Digital Communication Systems
ECS 452

Asst. Prof. Dr. Prapun Suksompong

(ผศ.ดร.ประพันธ์ สุขสมปอง)

prapun@siit.tu.ac.th

Office Hours:

BKD, 4th floor of Sirindhralai building

Monday	**14:00-16:00**
Thursday	**10:30-11:30**
Friday	**14:00-15:00**

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.

Announcements

- 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 also available on my web site (**prapun.com**).

Course Web Site

prapun.com

Current version

Last-year version

Teaching

- For 2/2015, he te
  - ECS203 (F
  - ECS452 (I
- For 1/2015, he ta
  - ECS315 (F
  - ECS332 (F
  - ECS204 (F
    students)
- For 2/2014, he ta
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  - ECS315 (F
  - ECS452 (I

Asst. Prof. Dr.Prapun Suksompong (ผศ.ดร.ประพันธ์ สุขสมปอง) is currently a faculty member 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.

Ajarn 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 2/2015, he teaches
  - 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)
- For 2/2014, he taught
  - ECS203 (Basic Electrical Engineering) (For non-major students)
  - ECS455 (Mobile Communications)
  - ECS204 (Basic Electrical Engineering Laboratory) (For non-major students)
  - ICT Elementary for Embedded Systems (Fourier transform and principles of communications)
- For 1/2014, he taught
  - ECS315 (Probability and Random Processes)
  - ECS452 (Digital Communication Systems)

Course Web Site

- Announcements
- References
- Handouts (Posted before corresponding lectures; also available at the copy center)
- Annotated Notes/Slides (Posted after corresponding lectures)
- Calendar
  - Exams
  - HW due dates

Please check the course website regularly.

www2.siit.tu.ac.th/prapun/ecs452/

Course Website: Notes & Slides

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

RSS Feed

http://page2rss.com/page?url=www2.siit.tu.ac.th/prapun/ecs452/index.html

page2rss

ECS 452: Digital Communication Systems G+1 0

http://www2.siit.tu.ac.th/prapun/ecs452/index.html - Last Checked: 08/24/14 12:40:14 - Added: 06/10/13 01:00:06

24 Aug 2014 08:28

- 2.4 (Shannon) Entropy for Discrete Random Variables [Posted @ 9PM on Aug 24][To be distributed in class]

Permalink | View Entire Page

20 Aug 2014 05:04

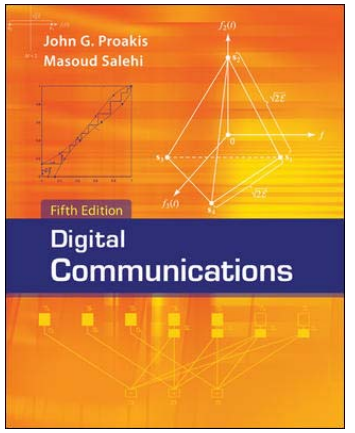
- [Posted @ 1PM on Aug 18, Updated @ 4PM on Aug 20]
- [Posted @ 9PM on Aug 18][Updated @ 4PM on Aug 20]

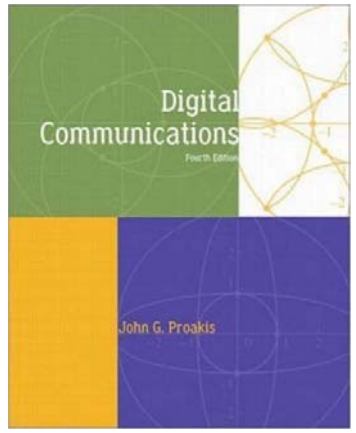
Permalink | View Entire Page

Powered by page2rss

Course Organization

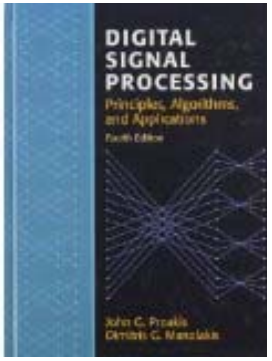
- **Course Website:**
  http://www2.siit.tu.ac.th/prapun/ecs452/
- **Lectures:**
  - **Wednesday 13:00-14:20 BKD 3214**
  - **Thursday 14:40-16:00 BKD 3214**
- **Textbook:** Digital Communications
  - By John Proakis and Masoud Salehi
    - Northeastern University
  - 5th (International) Edition
  - Call No. TK5103.7 P76 2008

