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.

EES315: Probability and Random Processes

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 electrical engineering. 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 @ 9PM on Sep 16]
  - The midterm exam:
    - 7 pages (including the cover page)
      - To save time, read the cover page before going into the exam room.
    - 12+1 = 13 questions.
    - Cover all the materials that we discussed in class and practice in the HWs.
      - Material Distribution (score-wise): 8 (CH1-2) + 21 (CH3-4) + 13 (CH5) + 8 (Sec 6.1)
  - Closed book. Closed notes.
- (1 pt) One **A4 page** allowed.
  - Must be hand-written in your own handwriting.
    - Recommendation: Avoid using pencil or erasable pen.
  - 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.

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    - 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.
    - Q: Can I use iPad or other devices with pen input to produce this?
      A: Yes, but, again, all the content must still be hand-written in your own handwriting.
    - Violating the above instructions will cost you 10 pt.

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- Basic SIIT-approved calculators, e.g,. FX-991 series, are permitted, but borrowing is not allowed.

- For your studying pleasure....

  - All pre-midterm annotated notes combined in one pdf file. [To be posted after the last lecture]

  - All pre-midterm HWs and their solutions

  - All pre-midterm exercises and their solutions

    - Graded exercises are posted on Google Drive.

  - All pre-midterm slides

Old Exams

- 2018 Midterm Exam
  - Midterm 2020 does not cover Q8, last part of Q11a&b, Q12, Q13d-e, Q14

  - Annotated version

  - The solutions of the in-class exercises in 2019 also contain the solutions for many of these problems.

- 2017 Midterm Exam
  - Midterm 2020 does not cover last part of Q7a&b, Q8, Q10

  - The solutions of the in-class exercises in 2018 also contain the solutions for many of these problems.

- 2016 Midterm Exam

  - Midterm 2020 does not cover Q7b, Q8, Q10-13.

  - Annotated version from 2017

  - The solutions of the in-class exercises in 2017 also contain the solutions for many of these problems.

EES 315 Midterm Exam: Tentative Info

- 7 pages (including the cover page)
- 12+1 = 13 questions.
- 50+1 = 51 points.
- Cover all the materials that we discussed in class and practice in the HWs.
- Material Distribution (score-wise):
  8 (CH1-2) + 21 (CH3-4) + 13 (CH5) + 8 (CH6)

EES 351 Midterm Exam: Tentative Info

- 6 pages (including the cover page)

- $9+1 = 10$ questions.

- $50+1 = 51$ points.

- Cover all the materials that we discussed in class and practice in the HWs.

- Material Distribution (score-wise):
  27 (CH2) + 11.5 (CH3) + 11.5 (Sec 4.1)

Cover page

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

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Cover page

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

Name..ID.....................Section.....1.....Seat No.............

Sirindhorn International Institute of Technology
Thammasat University

Midterm Examination: Semester 1 / 2020

Course Title: EES315 (Probability and Random Processes)

Instructor: Asst. Prof. Dr.Prapun Suksompong

Date/Time: October 2, 2020 / 13:15 - 14:45

Instructions:

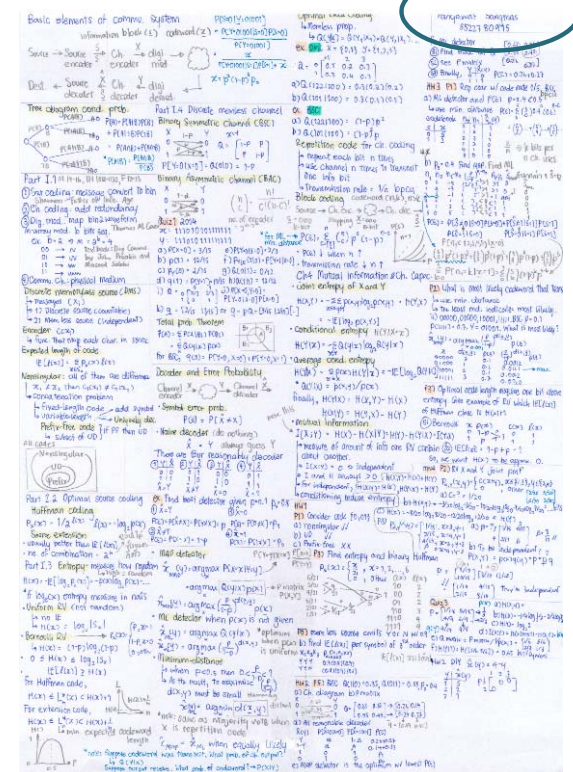➢ This examination has ....7.... pages (including this cover page).
➢ Conditions of Examination:

