

# Midterm Exams

- Check the course website regularly for breaking news about the midterm.
- To save time, read the cover page to be posted on the course website before going into the exam room.
- Closed book. Closed notes.
- One A4 page allowed.

ECS 332: Principles of Communications

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Synopsis

This course introduces the fundamental elements of analog and digital communication systems. The focus will be on the mathematical analysis of the signals and basic building blocks of communication systems. Performance of digital communication systems in the presence of noise will be discussed towards the end. The skills and knowledge gained from this class are essential for other advanced communication courses such as, data communications, computer network, digital communication systems, and mobile communication.

Announcements

- **Information regarding the midterm exam** [Posted @ 4PM on Sep 26]
  - Check this course website regularly for breaking news about the midterm.
  - Date: October 4, 2017 (Wednesday)
  - TIME: 12:00-14:00
  - ROOMS: BKD BKD 3506, 3507, 3510
  - Information about the midterm exam:
    - 6 pages (including the cover page)
      - To save time, read the cover page (to be posted) here before going into the exam room.
    - $11+1 = 12$  questions.  $(6+4+5+4+8+4+7+6+6+10+6+1 = 67$  pt)
    - Cover all the materials that we discussed in class and practice in the HWs.
      - Material Distribution (score-wise): 26 (CH2) + 24(CH3+SEC4.1) + 16 (SEC4.2)

ECS315: Probability and Random Processes

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Everything we do, everything that happens around us, obeys the laws of probability. We can no more escape them than we can escape gravity... "Probability," a philosopher (Bishop Butler) once said, "is the very guide of life." We are all gamblers who go through life making countless bets on the outcome of countless actions.

Every field of science is concerned with estimating probability. A physicist calculates the probable path of a particle. A geneticist calculates the chances that a couple will have blue-eyed children. Insurance companies, businessmen, stockbrokers, sociologists, politicians, military experts - all have to be skilled in calculating the probability of the events with which they are concerned.

[Gardner, 1986]

Synopsis

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 in electronics and communication. The topics to be covered include random experiments, events, probability, 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

- **Information regarding the midterm exam** [Posted @ 4PM on Sep 26]
  - Check this course website regularly for breaking news about the midterm.
  - Date: October 5, 2017 (Thursday)

# Grading System

- Coursework will be weighted as follows:

Assignments	5%
In-Class Exercises	5%
Class Discussion/Participation	10%
Midterm Examination	35%
Final Examination (comprehensive)	45%

- Late HW submission will be rejected.

# Midterm Exams

- ECS 332
  - Date: October 4, 2017 (Wednesday)
  - TIME: 12:00-14:00
  - ROOMs: BKD 3506, 3507, 3510
- ECS 315
  - Date: October 5, 2017 (Thursday)
  - TIME: 15:00-17:00
  - ROOMs: BKD 2506, 2501-2

# Cover page

- To be posted
- To save time, read it before going into the exam room.

Name \_\_\_\_\_ ID \_\_\_\_\_ Section \_\_\_\_\_ Seat No \_\_\_\_\_



**Sirindhorn International Institute of Technology**  
**Thammasat University**

Midterm Examination: Semester 1 / 2017

Course Title: ECS332 (Principles of Communications)