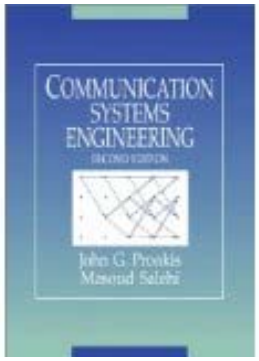


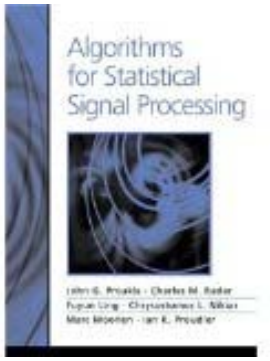


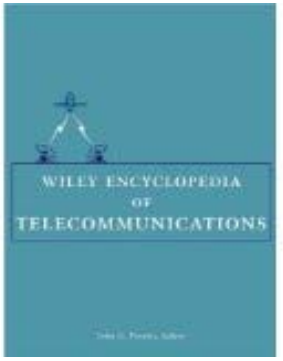
John Proakis

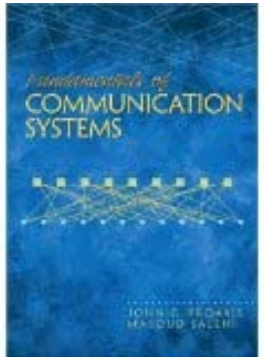
- Adjunct Professor at the University of California at San Diego (UCSD)
- Professor Emeritus at Northeastern University.

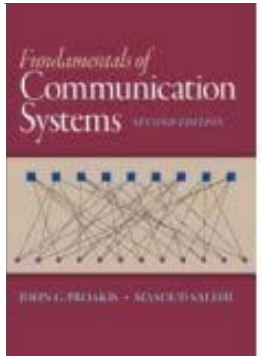


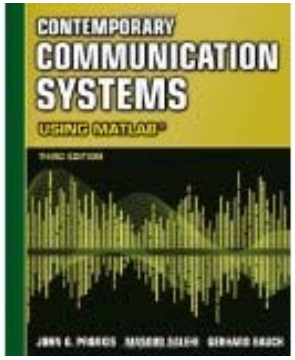


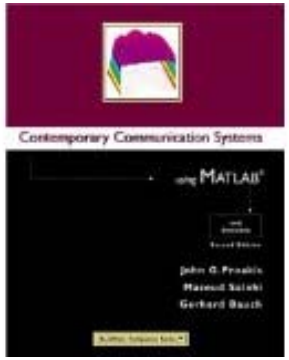












ECS 452 Topics

1. Elements of a Digital Communication System
2. Source Coding and Entropy
3. Optimal Detection for Discrete Memoryless Channels
4. An Introduction to Channel Coding and Decoding over BSC
5. Mutual Information and Channel Capacity
6. Introduction to Digital Modulation, Signal Space Representation of Waveforms, Constellations for Digital Modulation Schemes
7. The Waveform Channel, Random Processes, White Noise
8. Optimal Detection for Additive Noise Channels, Matched filter.

General Ideas About This Course

- Extend the knowledge from Principles of Communications (ECS332) and Probability and Random Processes (ECS315)
- Focus more on
  - Performance analysis (bit error rates),
  - Optimal receivers, and
  - Limits (information theoretic quantities).