☐ Open book

☐ Closed book

☑ Semi-Closed book (.......1........sheet(s) ☑ 1 page ☐ both sides of A4 paper note)

  This sheet must be hand-written. They should be **submitted with the exam**.
  Do not modify (.e.g., add/underline/highlight) content on the sheet inside the exam room.
  Indicate your name and ID in the upper-right corner of the sheet (in portrait orientation).
  Other requirements are specified on the course website. (-10 pt if not following the requirements.)

☐ Other:...

☑ No dictionary ☐ Dictionary allowed   ☐ No calculator ☑ Calculator allowed

➢ **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 examination paper is not allowed to be taken out of the examination room.
  Violation will result in a zero (0) score for the examination. Also, do not remove the staple.
➢ 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".
➢ The back of each page will not be graded; it can be used for calculations of problems that do not require explanation.
➢ When not explicitly stated/defined, all notations and definitions follow ones given in lecture.
➢ Some points are reserved for *accuracy* of the answers and also for reducing answers into their *simplest* forms. Watch out for roundoff error. Unless specified otherwise, the error in your final answer should not exceed 0.1%.
  ○ For counting problem, the answer should be reduced into just an integer.
    Exception: When the answer is more than 10⁶, you may leave the answer in some form of simplified expression.
➢ Points marked with * indicate challenging problems.
➢ Do not cheat. Do not panic. **Allocate your time wisely.**
➢ Don't forget to submit your first online self-evaluation form by the end of today.

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.

- Violating the above instructions will cost you 10 pt.

Some Instructions from the cover page

- 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

Some Instructions from the cover page

- 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

Some Instructions from the cover page

- Some points are reserved for *accuracy* of the answers and also for reducing answers into their *simplest* forms.

$$\int_{0}^{2\pi} e^{j\frac{\pi}{2}t}\, \delta(t-3)\,dt = g(c) = e^{j\frac{\pi}{2}3} = -j$$

$$c = 3$$

- Watch out for roundoff error. Unless specified otherwise, the error in your final answer should not exceed 0.1%.

- EES315: For counting problem, the answer should be reduced into just an integer.
  Exception: When the answer is more than 10^9, you may leave the answer in some form of simplified expression.

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/HW 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".

Some Instructions from the cover page

- Your exam will be scanned first and the grading is done on your scanned copy.
  - The back of each page will not be scanned nor graded
    - It can be used for calculations of problems that do not require explanation.
  - Write clearly. (The line should not be too thin or too light.)
  - Area near the border may not be scanned.
- When not explicitly stated/defined, all notations and definitions follow ones given in lecture.
  - For example, in EES351, $\text{sinc}(x) = \dfrac{\sin(x)}{x}$.
- Points marked with * indicate challenging problems.

Other tips/recommendation

- Manage your time carefully.

  Problem 5. $(1 \times 5 + 1^* + 1^* = 7 \text{ pt})$

  - There will be difficult or unseen questions.
    - Tiny points.
  - Most problems are straight-forward.
    - They're worth a lot of points.
      - You may want to double-check your answers.

- Red color is for grading.
  - Do not write in red.
    - Danger: negative numbers that are circled in red.

Other tips/recommendation

- Some formulas have assumption(s)
  - Ex. In EES315: classical probability
  - Ex. In EES351: channel output for cosine

3.22. For a cosine input,

$$\cos(2\pi f_0 t) \longrightarrow \boxed{H(f)} \longrightarrow \frac{1}{2}H(f_0)e^{j2\pi f_0 t} + \frac{1}{2}H(-f_0)e^{j2\pi(-f_0)t}.$$

Assume : $f_0 > 0$

$$= H(f_0)\left(\frac{1}{2}e^{j2\pi f_0 t} + \frac{1}{2}e^{-j2\pi f_0 t}\right)$$

$$= H(f_0)\cos(2\pi f_0 t)$$

If $H(-f_0) = H(f_0)$, then the output can be simplified to $H(f_0)\cos($

Without the assumption(s), we can't apply the formula(s).

