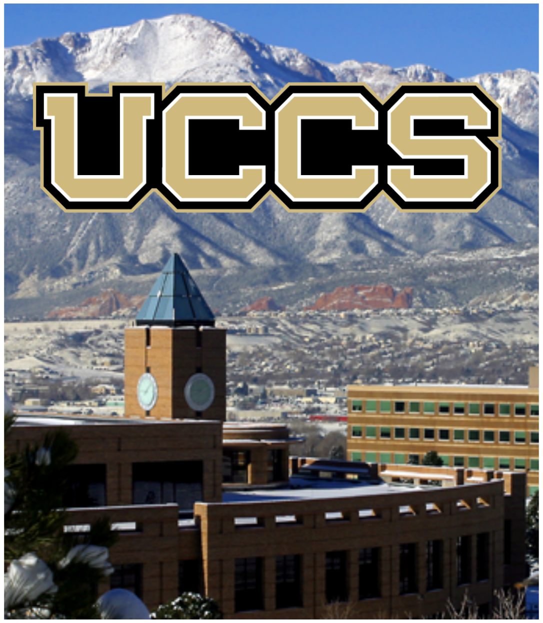


Cryptography and Information Theory

Cryptography Overview

Sang-Yoon Chang, Ph.D.

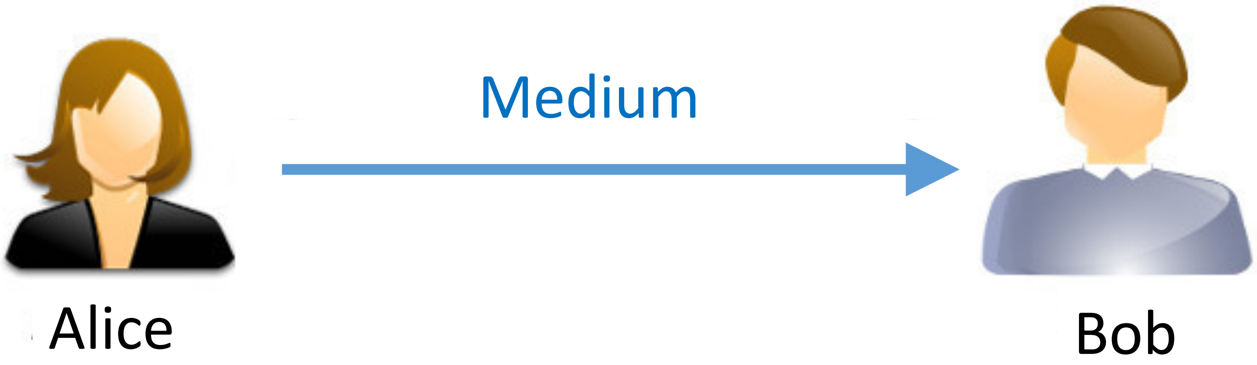
Module Objectives:

1. Alice, Bob, Eve, and Other Terminology

2. Kerckhoff’s Principle

3. Security by Obscurity

Alice, Bob, and Eve

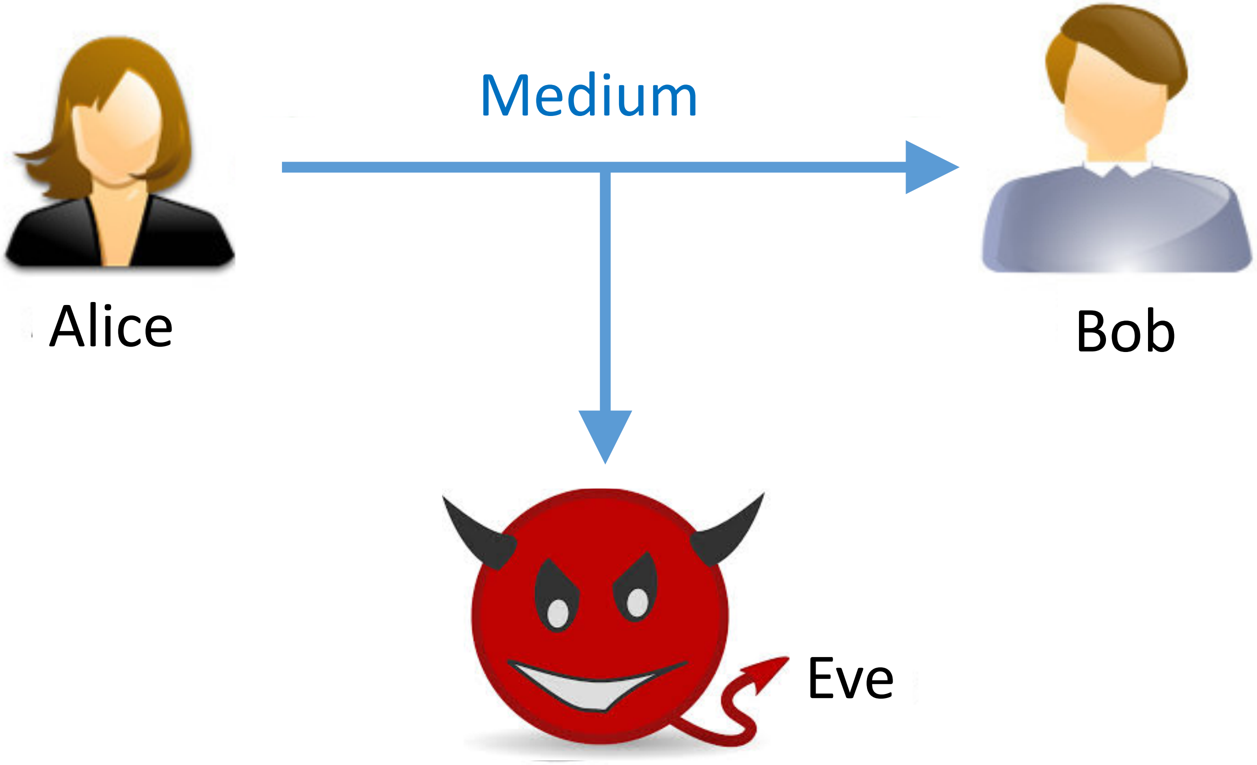


Medium

Alice

Bob

Alice, Bob, and Eve



Medium

Alice

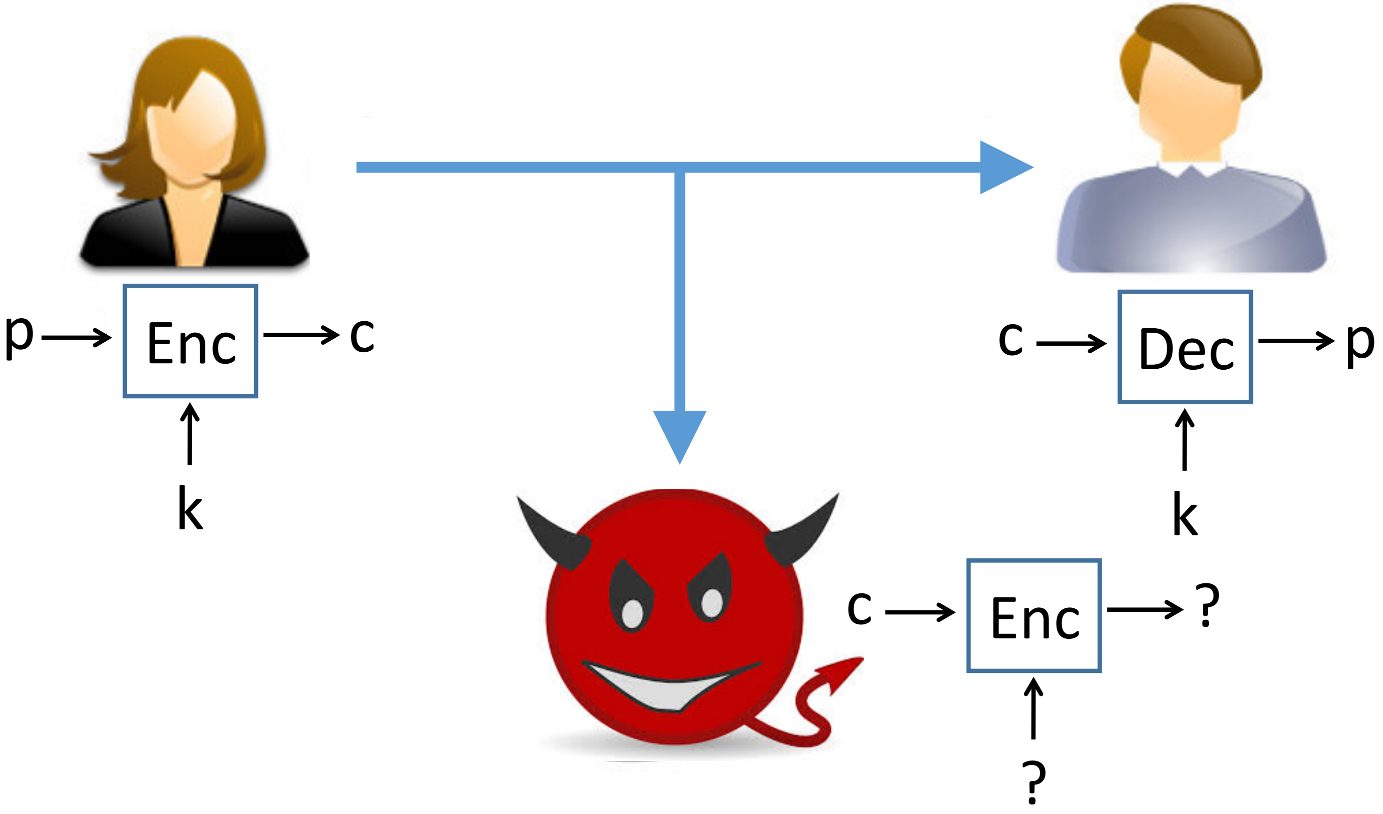
Bob

Eve