Grading System

- Coursework will be weighted as follows:

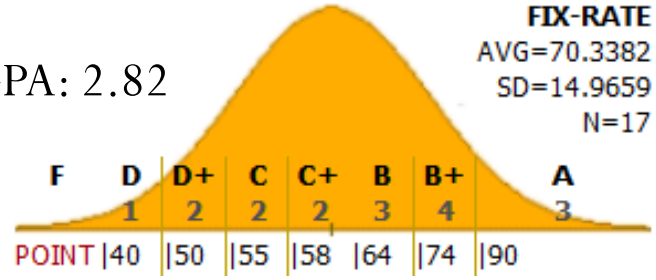
Assignments	5%
In-Class Exercises	5%
Class Discussion/Participation	10%
Midterm Examination • 9 Mar 2016 TIME 13:30 - 16:30	40%
Final Examination (comprehensive) •18 May 2016 TIME 13:30 - 16:30	40%

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

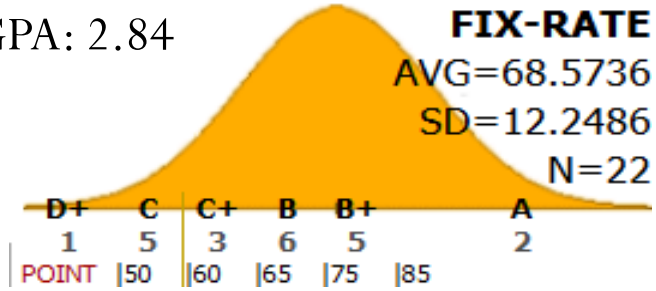
Please Double-Check Exam Dates!

