

Week 5

IGCSE Computer Science

Homework bundle for this week

本周作业合集

exercises.lol

Contents 目录

Topic 2 quiz	2
Exercise sheet 2.1	5
Past-paper questions 2.1	9
Exercise sheet 2.2	18
Past-paper questions 2.2	21
Exercise sheet 2.3	27
Past-paper questions 2.3	30

1. A packet header contains:
 - ☐ the sender and receiver IP addresses and the packet number
 - ☐ only the actual data
 - ☐ the end-of-packet marker
 - ☐ the whole file
2. In an even-parity system, the parity bit is set so that:
 - ☐ the total number of 1s in the byte is even
 - ☐ the byte always ends in 0
 - ☐ the number is positive
 - ☐ the data is encrypted
3. What does encryption achieve?
 - ☐ it makes intercepted data unreadable to the wrong person
 - ☐ it stops data being intercepted at all
 - ☐ it makes data travel faster
 - ☐ it compresses the data
4. Serial transmission:
 - ☐ sends one bit at a time down one wire and is good over long distances
 - ☐ sends several bits at once down several wires
 - ☐ is always faster than parallel
 - ☐ cannot be used on a network
5. A parity check catches a single flipped bit, but if TWO bits flip the 1-count's parity can still look correct, hiding the error.
 - ☐ True ☐ False
6. Symmetric encryption uses:
 - ☐ a single shared key for both encrypting and decrypting
 - ☐ a public key and a private key
 - ☐ no key
 - ☐ a parity bit

7. Simplex sends data one way only, half-duplex sends both ways but one at a time, and full-duplex sends both ways at the same time (like a phone call).
- ☐ True ☐ False
8. Asymmetric encryption is safer for sharing because only the public key is ever sent — the private key that decrypts the data never has to be shared.
- ☐ True ☐ False
9. A checksum detects errors by:
- ☐ recalculating a value from the received data and comparing it with the sent value
 - ☐ sending the data back to the sender
 - ☐ adding a parity bit
 - ☐ encrypting the data
10. In asymmetric encryption, data is encrypted with the _____ key and decrypted with the _____ key.
- ☐ public; private
 - ☐ private; public
 - ☐ same; same
 - ☐ secret; shared

1. the sender and receiver IP addresses and the packet number

The header carries control info (addresses + packet number); the payload is the data; the trailer marks the end + error check.

2. the total number of 1s in the byte is even

Even parity makes the count of 1s even; the receiver re-counts to detect a single-bit error.

3. it makes intercepted data unreadable to the wrong person

Encryption scrambles data so interception is useless — it does not prevent the interception itself.

4. sends one bit at a time down one wire and is good over long distances

Serial = one bit at a time (cheaper, long-distance reliable); parallel = many bits at once (fast, short-distance).

5. True

That blind spot is why stronger checks (checksums, CRC) are used when reliability really matters.

6. a single shared key for both encrypting and decrypting

Symmetric uses one secret key that both sides must share — the risk is that key being stolen.

7. True

The three modes differ by direction and timing: simplex (one way), half-duplex (take turns), full-duplex (both at once).

8. True

Symmetric encryption's weak point is getting the shared key to the other side safely; asymmetric removes that by keeping the private key secret.

9. recalculating a value from the received data and comparing it with the sent value

The receiver recomputes the checksum; if it differs from the sent one, the data is resent.

10. public; private

The public key encrypts; only the matching private key can decrypt — so the secret key is never shared.

2.1 Types and methods of data transmission

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS serial 串行 • packets 数据包 • packet switching 数据包交换 • data transmission 数据传输
• parallel 并行

Objective

Build the skills to answer exam questions on **data transmission** 数据传输 — **packets** 数据包 and packet switching, **serial/parallel** 串行/并行, and **simplex/duplex** 单工/双工.