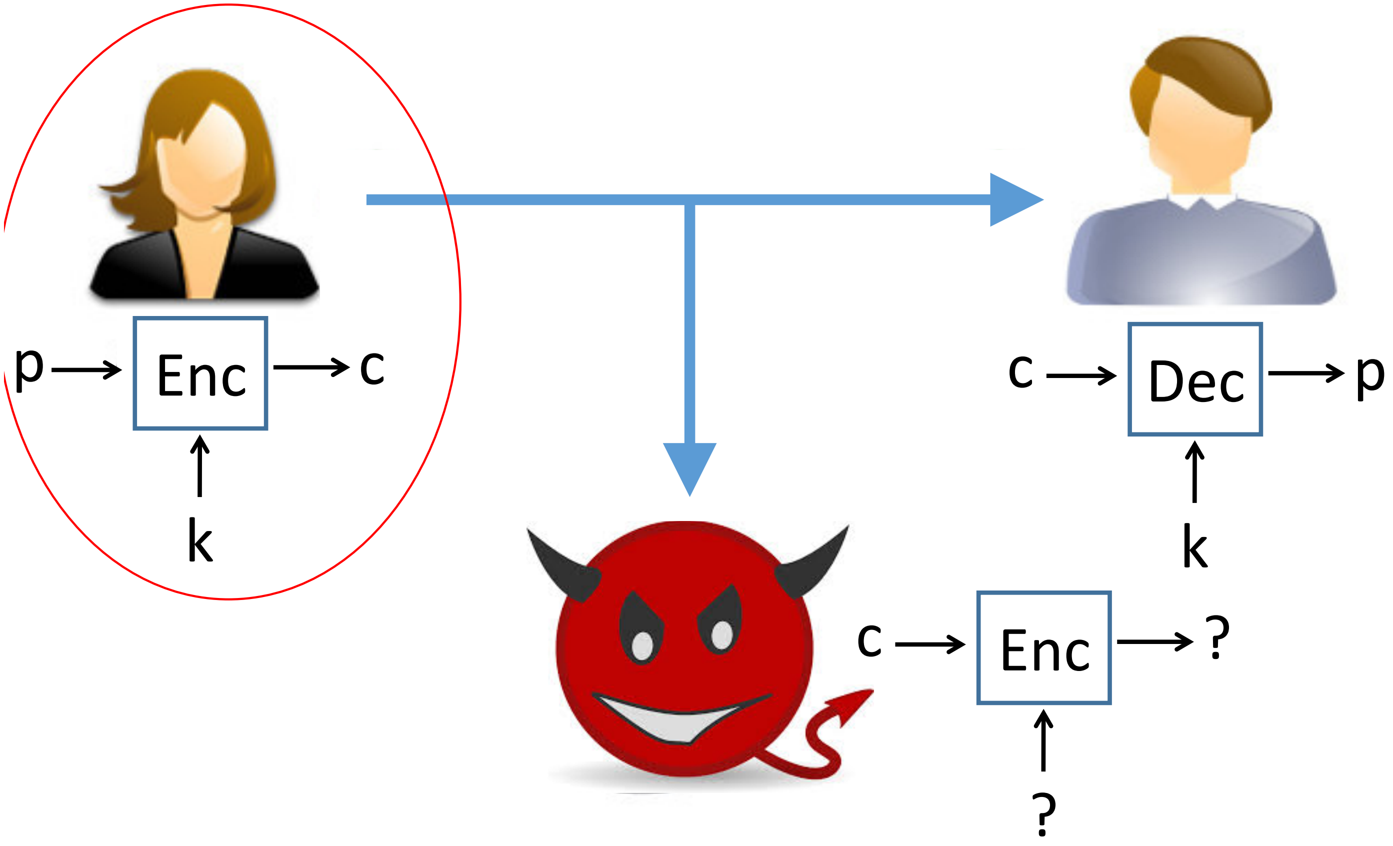
Cryptography Terminology

Plaintext (p) - the original message
Ciphertext (c) - the coded message
Cipher - the algorithm used for
transforming p to c
Key (k) - the information only known
to Alice and Bob
Encrypt - p → c
Decrypt - c → p