Instructor: Asst. Prof. Dr.Prapun Suksompong

Date/Time: October 4, 2017 / 12:00 - 14:00

## Instructions:

- This examination has 6 pages (including this cover page).
- Conditions of Examination:
  - ..... Closed book  
(No dictionary.  No calculator  Calculator (e.g. FX-991) allowed)
  - ..... Open book
  - .....  **Semi-Closed book** (..... sheet(s)  1 page  both sides of A4 paper note)
    - This sheet must be hand-written.
    - Do not modify (e.g., add underline/highlight) content on the sheet inside the exam room.
    - It should be submitted with the exam.
    - Other requirements are specified on the course web site. (-10 pt if not following the requirements.)
- **Read these instructions and the questions carefully.**
- Students are not allowed to be out of the examination room during examination.
- Going to the restroom may result in score deduction.
- Turn off all communication devices and place them with other personal belongings in the area designated by the proctors or outside the test room.
- Write your name, student ID, section, and seat number clearly in the spaces provided on the top of this sheet. Then, write your **first name and the last three digits of your ID** in the spaces provided on the top of each page of your examination paper, starting from page 2.
- The back of each page will not be graded; it can be used for calculations of problems that do not require explanation.
- The examination paper is not allowed to be taken out of the examination room. Also, do not remove the staple. Violation may result in score deduction.
- Unless instructed otherwise, write down all the steps that you have done to obtain your answers.
  - When applying formula(s), state clearly which formula(s) you are applying before plugging-in numerical values.
  - You may not get any credit even when your final answer is correct without showing how you get your answer.
  - Formula(s) not discussed in class can be used. However, derivation must also be provided.
  - **Exceptions:**
    - Problems that are labeled with "ENRPr" (Explanation is not required for this problem.)
    - Parts that are labeled with "ENRPa" (Explanation is not required for this part.)
    - These problems/parts are graded solely on your answers. There is no partial credit and it is not necessary to write down your explanation. Usually, spaces (boxes or cells in a table or rows of dashes) will be provided for your answers. "WACSP" stands for "write your answer(s) in the corresponding space(s) provided".
- When not explicitly stated/defined, all notations and definitions follow ones given in lecture.  
For example, the sine function is defined by  $\sin(x) = (\sin x)/x$ ; time is denoted by  $t$  and frequency is denoted by  $f$ . The unit of  $t$  is in seconds and the unit of  $f$  is in Hz.
- Some points are reserved for *accuracy* of the answers and also for reducing answers into their *simplest* forms. Watch out for roundoff error.
- Points marked with \* indicate challenging problems.
- Do not cheat. Do not panic. **Allocate your time wisely.**
- Don't forget to submit your list online self-evaluation form by the end of today.

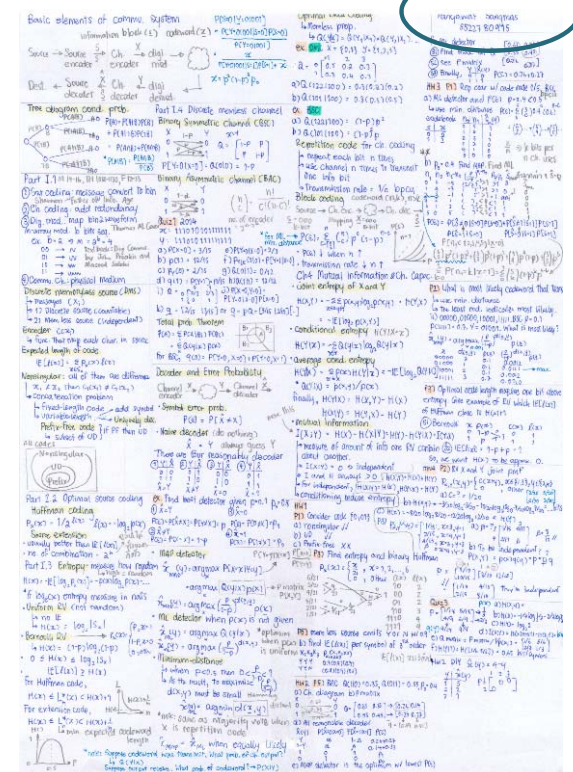
# Some Instructions from the cover page

- Unless instructed otherwise, write down all the steps that you have done to obtain your answers.
- When applying formula(s), state clearly which formula(s) you are applying before plugging-in numerical values.
  - You may not get any credit even when your final answer is correct without showing how you get your answer.
  - Formula(s) not discussed in class can be used. However, derivation must also be provided.
  - **Exceptions:**
    - Problems that are labeled with “**ENRPr**” (Explanation is not required for this problem.)
    - Parts that are labeled with “**ENRPa**” (Explanation is not required for this part.)
    - These problems/parts are graded solely on your answers. There is no partial credit and it is not necessary to write down your explanation. Usually, spaces (boxes or cells in a table or rows of dashes) will be provided for your answers. “**WACSP**” stands for “write your answer in the corresponding space provided”.
- Watch out for roundoff error.  
In general, the error in your final answer should not exceed 0.1%.

This information is posted on the course website.

# Midterm Exam: One A4 page

- Must be hand-written in your own handwriting.
- No small pieces of paper notes glued/attached on top of it.
- Indicate your name and ID on the upper right corner of the sheet (in portrait orientation).
- Do not modify (,e.g., add/underline/highlight) content on the sheet inside the exam room.
- Make sure that another side is blank. This will be used for the final exam.
- Submit your A4 sheet with your exam. (You will get it back before the final exam.)
- Q: I don't need any formulas. What should I do?  
A: Bring in and submit a blank sheet of paper with your name and ID. Note that you can still only use one side on the final exam.
- Violating the above instructions will cost you 10 pt.