You must be able to:

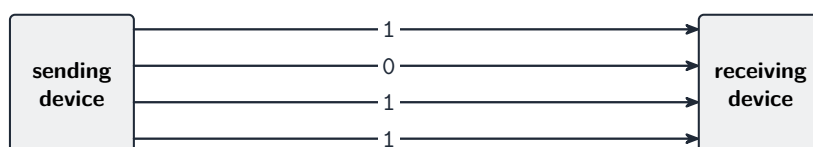
- describe a packet (header, payload, trailer) and packet switching
- compare serial and parallel transmission
- compare simplex, half-duplex and full-duplex

1 Worked examples

■ Transmission methods

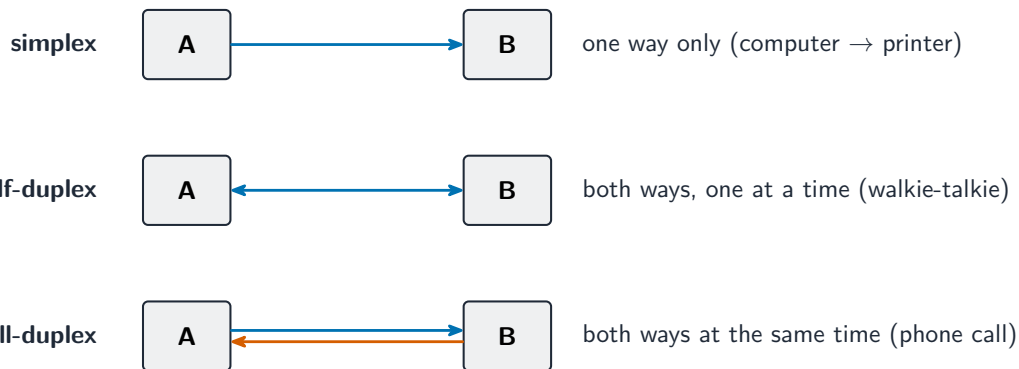


serial: one bit at a time, one wire



parallel: several bits at once, several wires

Serial: one bit at a time, good over long distances, cheaper. Parallel: several bits at once, short distances



Simplex: one way. Half-duplex: both ways, one at a time. Full-duplex: both ways at once

- a **packet** has a header (addresses, packet number), payload (data) and trailer (error check).

2 Practice

2.1 Name the three parts of a packet. [3]

2.2 State the difference between serial and parallel transmission. [2]

3 Exam-style questions

3.1 A walkie-talkie, where only one person speaks at a time, uses: [1]

- **A** simplex
- **B** half-duplex
- **C** full-duplex
- **D** parallel

3.2 Data is sent across a network as packets.

(a) State two benefits of sending data as packets. [2]

(b) Explain why packets may need to be reordered at the receiver. [2]

Solutions

2.1 header; payload; trailer.

2.2 serial sends one bit at a time down one wire; parallel sends several bits at once down several wires.

3.1 B. One at a time both ways is half-duplex.

3.2 (a) any two of: only a lost packet is resent (not the whole file); packets can take different routes; many users share the connection.

(b) packets can take different routes and arrive out of order; the packet numbers are used to put them back in the right order.

3 Data is split into packets before it is transmitted across a network.

(a) The diagram shows a packet with **three** sections.

Complete the diagram by writing the name of each section of the packet.

Write an example in each section of what would be stored in that part of the packet.

Packet	
The first section is called the	First Example
The second section is called the	Second Example
The third section is called the	Third Example

[6]

- (b)** Packets can be sent across a network using different methods of data transmission.

Explain how data is transmitted in the **two** given methods of data transmission.

- (i) Serial full-duplex

..... [4]

[4]

- (ii) Parallel half-duplex

..... [4]

[4]

4 Data packets are transmitted across a network from one computer to another computer.

(a) Describe the structure of a data packet.

[3]

(b) Packet switching is used to transmit the data packets across the network.

Identify the device that controls which path is taken by each data packet.

[1]

(c) Serial data transmission is used to transmit the data packets across the network.

Explain why serial data transmission is used to transmit the data packets.

[3]

2 Data can be transmitted from one device to another.

(a) Tick (✓) **one** box to show which of the terms is **not** a method for transmitting data.

- A** serial ☐
- B** simplex ☐
- C** parallel ☐
- D** parity ☐

[1]

(b) Data is broken down into smaller units to be transmitted from one device to another.

Give the name of the unit that data is broken down into.