Grading System

2013: CLASS GPA: 2.82

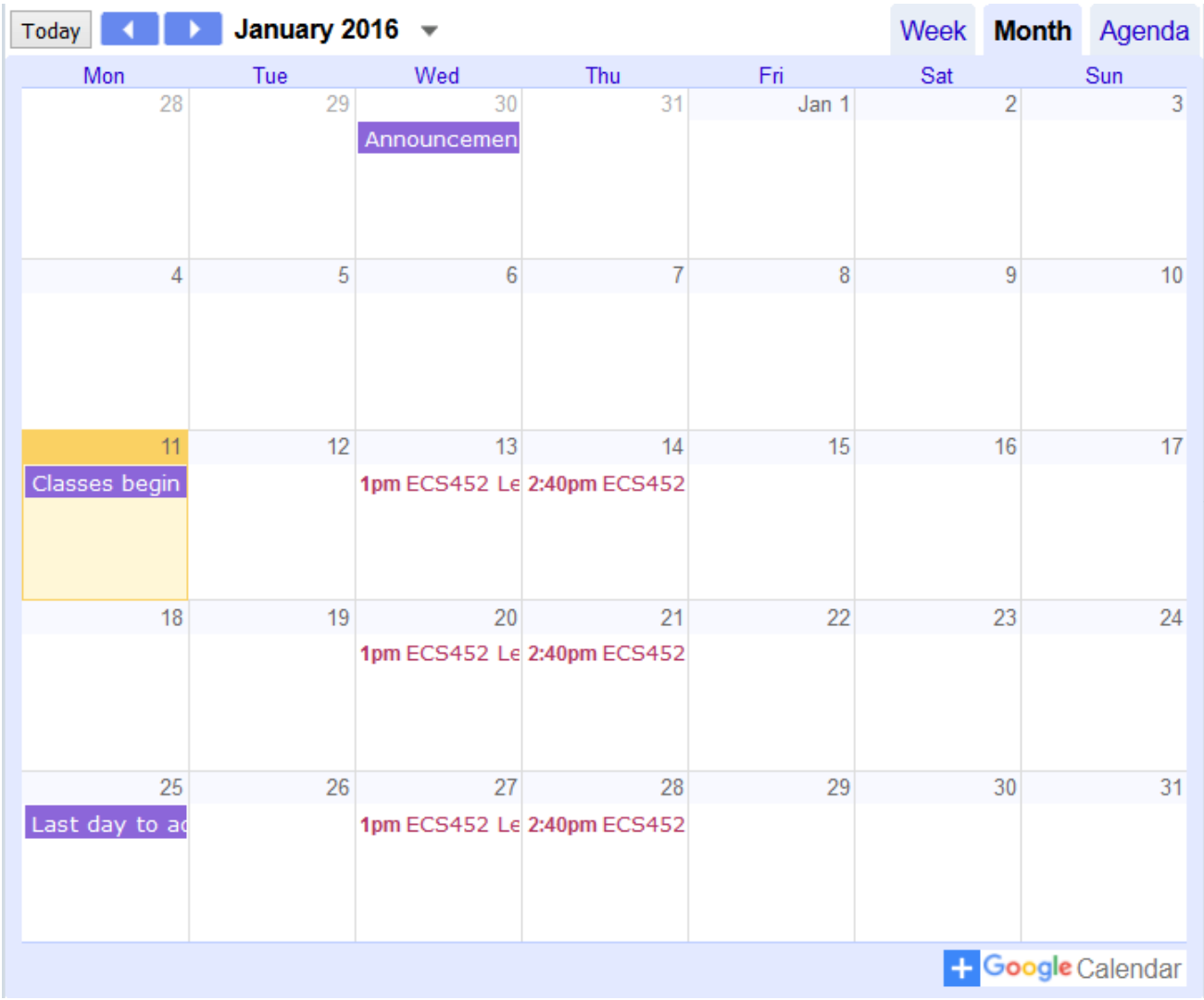


2014: CLASS GPA: 2.84



Calendar (Google)

Available on the course web site.



Calendar

M	T	W	R	F
11-Jan-16	12-Jan-16	13-Jan-16	14-Jan-16	15-Jan-16
18-Jan-16	19-Jan-16	20-Jan-16	21-Jan-16	22-Jan-16
25-Jan-16	26-Jan-16	27-Jan-16	28-Jan-16	29-Jan-16
1-Feb-16	2-Feb-16	3-Feb-16	4-Feb-16	5-Feb-16
8-Feb-16	9-Feb-16	10-Feb-16	11-Feb-16	
15-Feb-16	16-Feb-16	17-Feb-16	18-Feb-16	19-Feb-16
22-Feb-16	23-Feb-16	24-Feb-16	25-Feb-16	26-Feb-16
29-Feb-16	1-Mar-16	2-Mar-16	3-Mar-16	4-Mar-16
7-Mar-16	8-Mar-16	9-Mar-16	10-Mar-16	11-Mar-16
14-Mar-16	15-Mar-16	16-Mar-16	17-Mar-16	18-Mar-16
21-Mar-16	22-Mar-16	23-Mar-16	24-Mar-16	25-Mar-16
28-Mar-16	29-Mar-16	30-Mar-16	31-Mar-16	1-Apr-16
4-Apr-16	5-Apr-16	6-Apr-16	7-Apr-16	8-Apr-16
11-Apr-16	12-Apr-16	13-Apr-16	14-Apr-16	15-Apr-16
18-Apr-16	19-Apr-16	20-Apr-16	21-Apr-16	22-Apr-16
25-Apr-16	26-Apr-16	27-Apr-16	28-Apr-16	29-Apr-16
2-May-16	3-May-16	4-May-16	5-May-16	
9-May-16	10-May-16	11-May-16	12-May-16	13-May-16
16-May-16	17-May-16	18-May-16	19-May-16	20-May-16

