

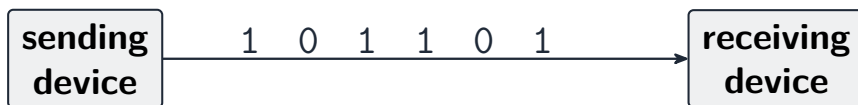
Exercise walk-through

2.1

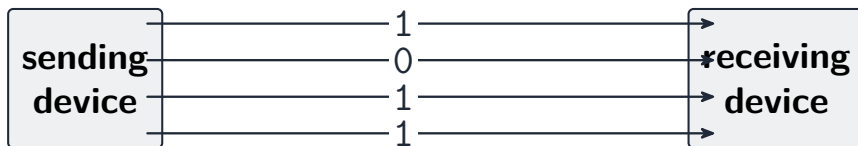
Types and methods of data transmission

IGCSE Computer Science

Serial vs parallel



serial: one bit at a time, one wire



parallel: several bits at once, several wires

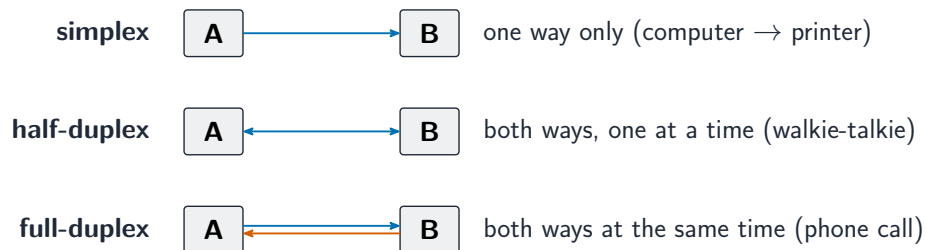
	serial	parallel
bits	one at a time	several at once
wires	one	many
distance	long	short only
cost	cheaper	dearer

Over long parallel wires the bits arrive at slightly different times – which is why long links go **serial** (USB, the S is serial).

Choosing a method

The choice depends on the **distance**, the **speed** needed, the **cost**, and whether data must travel both ways at once.

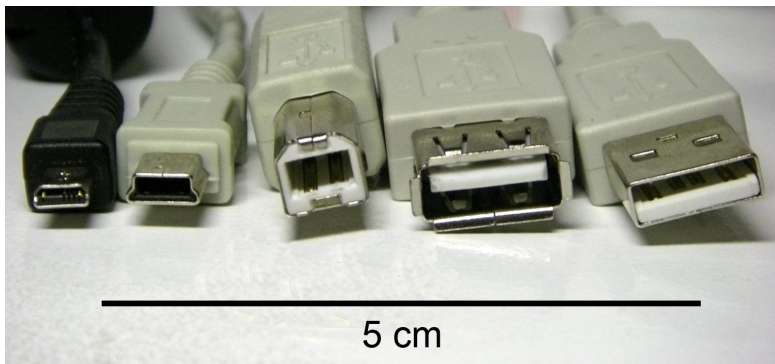
Direction: the three duplexes



- **simplex** : one way only
(PC → printer)
- **half-duplex** : both ways, one at a time
(walkie-talkie)
- **full-duplex** : both ways at once (phone call)

Choose by **distance**, **speed**, **cost**, and whether data must flow both ways **at once**.

USB



The **universal serial bus** is
one standard **interface** :

- one connector for many devices
- auto-detected; driver loaded
- carries power; fits only one way

But: limited cable length, and older versions are slower.

USB: what you give up

Cable length

Only a few metres – beyond that the signal is unreliable, so USB cannot wire a building.

Older versions

An old USB port stays slow even with a new device: both ends must support the newer standard.

Transfer speed

Transfer speeds can be lower than some other connection types – Ethernet or Thunderbolt beat USB for large transfers.

USB wins on convenience (one connector, auto-detected, carries power) and loses on **distance and top speed**.