..... [1] _____



(c) Data is often encrypted when it is transmitted from one device to another.

(i) Explain how data is encrypted using symmetric encryption.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(ii) Give the purpose of encryption.

.....

..... [1]

7 A company has a network that includes a web server.

Data is transmitted across the network using serial half-duplex data transmission.

(a) Draw and annotate a diagram to show how the data is transmitted using serial half-duplex data transmission.

[4]

(b) Give **two** benefits of the company using serial half-duplex data transmission for this purpose.

1
.....

2
.....

[2]

(c) Give **one** drawback of the company using serial half-duplex data transmission for this purpose.

.....
..... [1]

- (d)** The company uses a proxy server to help protect the web server and the network from cyber security threats.

- (i) Give **three** cyber security threats that the proxy server can help protect against.

1

2

3

[3]

- (ii) Identify **two** functions of the proxy server that can be used to help protect the web server and the network.

1

.....

2

.....

[2]

- (e) Customers access the company's web pages that are stored on the web server.

Describe how the web pages are located, retrieved and displayed on a customer's computer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

4 Data is transmitted between a computer and a printer.

(a) The data is transmitted one bit at a time down a single wire. The computer can transmit data to the printer and the printer can transmit data to the computer, using the same connection.

Circle the **two** data transmission methods that will transmit data in this way.

- parallel full-duplex

parallel half-duplex

parallel simplex

serial full-duplex

serial half-duplex

serial simplex

[2]

(b) An odd parity check is used to detect errors in the data transmission.

Explain how the odd parity check detects errors.

[4]

(c) Another error detection method sends the data from the computer to the printer, then a copy of the data received is sent back from the printer to the computer. The two sets of data are compared to see if they match.

State the name of this type of error detection method.

[1]

7 Complete the statements about data packets and packet switching.

Use the terms from the list.

Some of the terms in the list will **not** be used. You should only use a term once.

- destination address
- first
- footer
- header
- last
- main data
- packets
- payload
- routers
- servers
- trailer

Data is broken down into packets. A data packet has a packet

that contains the packet number and the

Each packet could take a different path from the sender to the receiver; this is controlled by

.....

Packets may arrive out of order. Once the packet has arrived,

the packets are reordered.

[4]

6 The table contains descriptions about data transmission methods.

Complete the table by identifying which data transmission methods are described.

Data transmission method	Description
.....	Data is transmitted down a single wire, one bit at a time, in one direction only.
.....	Data is transmitted down multiple wires, multiple bits at a time, in both directions, but only one direction at a time.
.....	Data is transmitted down a single wire, one bit at a time, in both directions at the same time.
.....	Data is transmitted down multiple wires, multiple bits at a time, in one direction only.

[4]

4 A student uses a mobile phone to take photographs for a school project.

The student needs to transmit the photographs to their computer. They could use serial data transmission or parallel data transmission to transmit the photographs.

(a) (i) Describe how the photographs would be transmitted using serial data transmission.

[2]

(ii) Give **two** benefits of transmitting the photographs using serial data transmission.

1

2

[2]

(iii) State **one** benefit of the student using parallel data transmission instead of serial data transmission.

[1]

(b) The photographs are also transmitted across a network to cloud storage. A device on the network forwards the data towards its correct destination.

(i) State the name of this device.

[1]

(ii) Describe what is meant by cloud storage.

[2]

(iii) Give **one** disadvantage of storing the photographs in cloud storage instead of storing them locally.

2.2 Methods of error detection

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS parity check 奇偶校验 • echo check 回送校验 • checksum 校验和 • parity bit 奇偶校验位
• check digit 校验码

Objective

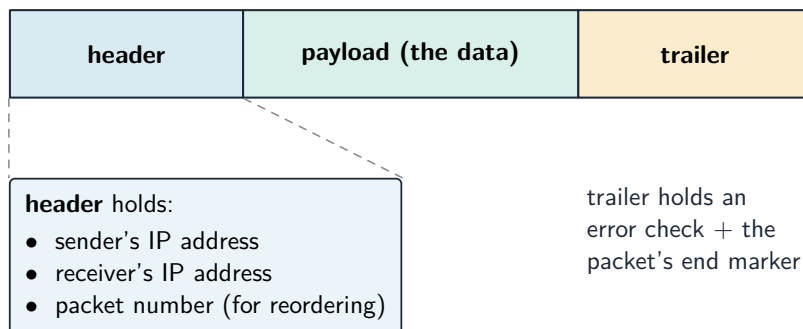
Build the skills to answer exam questions on **error detection** 错误检测 — **parity check** 奇偶校验, **checksum** 校验和, **ARQ** 自动重传请求, and **check digit** 校验码.

