

Computer fundamentals · supported focus

International Baccalaureate · IB Diploma · Computer Science · HL

Scope and prerequisites

Supported HL focus. First assessment 2027 target; official PDF returns 403; older acquired brief is final assessment 2026. Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

Computing systems, networks and requirements

■ What would explain this observation?

- A school booking system can calculate correctly and still fail if users lose access or records are disclosed. Success includes the system context.
 - Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.
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■ Build the model

- A computer system combines hardware, software, data and people. A network enables communication using protocols. Requirements should distinguish function from constraints such as availability, security and accessibility.
- **authentication** : Checking an asserted identity; **authorization** : Determining permitted actions.



■ Choose evidence that can test it

- Separate authentication from authorization. Authentication checks identity; authorization determines permitted actions. A threat model connects a valuable asset, a possible attack and an appropriate control.
 - Use a fictitious school dataset to define users and permissions. Draw data flows, compare validation and verification, and specify tests for normal, boundary and invalid input. Do not use real credentials or student records in exercises.
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■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: a file contains 12 megabytes, where this example defines one megabyte as one million bytes. $\text{Bits} = \text{bytes} \times 8 = 12 \times 1,000,000 \times 8 = 96,000,000$ bits. At 8,000,000 bits per second, ideal time = size/rate = 12 s, excluding overhead.

Example:

A 40 million bit file transfers at 5 million bits per second. Find ideal time. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ Check the conclusion and its limits

- Bandwidth is not actual end-to-end throughput. Encryption does not by itself ensure correct authorization or remove every security risk.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Encryption guarantees that every user has appropriate access permissions. This claim is false: Bandwidth is not actual end-to-end throughput. Encryption does not by itself ensure correct authorization or remove every security risk.

Key:

Computing systems, networks and requirements: Separate authentication from authorization. Authentication checks identity; authorization determines permitted actions. A threat model connects a valuable asset, a possible attack and an appropriate control.

■ Runnable trace and boundary

```
size_MB, rate_Mbps = 20, 10
bits = size_MB * 1_000_000 * 8
if rate_Mbps <= 0:
    raise ValueError("Rate must be positive")
seconds = bits / (rate_Mbps * 1_000_000)
print(seconds)
print(0 / (rate_Mbps * 1_000_000))
```

Expected output:

```
16.0
0.0
```

Decimal MB means one million bytes; multiply by eight before dividing by bits per second. Zero data has zero ideal transmission duration. A nonpositive rate is rejected; actual overhead is outside this arithmetic model.