

# Cryptography Principles

Yu Zhang

Harbin Institute of Technology

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# What cryptography is and is not

Cryptography is:

- A tremendous tool
- The basis for many security mechanisms
- Secure communication/computation:
  - web traffic: HTTPS (SSL/TLS)
  - wireless traffic: Wifi (WPA2/3), 5G (AES-128 CTR), Bluetooth (SAFER+)
  - encrypting files on disk: EFS, TrueCrypt
  - digital rights management: Apple's FairPlay, console games
  - cryptocurrency: bitcoin

Cryptography is **NOT**:

- The solution to all security problems
- Reliable unless implemented and used properly
- Something you should try to invent yourself

# Purposes

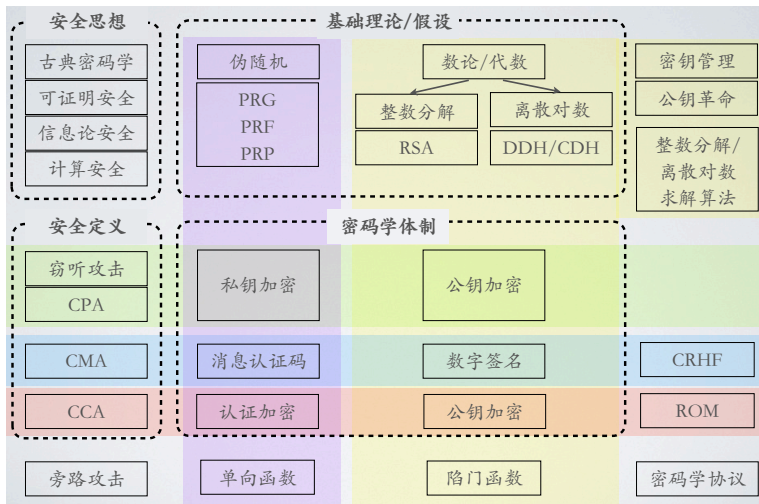
- Learn what the rigorous information security is
- Learn how to secure information rigorously
- Learn how mathematics interplays with engineering

# We will learn from Turing Award recipients

- 1995 M. Blum
- 2000 A. Yao
- 2002 R. Rivest, A. Shamir, L. Adleman
- 2012 S. Micali, S. Goldwasser
- 2013 L. Lamport
- 2015 M. E. Hellman, W. Diffie

- Classic cryptography, Perfect Secrets
- Private Key Encryption, MAC, Block Cipher, OWF
- Number Theory, Factoring and Discrete Log
- Key Management, Public Key, Digital Signature
- TPD, Random Oracle Model
- Cryptographic Protocols (Many magics here)

# Syllabus [in Chinese]



**Textbook:** **Introduction to Modern Cryptography (2nd Ed.),**  
*Jonathan Katz and Yehuda Lindell*

**MOOC:** Stanford Dan Boneh's Cryptography @Coursera

**Slides:** <https://github.com/YuZhang/cryptography>

**QQ group:** 737412187 for 2021

- Composition:

**Homework:**  $4 \times 5 = 20\%$  (Homework 1~5)

**Final Exam:** 80%

**Extra:** 5% for outstanding homework (Homework 1~6)

- How to score high:

- Read the textbook IMC
- Do homework by yourself
- **No Plagiarism!**