You must be able to:

- work out a parity bit and detect a parity error
- describe checksum, echo check and ARQ
- describe a check digit and the errors it catches

1 Worked examples

■ Parity and ARQ



The trailer carries an error check; the receiver checks the data arrived correctly

- **even parity:** total number of 1s must be even; add a parity bit to make it so.
- **ARQ:** receiver sends an acknowledgement; no positive one before the timeout → resend.

2 Practice

2.1 State what a parity bit is used for. [1]

2.2 State one error a check digit can detect. [1]

3 Exam-style questions

3.1 Using **even** parity, the parity bit for the data 1101001 is: [1]

- **A** 0
- **B** 1
- **C** either
- **D** none

3.2 Data is checked using a checksum.

(a) Describe how a checksum detects an error. [2]

(b) Explain why a parity check might fail to detect an error. [2]

3.3 Describe how Automatic Repeat reQuest (ARQ) ensures data arrives correctly. [2]

Solutions

2.1 to detect an error in a byte after transmission.

2.2 any of: an incorrect digit; a transposition error; a missing/extra digit.

3.1 A. 1101001 already has four 1s (even), so the even-parity bit is 0.

3.2 (a) the checksum is calculated from the data before sending and re-calculated at the receiver; if the two values differ, an error has occurred.

(b) if two bits flip, the number of 1s may still be correct, so the parity check passes despite the error.

3.3 the receiver sends a positive or negative acknowledgement; if the sender gets no positive acknowledgement before a timeout, it resends the packet.

7 Data is sent from an employee’s computer to a server. The data is correct when it is sent, but an error is detected when the data is received.

(a) Describe how an error can occur in the data during transmission.

.....

.....

.....

..... [2]

(b) Methods of error detection and correction can be added to make sure that errors are identified after data is transmitted.

Complete the statements about methods of error detection and correction.

Use terms from the list. **Not** all terms need to be used. You should only use each term once.

- acknowledgement automatic repeat query (ARQ) binary bit
- byte calculation check digit checksum correct
- echo check error even incorrect negative
- number odd positive timeout

A parity check is set to be or

..... A parity is added to each byte before transmission to make it match the set parity.

An involves comparing the data sent to the data received back from the receiving device.

An uses acknowledgement and

..... The acknowledgement system can be or

[8]

5

(a)

[4]

(b)

The data is sent to the stock control system using serial simplex data transmission.

(i)

[3]

(ii) Explain why serial simplex is the most appropriate method of data transmission for this purpose.

[3]

(iii) The data is checked for errors after it has been transmitted to the stock control system.

Give **two** error detection methods that could be used for this purpose.

1

2

[2]

- 9

The company owner is concerned that data might have errors after transmission.

- (a)

[3]

- (b)

The error detection system uses an odd parity check and a positive automatic repeat query (ARQ).

- (i)

24

(ii) Give **two** other error detection methods that could be used.

- 1
- 2 [2]

(c) The company owner also installs a firewall to help protect the network from hackers and malware.

(i) Explain how the firewall operates to help protect the network.

-
-
-
-
-
-
-
-
-
- [5]

(ii) Give **two** examples of malware that the firewall can help protect the network from.

- 1
- 2 [2]

6 The table contains statements about error detection methods.

Complete the table by giving the correct error detection method for each statement.

error detection method	statement
.....	An odd or even process can be used.
.....	A value is calculated from the data, using an algorithm. This happens before and after the data is transmitted.
.....	A copy of the data is sent back to the sender by the receiver.
.....	Acknowledgement and timeout are used.
.....	A value is appended to data that has been calculated using the data. This value is checked on data entry.