# ECS 332 Midterm Exam: Tentative Info

- 6 pages (including the cover page)
- $11+1 = 12$  questions.  
( $6+4+5+4+8+4+7+6+6+10+6+1 = 67$  pt)
- Cover all the materials that we discussed in class and practice in the HWs.
- Material Distribution (score-wise):  
 $26$  (CH2) +  $24$ (CH3+SEC4.1) +  $16$  (SEC4.2)

# ECS 315 Midterm Exam: Tentative Info

- 7 pages (including the cover page)
- 10+1 = 11 questions.  
(10+5+4+10+8+8+8+9+3+1+1 = 67 pt)
- Cover all the materials that we discussed in class and practice in the HWs.
- Material Distribution (score-wise):  
10 (CH1-2) + 27 (CH3-4) + 10 (CH5) + 19 (CH6)



# Preparation

- In-class exercises
- 2016 Exam
- HW
  - Don't forget that we have one free HW whose content is still useful for the exam.
- Lecture notes

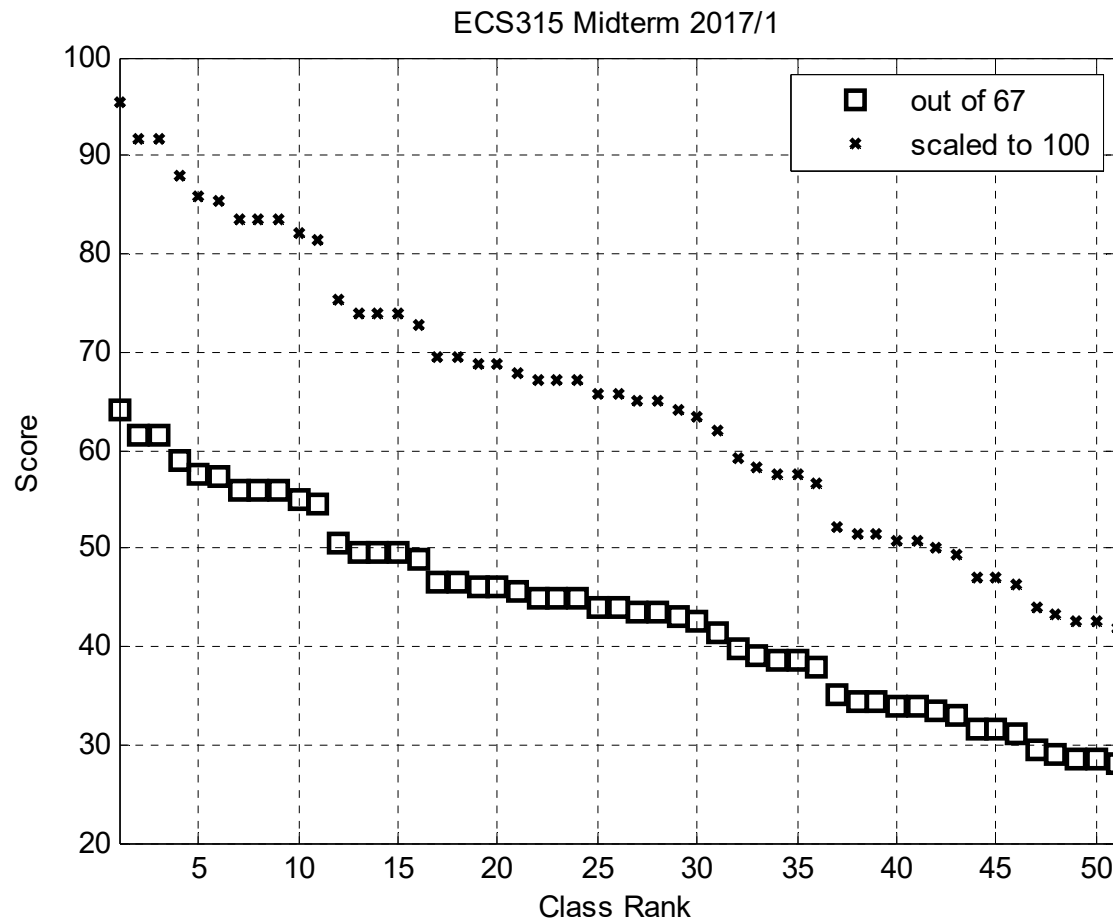
# ECS315/332 Grading System

- Coursework will be weighted as follows:

Assignments	5%
In-Class Exercises	5%
Class Discussion/Participation	10%
Midterm Examination	35%
Final Examination (comprehensive)	45%

- Late HW submission will be rejected.