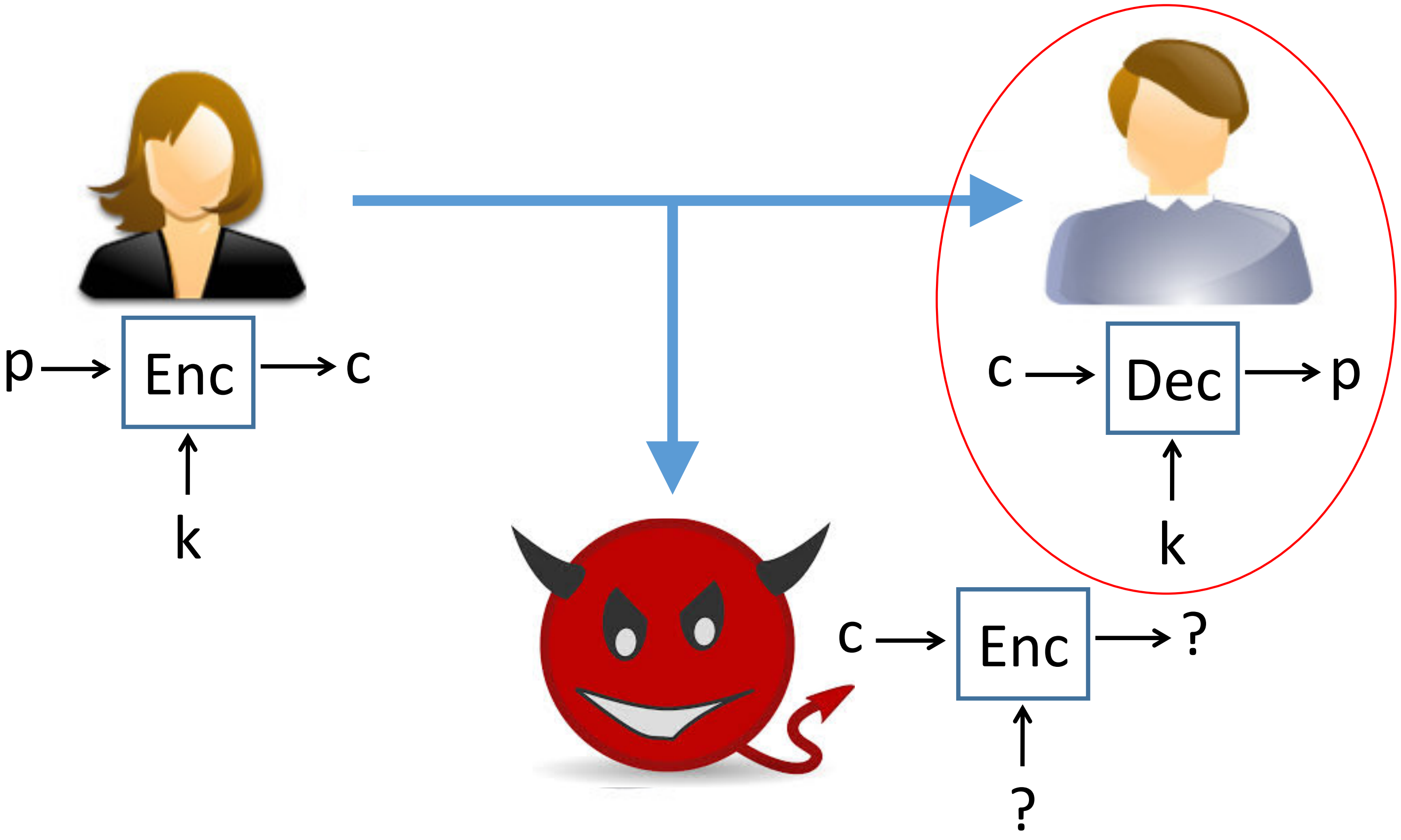
Cryptography Terminology



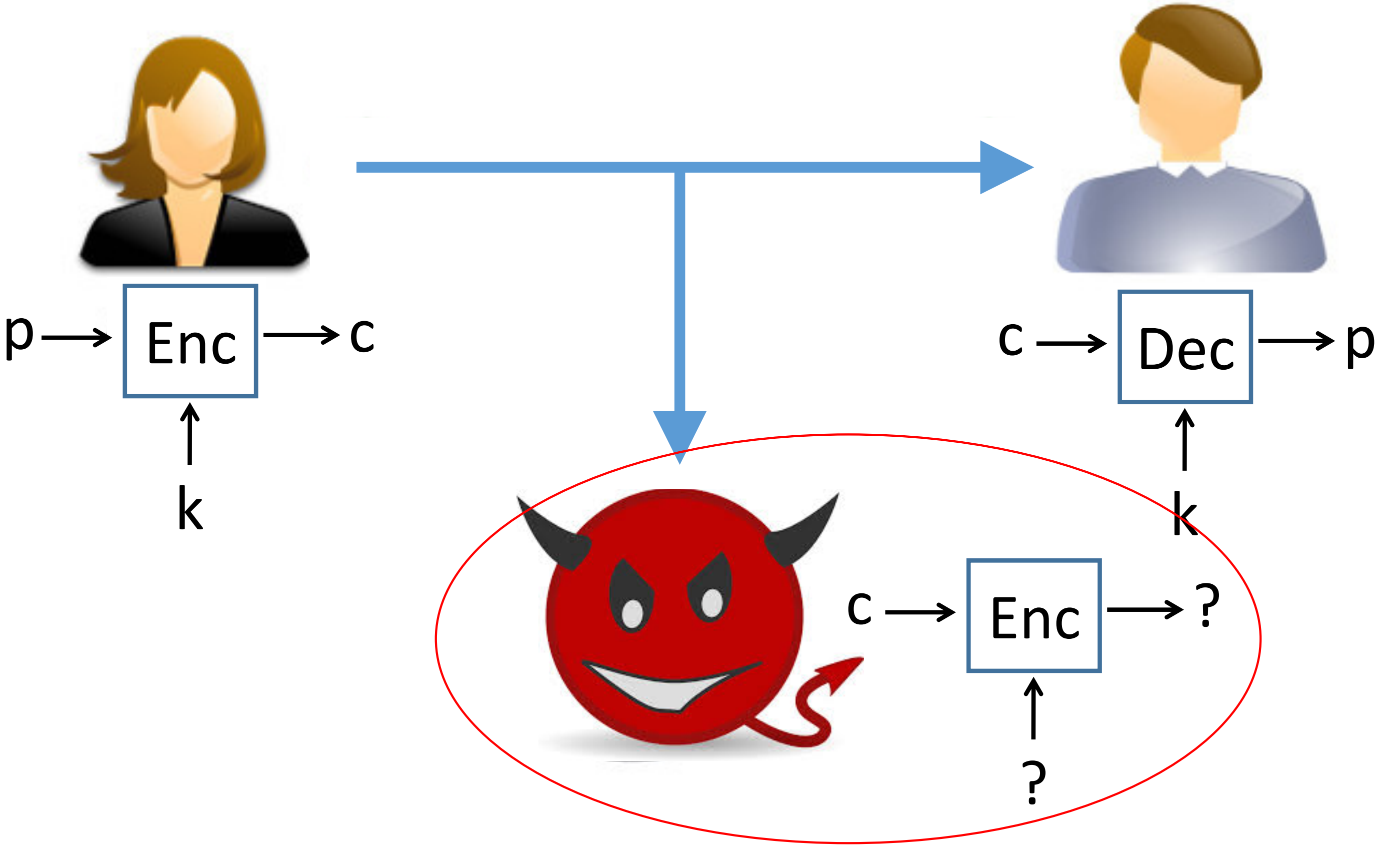
Cryptography Terminology



Cryptography Terminology



Cryptography Terminology



Cryptography Terminology

Cryptography - the study of encryption and decryption techniques
Cryptanalaysis – codebreaking and deciphering ciphertext without the key
Cryptology – the field of cryptography and cryptology

Threat Model

How much does the attacker know?

What does the attacker not know?

