Your notes

GCSE Computer Science: revision notes

Data transmission and error checking

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Start here: packets

- Data sent over a network is split into small pieces called **packets**. Each **packet** travels on its own and is put back together at the other end.
- A **packet** has three parts. The header holds the destination address, the source address and the **packet** number. The payload is the data itself. The trailer marks the end of the **packet** and can hold an error check.
- **Packet switching**: each **packet** can take a different route through the routers on the network. **Packets** may arrive out of order, so the packet numbers are used to put them back in the right order. A missing packet is asked for again.

Ways of sending data

- Serial transmission sends one bit at a time down a single wire. It is reliable over long distances.
- Parallel transmission sends several bits at once down several wires. It is fast over short distances, but over long ones the bits can arrive at slightly different times (**skew**), which causes errors.
- Simplex sends data in one direction only. Half-duplex sends both ways, but only one way at a time. **Full-duplex** sends both ways at the same time.
- USB (universal serial bus) is a serial connection. Benefits: it is a standard every computer has, devices are recognised automatically, it can power and charge devices, and newer versions still work with older ones. Drawbacks: cables only work over a few metres, and older versions are slow.

Checking for errors

- Interference, such as electrical noise, can change bits during transmission, so the receiver checks the data.
- Parity check: the sender adds a **parity bit** so the number of 1s is even (even parity) or odd (odd parity). If the count is wrong when the data arrives, there is an error. A parity block checks every row and every column, so the bit that is wrong can be found where the faulty row and column cross.
- **Checksum**: the sender works out a value from the data and sends it too. The receiver works it out again. If the two don't match, the data is sent again.
- **Echo check**: the receiver sends the data straight back, and the sender compares it with the original.
- **Check digit**: an extra digit worked out from the other digits, such as the last digit of an ISBN or a barcode. It catches typing mistakes, such as two digits swapped.
- Automatic repeat query (ARQ): the receiver sends a positive acknowledgement when the data is correct, or a negative one if it isn't. If the sender hears nothing before a timeout, it sends the data again.

Exam tip

- When asked to compare methods, say what each one does and one weakness: a parity check misses an error if two bits flip, and an **echo check** doubles the data sent.

Common mistakes

- Saying parallel is always faster. Over long distances serial is better.
- Mixing up the **check digit**, which catches input errors, with the **checksum**, which checks data after it has been sent.

Worked examples

Add an even parity bit to the 7 bits 1011001.

Count the 1s. **1011001 has four 1s**

Four is already even, so the parity bit is 0. **The byte is 01011001 with the parity bit first**

Answer: 01011001

Key terms

Packet	A small piece of data sent across a network, with a header, a payload and a trailer.

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Packet switching	Sending packets by different routes and putting them back in order when they arrive.
Parity bit	An extra bit that makes the number of 1s odd or even, so errors can be spotted.
Checksum	A value worked out from the data, sent with it, and worked out again by the receiver.
Echo check	Sending the received data back to the sender to compare with the original.
Check digit	A digit worked out from the other digits in a number, used to catch input errors.
Full-duplex	Data is sent in both directions at the same time.
Skew	Bits sent in parallel arriving at slightly different times.

Your notes

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What does a packet's header contain?
2. Why do packets have a packet number?
3. Which method sends one bit at a time down a single wire?
4. What problem affects parallel transmission over long distances?
5. A walkie-talkie lets people talk both ways, but only one at a time. What is this?
6. Using even parity, what is the parity bit for 1110000?
7. What does a parity block let you do that a single parity bit doesn't?
8. In an echo check, what does the receiver do?

Answers

1. The destination address, the source address and the packet number
2. So they can be put back in the right order
3. Serial transmission
4. Skew: bits arrive at slightly different times
5. Half-duplex
6. 1
7. Find which bit is wrong
8. Sends the data back to the sender to compare

What to do next

Practise 10 questions on this topic

Try 3 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.