# 17 Asymmetric encryption and hashing – Part 2

Name: _____ Class: _____ Date: _____

## Vocabulary 词汇

*Write each word three times.* 把每个单词抄写三遍。

| English | 中文 | Write it 3 times (English) | | |
|---|---|---|---|---|
| Asymmetric encryption | 非对称加密 | | | |
| public key | 公钥 | | | |
| private key | 私钥 | | | |
| cryptographic hash | 密码散列 | | | |
| digest | 摘要 | | | |

## Recall

Symmetric encryption struggles to share its key. Asymmetric encryption solves that with a pair of keys.

## New ideas

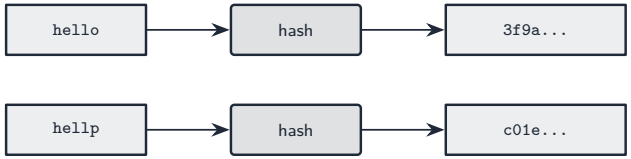
Read these first. Each idea has a short worked example. Then do the Practice.

### 1 Asymmetric encryption


**Asymmetric encryption** 非对称加密 gives each user a **public key** 公钥 (shared) and a **private key** 私钥 (secret). Anyone can lock with the public key, but only the owner's private key unlocks — so no key needs sharing first.

*Worked example.* Alice publishes her public key for all to see. Bob locks a message with Alice's public key and sends it. Only Alice's private key can unlock it — so they never had to share a secret key beforehand.

### 2 Hashing




one letter changed → a totally different digest (cannot be reversed)

A **cryptographic hash** 密码散列 turns any input into a fixed-size **digest** 摘要. It is one-way (you cannot get the input back) and a tiny change flips the digest completely.

*Worked example.* A website stores the *hash* of your password, not the password. At login it hashes what you typed and compares. Because hashing is one-way, a thief who steals the stored hashes still cannot read the passwords.

**Watch out:** a hash is *not* encryption — it has no key and cannot be reversed. And in asymmetric encryption the public key only *locks*, the private key only *unlocks* — don't swap their jobs.

## Practice

Try these in order.

**17.1** How many keys does each user have in *asymmetric* encryption? [1]

**17.2** Which key is shared, and which is kept secret? [1]

**17.3** If a message is locked with someone's *public* key, whose key can unlock it? [1]

**17.4** Can a *hash* be reversed to get the input back? [1]

**17.5** What happens to the digest if you change one letter of the input? [1]

**17.6** Explain why a website stores the *hash* of your password rather than the password itself. [2]

**17.7 Challenge.** Asymmetric encryption removes the key-sharing problem, yet symmetric encryption is still widely used for bulk data. Suggest why. [2]