MODULE D · CAMBRIDGE 0478 2.1-2.3 · OCR J277 1.3.2, 1.4.2, 1.5.2 (ENCRYPTION ONLY)

Data transmission

Packets, **serial and parallel**, **simplex and duplex**, **USB**, **parity**, **checksums**, **echo checks**, **check digits**, **ARQ** and **encryption**. **OCR J277: you only need card 06 (encryption).** Cards 01-05 are IGCSE only. Spec versions as checked in November 2026.

01 Packets (D1) IGCSE only

Packets Data is broken down into packets, each sent on its own.

Header Destination address, packet number, originator's address.

Payload The actual data. **Trailer:** end of packet, error checking data.

Switching Each packet could take a different route; a router controls the route using the destination address.

Arrival May arrive out of order; reordered using packet numbers once the last packet arrives.

02 Transmission methods (D2) IGCSE only

Serial One bit at a time, one wire. No skew, less interference: reliable over long distances. Slower.

Parallel Several bits at once, several wires. Faster over short distances; skew and interference over long ones.

Simplex One direction only.

Half-duplex Both directions, one at a time.

Full-duplex Both directions at the same time. 40 km, both ways at once: serial full-duplex.

03 USB (D3) IGCSE only

What Universal serial bus: serial, one bit at a time down a single wire. Carries power too.

Plug in Device detected automatically; driver installed automatically.

Benefits Universal; cannot be inserted incorrectly; different speeds; backward compatible; powers devices.

Drawbacks Slower transmission than parallel; cable can get in the way.

04 Parity and checksums (D4) IGCSE only

Why check Interference: data lost, gained or changed.

Parity bit Odd or even agreed first. Even: 1010011 (4 ones) gives 01010011.

Receiver Counts the 1s in each byte; wrong parity = error. Misses two changed bits.

Parity block Parity byte checks each column; the wrong row and column cross at the error bit.

Checksum Value calculated from the data; receiver recalculates; no match = error (572 sent, 568 found).

05 Echo, check digit, ARQ (D5) IGCSE only

Echo check Receiver sends a copy back; sender compares. Cannot tell which way the error happened; data sent twice.

Check digit Checks data entry. Calculated from the other digits, recalculated on entry. ISBNs, bar codes.

Example Method given in the question, e.g. weights 5 4 3 2 on 3174: 15+4+21+8 = 48; 55 - 48 = 7, code 31747.

ARQ Sender starts a timer. Receiver checks: positive or negative acknowledgement.

Resend Negative acknowledgement, or none before the timeout: data sent again.

06 Encryption (D6) · both boards

Principle An algorithm and a key scramble the data; it cannot be understood without the key.

Interception Not stopped: intercepted data is meaningless without the key.

Uses Secure websites (HTTPS), Wi-Fi, online payments.

OCR GCSE only Network connections (1.3.2), prevention method (1.4.2), encryption software (1.5.2). Principle only.

Cambridge IGCSE only Plaintext to ciphertext. Symmetric: one shared key, which must be sent. Asymmetric: encrypt with the receiver's public key; only their private key (never sent) decrypts.

01
Skew is a **parallel** problem; it is **bits**, not packets, that travel one at a time down a serial wire.

02
Parity: say **the receiver counts the 1s in each byte**.

03
Check digit = data entry; **checksum** = after transmission.

04
Never write that encryption **stops interception**: the data **cannot be understood** without the key.