http://www.math.uah.edu/stat/applets/MontyHallGame.xhtml>
- <http://scratch.mit.edu/projects/nadja/484178>
- <http://www.math.ucsd.edu/~crypto/Monty/monty.html>



Interactive Monty Hall

The New York Times's Version



You win! You get the fancy car (or at least a picture of one).

Try Again

See How It Works

Current Score

| | Switched | Stayed |
|----------|----------|--------|
| Attempts | 1 | 1 |
| Goats | 0 | 0 |
| Cars | 1 | 1 |
| % Won | 100% | 100% |

Clear Score

<http://www.nytimes.com/2008/04/08/science/08monty.html>

Back to the boring
administrative stuff!

Calendar

Lecture



Exam



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

Please Double-Check Exam Dates!

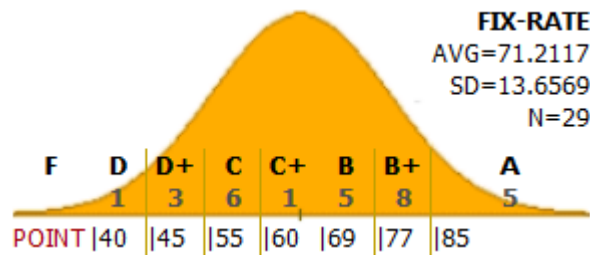
Grading System

- Coursework will be weighted as follows:

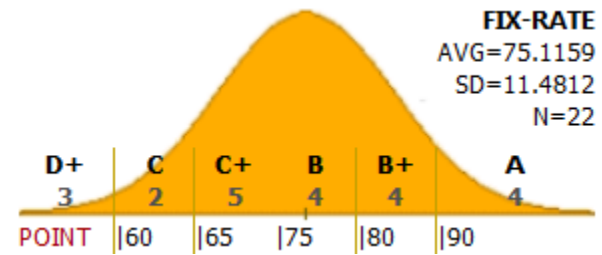
| | |
|--|-----|
| Assignments | 5% |
| Class Participation and Quizzes | 15% |
| Midterm Examination •7 Oct 2014 TIME 13:30 - 16:30 | 40% |
| Final Examination (comprehensive) •16 Dec 2014 TIME 13:30 - 16:30 | 40% |

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

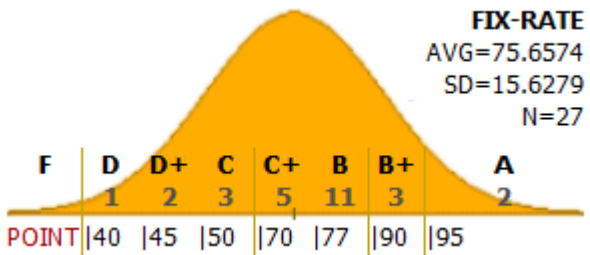
Grading System



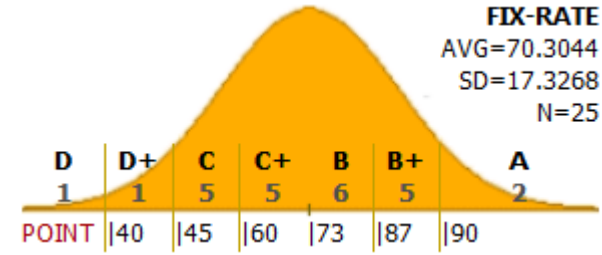
2013: CLASS GPA: 2.86



2012: CLASS GPA: 2.86



2011: CLASS GPA: 2.74



2010: CLASS GPA: 2.74

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

Which clock?

- 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. 
- We may have some **pop quizzes** (without prior warning or announcement) and in-class activities.
- Attendance and pop quizzes will be taken/given irregularly and randomly.
- Cheating will not be tolerated.

Policy (con't)

- Feel free to stop me when I talk too fast or too slow.
- I will surely make some **mistakes** in lectures / HWs / exams.
 - Some amount of class participation scores will be reserved to reward the **first** student who inform me about each of these mistakes.
 - Grammatical errors are best informed/corrected after class.
- Points on quizzes/ exercises/ exams are generally based on your entire solution, not your final answer.
 - You can 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.