[5]

2.3 Encryption

Name: _____ Class: _____ Date: _____

Total: 8 marks

KEY WORDS encryption 加密 • symmetric 对称 • symmetric encryption 对称加密 • asymmetric 非对称
• asymmetric encryption 非对称加密

Objective

Build the skills to answer exam questions on **encryption** 加密 — why it is used, and **symmetric** 对称 and **asymmetric** 非对称 encryption.

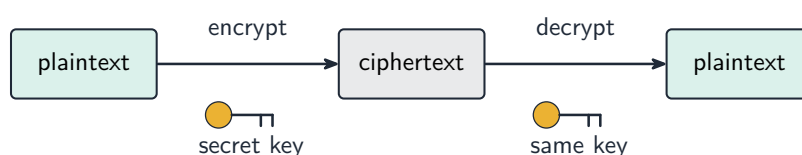
You must be able to:

- explain the purpose of encryption (plaintext → ciphertext)
- describe symmetric encryption (one shared key)
- describe asymmetric encryption (public and private keys)

1 Worked examples

■ Symmetric vs asymmetric

Symmetric: one shared secret key



Asymmetric: a public key and a private key



Symmetric: one shared key. Asymmetric: a public key to encrypt, a private key to decrypt

- encryption scrambles data so it cannot be **understood** if intercepted (it does not stop interception).
- plaintext → (encrypt) → ciphertext.

2 Practice

2.1 State the purpose of encryption. [1]

2.2 Name the readable form of data before it is encrypted. [1]

3 Exam-style questions

3.1 In asymmetric encryption, data encrypted with a public key can be decrypted only with the: [1]

- **A** same public key
 - **B** matching private key
 - **C** shared secret key
 - **D** checksum
-

3.2 A company chooses between symmetric and asymmetric encryption.

(a) State the main risk of symmetric encryption. [1]

(b) Explain why asymmetric encryption is more secure for sharing a key. [2]

3.3 State whether encryption stops data being intercepted, and explain. [2]

Solutions

2.1 to scramble data so it cannot be understood if intercepted.

2.2 plaintext.

3.1 B. It can be decrypted only with the matching private key.

3.2 (a) the shared secret key could be stolen while being sent.

(b) the public key encrypts and only the private key (kept secret) decrypts; so no secret key ever has to be shared.

3.3 no — encryption does not stop interception; it only stops the intercepted data from being understood.

6 Data can be encrypted using asymmetric encryption.

(a) Complete the paragraph about asymmetric encryption.

Use the terms from the list.

Some of the terms in the list will **not** be used. You may use a term more than once.

- algorithm binary cipher text compression error
- hardware hexadecimal meaningless plain text private
- public readable transmission unreadable

Data is encrypted using an encryption key. This is a type of
that scrambles the and turns it into
..... . This makes the data
A key is used to encrypt the data. This key cannot be used
to decrypt the data. A key is used to decrypt the data. Any
device is able to request the key, but only your device
knows the key.

[8]

(b) Data can also be encrypted using symmetric encryption.

Give **one** reason why a person would use asymmetric encryption instead of symmetric encryption.

.....
..... [1]

7 Data is encrypted to keep it safe during transmission.

Complete the paragraph about asymmetric encryption.

Use the terms from the list.

Some of the terms in the list will **not** be used. You should only use a term once.

- asymmetric certificate cipher text
- decrypted encrypted parallel key plain text private key
- protected public key serial key symmetric

..... is encrypted into
using a The encrypted data is then transmitted from the
sender to the receiver. The encrypted data is then decrypted using a
..... .

[4]

7 Data is transmitted using the internet.

(a) The data is encrypted before transmission.

(i) State the purpose of encrypting data.

..... [1]

(ii) Describe the differences between symmetric and asymmetric encryption.

..... [4]

(b) The data is transmitted using packet switching.

(i) Identify **two** items of data contained in a packet header.

1
2 [2]

(ii) Give the purpose of a router in the packet-switching process.

..... [1]

8 (a) Draw and annotate a diagram that demonstrates the cyber security threat of data interception.

[4]

(b) Identify **one** security solution that will help keep data safe from data interception and state why it will help keep the data safe.