

Introduction to Information Theory

Instructor:

Prof. Heung-No Lee, Ph.D.

- Ph.D. in Wireless Communications
- Research Areas in the past: Wireless Communications, Wireless Networks, Information Theory, Signal Processing Theory, Brain Computer Interfaces, Machine Learning, Optimization
- Current Research Topics: Cryptocurrencies/Blockchains, Digital Networks, Financial Engineering, Stock Market Prediction

Contacts and Communications:

- Phone number: 010-4946-4710
- E-mail: heungno@gist.ac.kr; I may be very slow to give you response.
- SNS: Send me your message; state your needs.
- Kakao talk room: I am thinking of setting up a Kakao talk room for the class at the end of the second week.
- Office hours: anytime, please send me messages.
- Classroom: EECS Building B201.
- This will be used for the midterm and the final.

Course Period: Sept. 1st 2020 – Dec. 24th 2020

There are 26 lectures. There are 14 lectures before midterm and 12 lectures after midterm.

Two quizzes.

Week	Monday	Wednesday	
1		9/2	
2	9/7	9/9	HW#1
3	9/14	9/16	HW#2
4	9/21	9/23	
5	9/28	9/30 Chu-Seok	Quiz 1
6	10/5	10/7	HW#3
7	10/12	10/14	HW#4
8	10/19	10/21	
9	10/26 Midterm		Midterm Week
10	11/2	11/4	HW#5
11	11/9	11/11	HW#6
12	11/16	11/18	Quiz 2
13	11/23	11/25	HW#7
14	11/30	12/2	HW#8
15	12/7	12/9	
16	12/14 Final Exam		Final Week

Course Grades

- Midterm (30%), Final (30%)
- Two Quizzes (10%)
- Homeworks + Reviews (20%)
- Attendance (10%): No show without prior notice and late entry into Zoom class are considered no good.

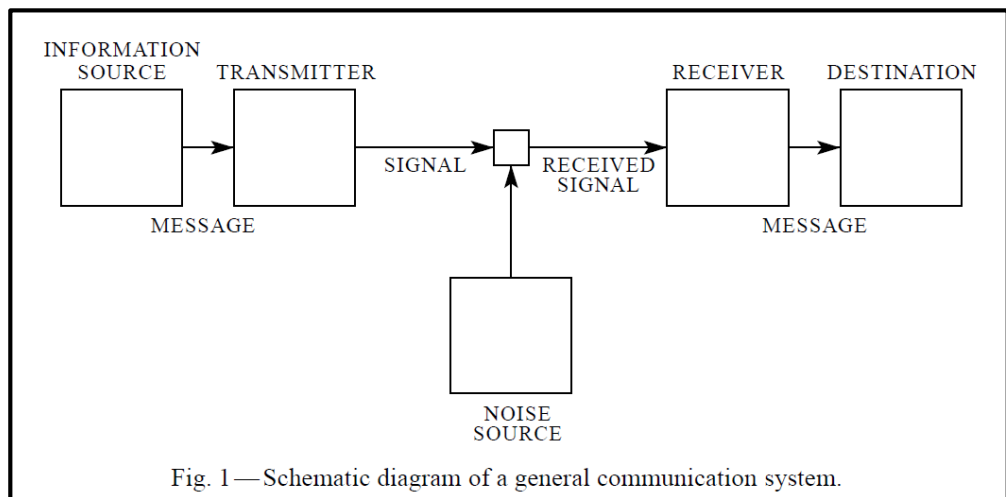
Homework Policies

- Discussion and exchange of ideas among classmates are encouraged.
- Homework submission from a group of up to 2 persons is allowed.
- On each homework, a reviewer team of two persons will be assigned.
- A sign-up sheet will be prepared and given out to you during the second week.
- The job of each reviewer team is to
 - Gather the student homeworks
 - Grade them and keep the grade record in MS EXCEL.
 - Type up the best homework solution manual (using MS WORD).
 - Get an SNS approval of the solution manual from Prof. Lee.

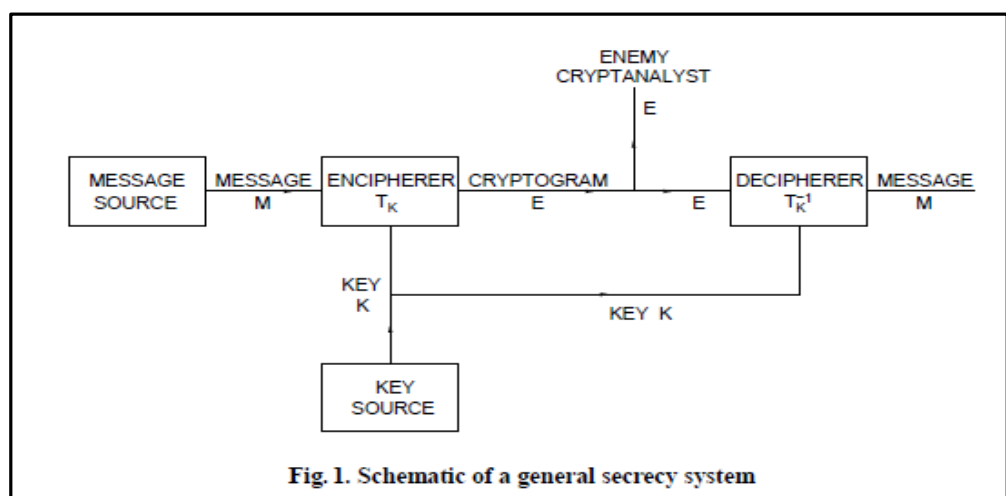
- Distribute the graded homeworks and the solution manual within a week submission.

Scope of this course

- Information Theory, as it was created by Claude Shannon in 1948.
- Claude E. Shannon (1916 – 2001)
 - Math/EE Bachelor from University of Michigan (1936)
 - MSEE and Math Ph.D. from MIT (1940)
 - Landmark papers
 - ◆ C. E. Shannon, “[Mathematical Theory of Communications](#),” Vol. 27, pp. 379-423, The Bell System Technical Journal, July, Oct. 1948.



- ◆ C. E. Shannon, “[Communication Theory of Secrecy Systems](#),” *Bell System Technical Journal*, vol. 28(4), page 656–715, 1949.



- Use of random variables, probabilities and optimization tools in research problems.
- Applications include:

- Wireless Communications, Information Theory, Covert Communications, MIMO communications, Mobile Communications
- Signal Processing Theory,
- Network Information Theory
- Channel Codes, Error Correction Codes, Source Compression
- Cryptographies, Zero-Knowledge-Proofs, Homomorphic Cryptosystems, Multiparty Computation
- Optimization, Machine Learning, Gambling
- Finance, Gambling, Blockchains

What you will learn from this course?

- How to think slowly but with rigor.
- How to make original problems.
- How to solve them.
- Making a systemic thought process so that you can self-correct your mistakes.
- How to break down a big problem into smaller ones and conquer each one at a time.
- How to frame original mathematical problems and solve them.

Books and Courses

- Main: Thomas and Cover, *Elements of Information Theory*, 2nd Ed., Wiley, 2006.
- Reference 1: Robert Gallager, *Information Theory and Reliable Communication*, John Wiley & Sons, Inc. New York, NY, USA, 1968.
- Reference 2: Keith Devlin, *Introduction to Mathematical Thinking*, [Coursera Online Course](#).

Introduction of Students

- **Let us go around each one of you.**
- **I would like to know who you are and your interests in coming to this class.**
- **Please at least share with me**
 - **your background,**
 - **your advisor, and**
 - **your research interests.**