Lectures

Exams

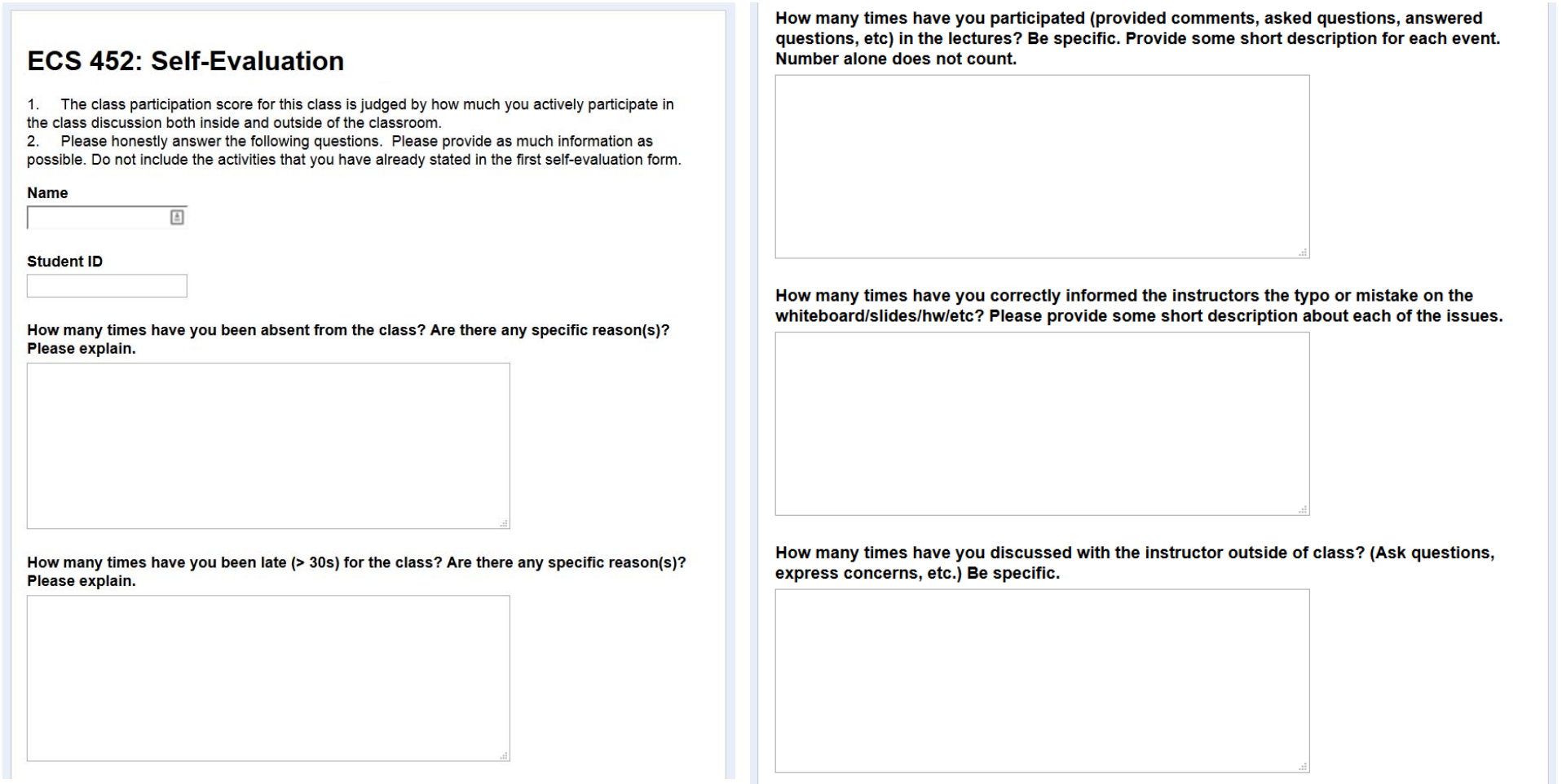
Please Double-Check Exam Dates!

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 452: 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.

- We will some in-class exercises. Some of these may occur without prior warning or announcement.
- Attendance 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 assignments/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
  - Time: M 14:00-16:00, R 10:30-11:30, F 14:00-15:00
  - Appointment can be made.
  - Feel free to come to my office and chat!
  - Don't be shy.

	Asst.Prof.Dr.Prapun Suksompong - 2/2015				
	9.00-10.20	10.40-12.00	13.00-14.20	14.40-16.00	16:00-17:00
MON		ECS203 (T) BKD 2506	OH	Office Hours	
TUE			ECS203 BKD 2401		
WED			ECS452 BKD 3214		
THU		Office Hour		ECS452 BKD 3214	
FRI		ECS203 BKD 3507	OH	OH	