Policy (con't)

- Please stop me if I go over the time limit.
- Please stop me if I talk too fast.
- Please stop me if you have any question.



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 (BKD-3601)
 - Time: Monday 14:00-16:00, Wednesday 14:40-16:00
 - Appointment can be made.
 - Tutorial session can be arranged.
 - Feel free to come to my office and chat!
 - Don't be shy.

Warning

- This class is **difficult**.
 - Keep up with the lectures.
 - Make sure that you understand the concepts presented in the lecture before you go home.
- I will **evaluate** your understanding of the course **regularly** through
 - In class problems/ activities
 - Quizzes
 - Exams



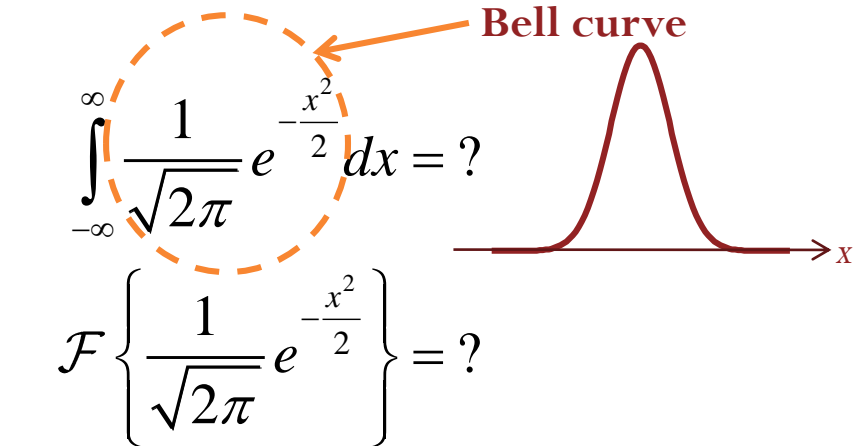
Difficulty in ECS315

- 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

Prerequisite

- Working knowledge of calculus
- Some MATLAB skills for doing HWs and understanding in-class demo
- Frequency domain analysis (Fourier transform)

Soon, we will need to find

$$\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} dx = ?$$
$$\mathcal{F} \left\{ \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} \right\} = ?$$


Bell curve

Tips

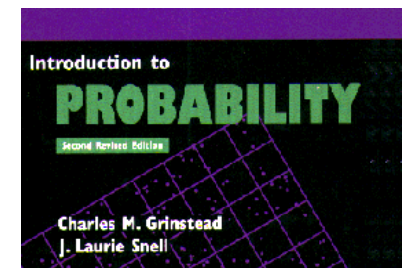
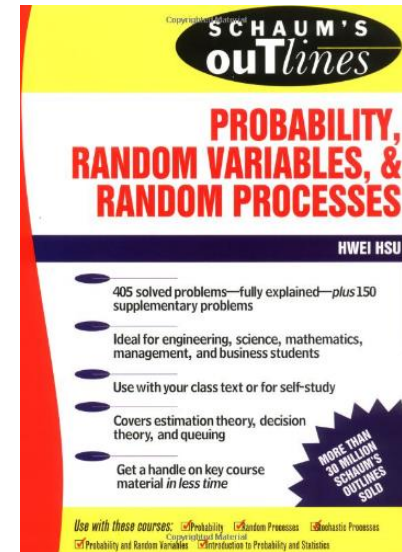
- Almost everything including what I have written on my convertible tablet will be saved and posted on web soon after class.
- No need to take detailed lecture notes (if you don't want to).
 - Put all of your energy into understanding the material.
 - Of course, there is always someone (in the class) who will take good notes anyway and you can (potentially) borrow or make a copy of the notes from them.
- Have fun with the materials presented in class.

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.