Exercises 2.1-2.3

2.1 Name the three parts of a packet.

[3]

2.2 State the difference between serial and parallel transmission.

[2]

2.3 Identify the type of transmission used by USB, in both senses (serial or parallel, and which directions).

[2]

Exercises 2.1-2.3

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

2.1

- a packet has three parts
 - **header**, **payload**, **trailer**
-

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

2.2

- **serial**: one bit at a time down one wire
 - **parallel**: several bits at once down several wires
-

2.3 Identify the type of transmission used by USB, in both senses (serial or parallel, and which directions). [2]

2.3

- USB sends bits one after another, so **serial**
- it can send both ways, but not at the same time, so **half-duplex**

Exercises 2.4-2.5

2.4 Complete the parity bit for the byte 1011011 using odd parity, and state the value you chose. [2]

2.5 Give two reasons why USB is widely used. [2]

Exercises 2.4-2.5

2.4 Complete the parity bit for the byte **1011011** using odd parity, and state the value you chose. [2]

2.4

- count the 1s in **1011011**: five, which is already odd
- odd parity needs an odd number of 1s, so the parity bit is **0**; byte sent **10110110**

2.5 Give two reasons why USB is widely used. [2]

2.5

- any **two** of: connector fits only one way / device detected automatically and driver loaded / carries power as well as data / industry standard

Exercise 3.1

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

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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

3.1 B

- only one person speaks at a time, but both can speak, so **half-duplex**
- simplex is one way only; full-duplex is both ways at once; parallel is about wires, not turn-taking

Exercise 3.2 (a)

3.2 Data is sent across a network as packets.

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

[2]

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3.2 Data is sent across a network as packets.

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

[2]

(a)

- any **two** of: only a lost packet is resent / packets can take different routes / many users share the connection

Exercise 3.2 (b)

3.2 Data is sent across a network as packets.

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

[2]

Exercise 3.2 (b)

3.2 Data is sent across a network as packets.

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

[2]

(b)

- packets take different routes and can arrive out of order
- **packet numbers** put them back in the right order

Exercise 3.3 (a)

3.3 A weather station sends readings to a computer 200 metres away.

(a) Identify the method of transmission that should be used over this distance, and explain why. [3]

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(a)

- **serial** transmission
- over 200 m, parallel wires would **skew** (bits arrive at different times)
- the wires would also interfere, so serial is more reliable and needs less cable

Exercise 3.3 (b)

3.3 A weather station sends readings to a computer 200 metres away.

(b) The station only ever sends data and never receives it. Give the name of this type of transmission. [1]

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3.3 A weather station sends readings to a computer 200 metres away.

(b) The station only ever sends data and never receives it. Give the name of this type of transmission. [1]

(b)

- data only ever goes one way
- **simplex**

Exercise 3.3 (c)

3.3 A weather station sends readings to a computer 200 metres away.

(c) Each reading is sent as a byte with even parity. Complete the table by giving the parity bit for each byte. [3]

Data bits	Parity bit
0110110	
1111011	
0000001	

Exercise 3.3 (c)

3.3 A weather station sends readings to a computer 200 metres away.

(c) Each reading is sent as a byte with even parity. Complete the table by giving the parity bit for each byte. [3]

Data bits	Parity bit
0110110	
1111011	
0000001	

(c)

- 0110110 has four 1s (already even) → parity bit **0**
- 1111011 has six 1s (already even) → parity bit **0**
- 0000001 has one 1 (odd) → parity bit **1**

Exercise 3.3 (d)

3.3 A weather station sends readings to a computer 200 metres away.

(d) Explain why a parity check would not detect the error if two bits were changed during transmission. [2]

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(d) Explain why a parity check would not detect the error if two bits were changed during transmission. [2]

(d)

- a parity check only counts the number of 1s
- if one bit flips $0 \rightarrow 1$ and another $1 \rightarrow 0$, the count is unchanged, so the **error is missed**

Exercise 3.3 (e)

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(e) Describe how an echo check works, and give one disadvantage of using it. [3]

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(e)

- the receiver sends a copy straight back; the sender compares it with what it sent
- disadvantage: **doubles the traffic**, or cannot tell whether the error happened on the way out or back

Exercise 3.3 (f)

3.3 A weather station sends readings to a computer 200 metres away.

(f) The computer is connected to a printer with a USB cable. Give two benefits of using USB. [2]

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- any **two** of: connector fits only one way / device and driver detected automatically / carries power / universal standard