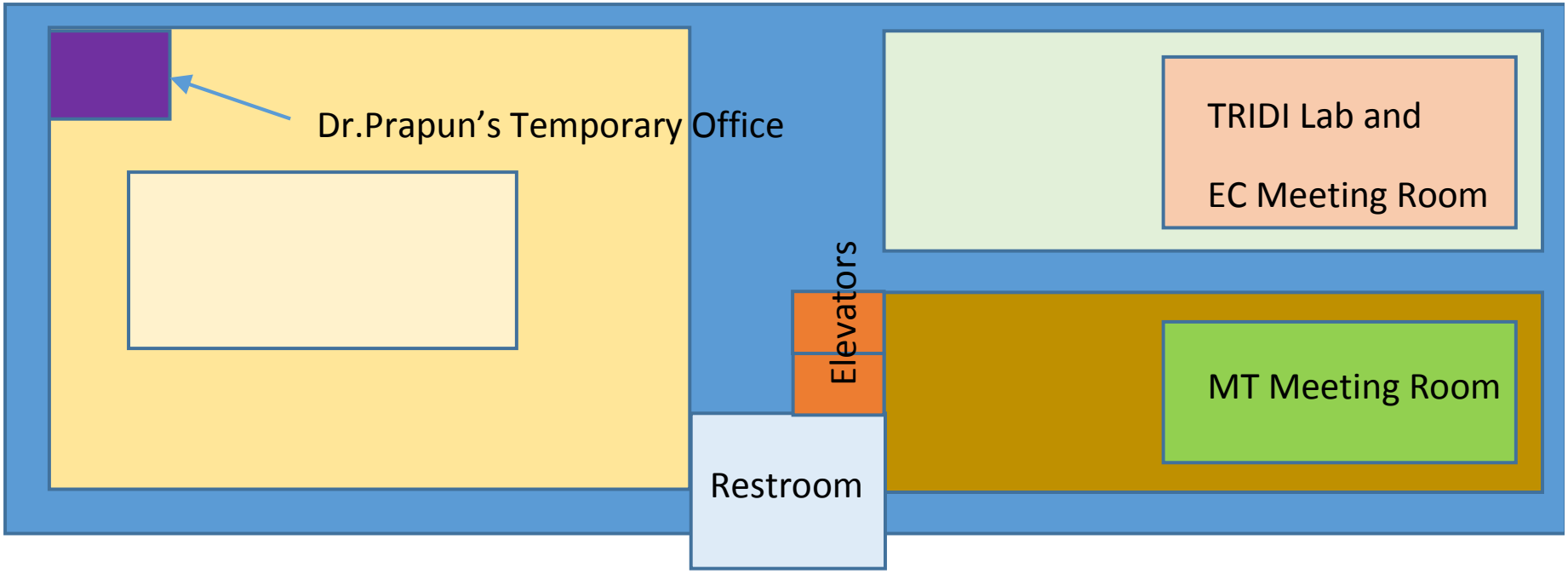
Office Hours:

BKD, 4th floor of Sirindhralai building

Monday	**14:00-16:00**
Thursday	**10:30-11:30**
Friday	**14:00-15:00**

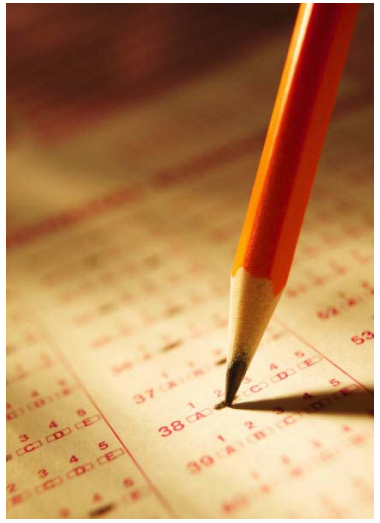
My (Temporary) Office

- Sirindhralai building
- 4th floor



Warning

- This class can be **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 exercises/activities
  - Weekly assignments
  - Exams



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.
- My notation can be different from the textbook.
  - Every notation has some advantages and disadvantages.

More References

- A first course in digital communications
  - By Ha H. Nguyen and Ed Shwedyk
  - Call No: TK5103.7 N49 2009
  - Cambridge University Press
- Digital communications: fundamentals and applications
  - By Bernard Sklar.
  - Call No: TK5103.7 S55 2001
  - Prentice Hall
- Principles of Digital Communication
  - By Robert G. Gallager
  - 2008
  - Cambridge University Press