- Look at the solutions for HW & in-class exercises
  - Even if you can solve the problems by yourselves, the solutions may give you some alternative approaches or different perspective on the problems.

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Tips specific to EES 315

- True/false questions

Problem 9. (1 pt) [ENRPr] For each of the following statement, write a T if it is always **true**. Write an F if the statement can be **false**; that is, write an F if one can find a counter-example to the statement.

$$\underline{\qquad} \quad P(A \cup B) = P(A) + P(B)$$
$$\underline{\qquad} \quad P(A \cup B) - P(A \cup B^c) = P(A^c \cap B) - P(A^c \cap B^c)$$

- $\underline{\text{T}}$ If $x > 2$, then $x^2 > 1$.
- $\underline{\text{F}}$ If $x > 2$, then $x > 3$.

Tips specific to EES 351

- Read the question carefully
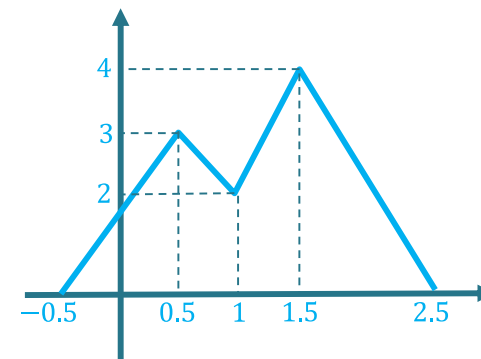 - t or f
  - Plot or find a simplified expression
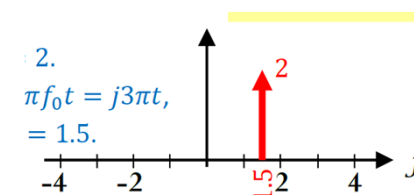 - $X(f)$ or its magnitude $|X(f)|$
- For a plot,
  - indicate the values at all the vertices (corners)
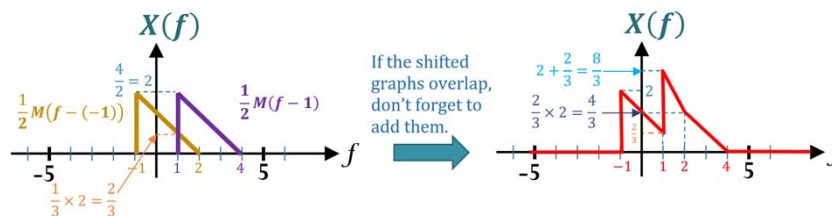
  - indicate the location/size of each δ function
  - if a part of a plot is a sum of two or more overlapping graphs, don't forget to combine them.
    - Make sure that it is clear which lines are used in your final answer.

Tips specific to EES 351

- Ideal Filters
  - low-pass (LP), high-pass (HP), band-pass (BP)

$$H_{LP}(f) = \begin{cases} g, & |f| \le 30, \\ 0, & \text{otherwise.} \end{cases} \qquad H_2(f) = \begin{cases} 1, & |f| > 315, \\ 0, & \text{otherwise.} \end{cases} \qquad H_{BP}(f) = \begin{cases} 1, & |f - f_c| \le 332, \\ 1, & |f + f_c| \le 332, \\ 0, & \text{otherwise.} \end{cases}$$

  - Specifying frequency range.
    - "$|f - 30| < 5$" is the range of frequency
      $$30 - 5 < f < 30 + 5$$
  - The gain may not be 1.

Preparation

- In-class exercises & solutions
  - Look at the graded exercises
    - "OK" means something is not right (most likely not enough explanation)
- Old Exam
  - Some solutions are available in in-class exercises/HW solutions.
- HW + solutions
  - Don't forget that we have free HW(s) whose content is/are still useful for the exam.
- Lecture notes

The First Self-Evaluation Forms

- Posted as an assignment in Google Classroom

- Record what you have done.

- Due: 11:59PM on the midterm day.

Self-Evaluation (1)

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.
3. A link is provided after submission so that you can come back and edit your own response later.

Name

Student ID

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? Provide short description for each of the issues.

How many times have you discussed with the instructor outside of class? (Ask questions, express concerns, etc.) Be specific. Number alone does not count.