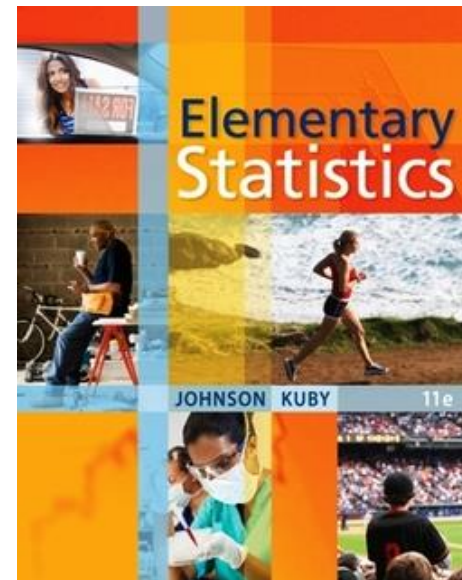
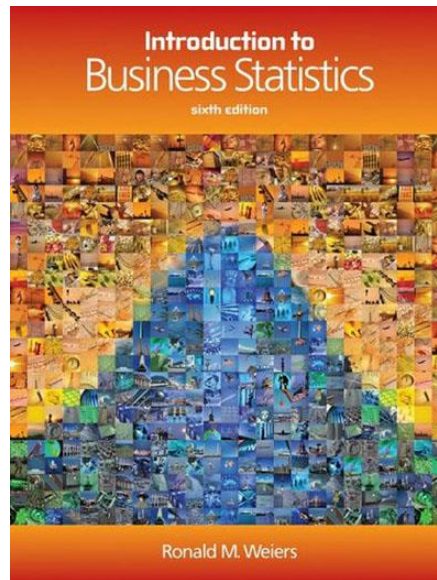
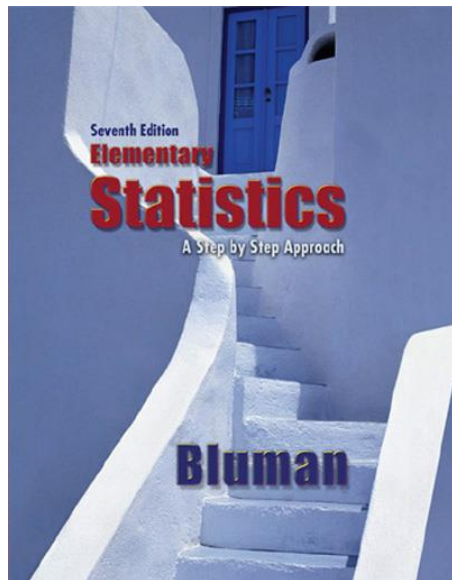
Need More Examples or Practice?

- 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.

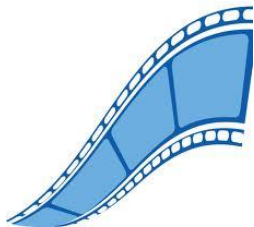
Monty Hall Problem: a short revisit

Assuming that our goal is to **maximize** our **chances** of **win**ning the car, what decision should we make?

- Will you do better by **stick**ing with your first choice, or by **switch**ing to the other remaining door?
- Make no difference?

Monty Hall Problem: vos Savant's Answer

“You **double** your chances of **winning** by **switching** doors.”



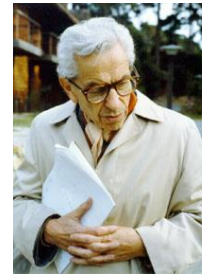
Monty Hall Problem: Controversy

- Approximately **10,000 readers**,
 - including nearly **1,000 with PhDs**
 - (many of them **math professors**),
 - wrote to the magazine
 - **claiming** the published solution was **wrong**.
- “You blew it,” wrote a mathematician from George Mason University.
- From Dickinson State University came this: “I am in shock that after being corrected by at least three mathematicians, you still do not see your mistake.”

[Mlodinow, 2008, p 42-45]

Controversy (2)

- From Georgetown: "How many irate mathematicians are needed to change your mind?"
- And someone from the U.S. Army Research Institute remarked, "If all those Ph.D.s are wrong the country would be in serious trouble."
- When told of this, Paul **Erdős**, one of the leading mathematicians of the 20th century, said, "That's **impossible**."
 - Then, when presented with a formal mathematical proof of the correct answer, he still didn't believe it and grew angry.
 - Only after a colleague arranged for a **computer simulation** in which Erdős watched hundreds of trials that came out 2-to-1 in favor of switching did Erdős concede that he was wrong.



Let's learn some concepts
so that we can analyze
interesting examples!