# ECS315 Midterm 2017/1



Average	65.1 / 100
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Standard Deviation	14.8 / 100
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# Reading the cover page



**Sirindhorn International Institute of Technology**  
**Thammasat University**

**Midterm Examination: Semester 1 / 2017**

Course Title: ECS315 (Probability and Random Processes)

Instructor: Asst. Prof. Dr.Prapun Suksompong

Date/Time: October 5, 2017 / 15:00 - 17:00

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Name	You-know-who
ID	
<b>Score (out of 67)</b>	<b>64.0</b>
Score (out of 100)	95.5
Class Rank	1
Z-Score	2.1
Average (out of 100)	65.1
Standard Deviation (out of 100)	14.8

# Reading the graded exam

- Based on subtraction out of the full score (67).
- See the red circled numbers for the subtracted scores on each page.
- The blue circled number is the total subtracted score on that page.

(7)

ECS 315 EXAM 1 - Name ID 2017/1

**Problem 8.** ( $2 \times 4 + 1^* = 9$  pt) [Digital Communication] A certain binary-symmetric channel has a crossover probability (bit-error rate) of 0.4. Assume bit errors occur independently. Your answers for parts (a) and (b) should be of the form X.XXXX.

(a) Suppose we input bit sequence "1010101" into this channel.

(i) What is the probability that the output is "1000001"?

$(1-p)(1-p)(p)(1+p)(p)(1-p)$  ;  $p^4(1-p)^4$  ~~x~~ = ? **(-1)** **(-0.5)**

(ii) What is the probability that exactly 4 bits are in error at the channel output?

$\binom{7}{4} p^4(1-p)^3$  = ? **(-0.5)**

(iii) What is the probability that there is at least one bit error at the channel output?

$1 - (1-p)^7$  ~~x~~ **(-2)**

(b) Suppose we keep inputting bits into this channel. What is the probability that the first bit error at the output occurs on the fourth bit?

**(-2)**

(c) Suppose the input bits are generated by flipping a fair coin 7 times. Heads and tails are represented by 1 and 0, respectively. Let  $A$  be the event that the output of the channel is "1000001". Let  $B_1$  be the event that the input of the channel is "1100011". Let  $B_2$  be the event that the input of the channel is "1011101". Compare  $P(B_1|A)$  and  $P(B_2|A)$ . (Which one is larger? Explain.)

$\frac{P(B_1 \cap A)}{P(A)} = \frac{2}{7}$  ;  $\frac{P(B_2 \cap A)}{P(A)} = \frac{2}{7}$  **(-1)**