Kerckhoff’s Principle

- Also called Open Design or Shannon Maxim
- The attacker knows the system

Kerckhoff’s Principle

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- Security relies on the secrecy of keys

Kerckhoff’s Principle

- Also called Open Design or Shannon Maxim
- The attacker knows the system
- Security relies on the secrecy of keys
- Common design principle among security experts

Security by Obscurity

- The attacker does not know the system because the algorithms/protocols are proprietary and confidential
- History shows that the approach is vulnerable, e.g., reverse engineering

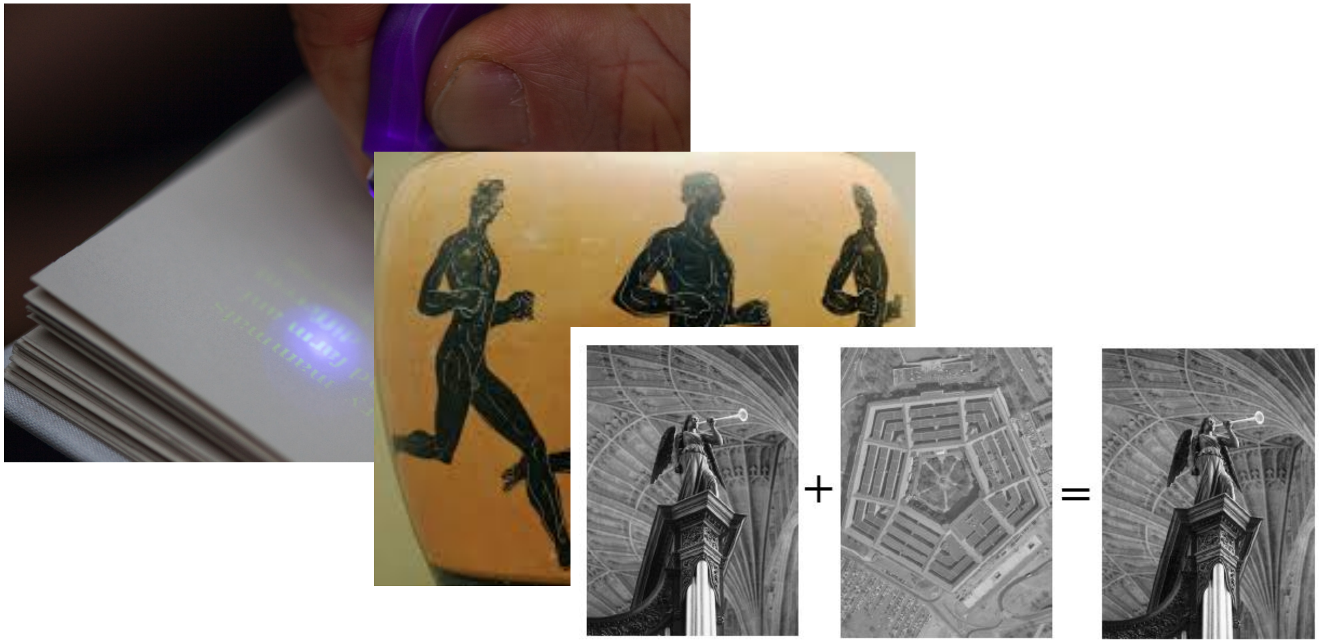
Steganography

- Related to Security by Obscurity but focuses more on concealing the presence of the message
- Typically the security is breached once the concealment method is known

Steganography

Steganography

Steganography



Steganography

Since everyone can read, encoding text in neutral sentences is doubtfully effective

Steganography

Since **E**veryone **C**an **R**ead, **E**ncoding **T**ext **I**n **N**eutral **S**entences **I**s **D**oubtfully **E**ffective

Steganography (A Puzzle for Inspector Morse)

Dear George,
Greetings to all at Oxford. Many thanks for your
letter and for the summer examination package.
All entry forms and fees forms should be ready
for final despatch to the Syndicate by Friday
20th or at the very latest, I'm told, by the 21st.
Admin has improved here, though there's room
for improvement still; just give us all two or three
more years and we'll really show you! Please
don't let these wretched 16+ proposals destroy
your basis O and A pattern. Certainly this
sort of change, if implemented immediately,
would bring chaos.
Sincerely yours.

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Kerckhoff’s vs. Obscurity

- History shows that Security by Obscurity is vulnerable
- We assume Kerckhoff’s Principle moving forward
- The scope of secrecy is clearly defined, and everything else can be known to the attacker