1-6

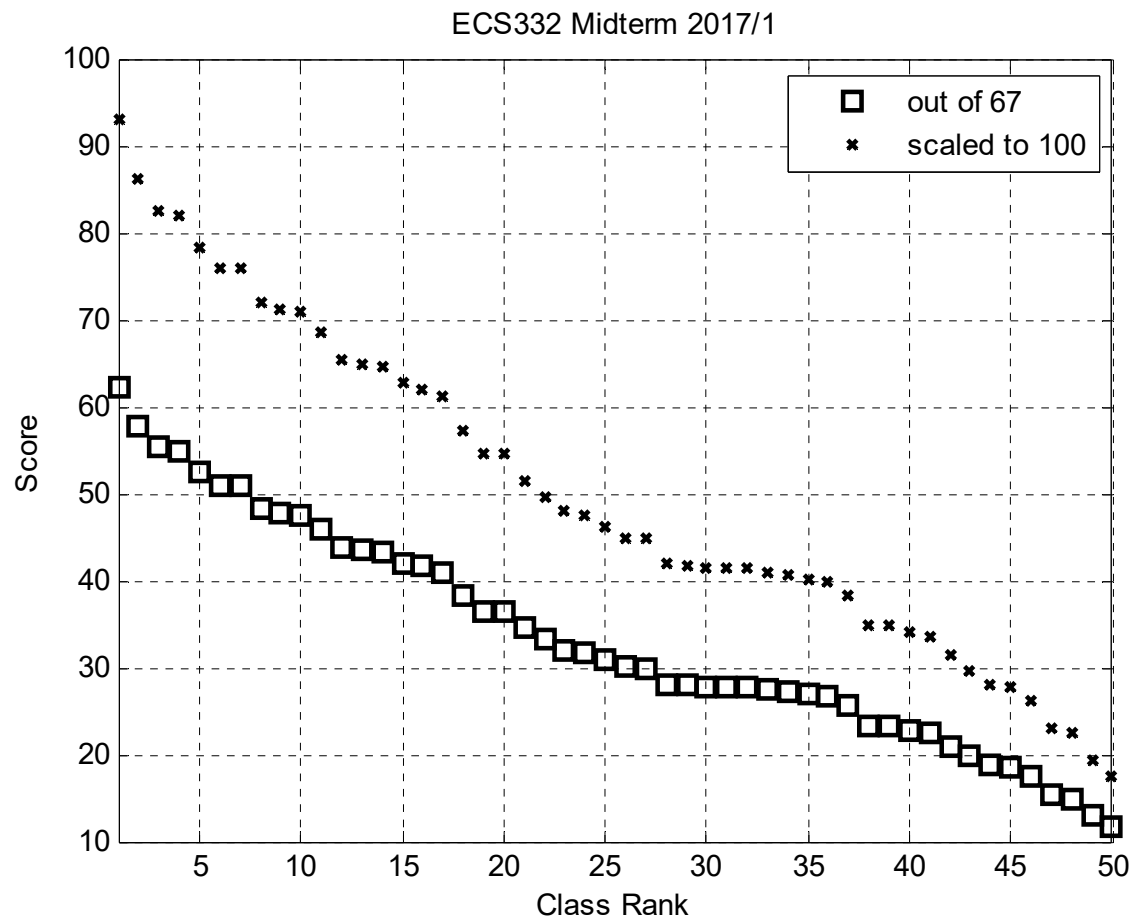
no one larger because they are equal

# ECS315 2016 Information

- The table here shows the information from 2016 (last year).
- The first column shows the midterm Z-Score.
- The second column shows the final grade at the end of the semester.

Z-Score	Grade
2.1	A
1.8	A
1.6	A
1.4	B+
1.3	A
1.0	A
0.9	B+
0.8	B+
0.8	B+
0.6	A
0.5	B+
0.5	B
0.4	B
0.4	C+
0.3	B
0.2	B
0.1	B
0.1	D
0.0	C+
-0.1	C+
-0.1	C+
-0.1	C+
-0.2	C+
-0.2	C+
-0.3	C+
-0.5	C+
-0.6	C+
-0.6	D+
-0.8	C+
-0.9	D+
-0.9	C
-0.9	C
-1.1	D+
-1.1	C
-1.3	D+
-1.4	D+
-1.8	C
-2.3	D

# ECS332 Midterm 2017/1



Average	50.1 / 100
Standard Deviation	19.2 / 100

# ECS332 2016 Information

- The table here shows the information from 2016 (last year).
- The first column shows the midterm Z-Score.
- The second column shows the final grade at the end of the semester.

Z-Score 2016	Grade
2.3	A
1.9	A
1.7	W
1.5	A
1.5	A
1.4	A
1.3	A
1.2	A
1.0	B+
0.7	B+
0.7	B+
0.1	C+
0.1	B
0.0	B
0.0	B+
-0.1	C+
-0.1	B
-0.2	C+
-0.2	C+
-0.3	C+
-0.3	B
-0.3	B
-0.5	C+
-0.5	C+
-0.6	D+
-0.6	C
-0.7	C+
-0.7	C+
-0.8	C+
-0.8	C+
-0.9	C+
-0.9	C
-0.9	C+
-1.1	C+
-1.1	C
-1.2	D+
-1.3	F
-1.4	D



# Tutorial

- We will still have tutorial every week.
  - from 9:20-10:20.
  - Start: Tomorrow
- The tutorial will still be in Thai.
- There will be **attendance check** for the following students  
Chinakrit, Chofar, Jinnapat, Kanchana, Kornpol, Napat, Naphatsaminh, Natthapon, Natthapong, Natwara, Nichaphat, Pattawut, Peeratad, Phonpawee, Puttachard, Saran, Sihan, Sirima, Sukarn, Suphawut, Thanachart, Tunthita, Watcharapon, Yanisa
  - at the beginning of the tutorial
  - (randomly) chosen during the tutorial time.
- We may still have to use some of the tutorial slots for make-up classes.
  - Will be announced at least a week before that.