Grade 12 A/L ICT · Lesson 1

1.5 Data Processing: Gathering, Validation, Processing, Output and Storage

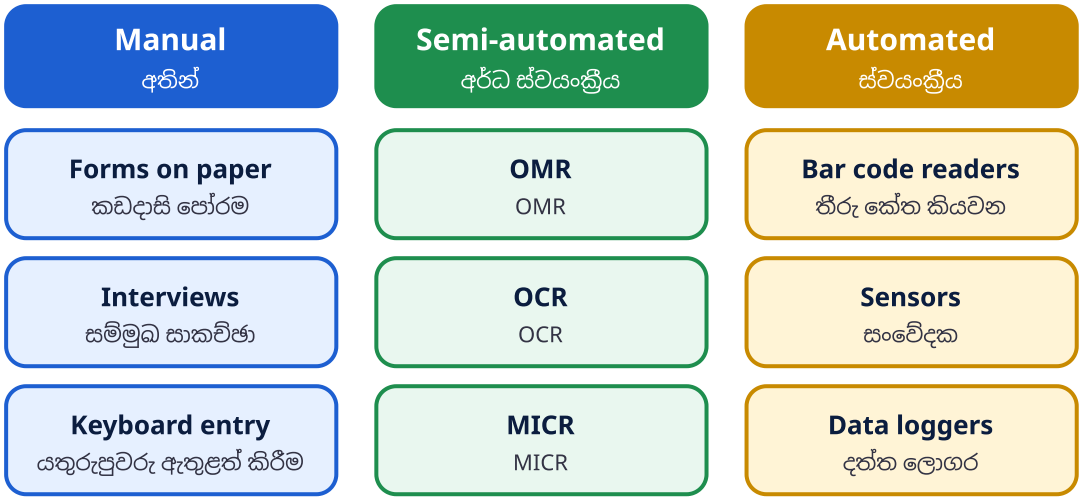
Syllabus 1.5. Data processing is the full set of steps that turns raw data into useful information. In this part you learn the steps in order: **data gathering**, **data input**, **data validation**, **processing**, **output** and **storage**. You also learn the tools used to collect data and the different **modes** of processing.



The steps of data processing.

1. Data gathering

Data can be gathered **manually** (people fill forms, interviews, questionnaires, observation) or **automatically** using machines. Automatic methods are faster and make fewer mistakes.



Automatic data gathering tools.

Tool	How it works	Where it is used
OMR – Optical Mark Reader	Senses pencil or pen marks in fixed boxes	MCQ answer sheets, lottery tickets, surveys
OCR – Optical Character Recognition	Software reads printed or handwritten letters from a scanned image and changes them into editable text	Scanning documents, number plate reading, passports

© 2026 schoolict.net (Ruwan Mangala Suraweera) · All rights reserved

MICR – Magnetic Ink Character Recognition	Reads characters printed in magnetic ink	Bank cheques
Punched cards and paper tape	Holes in fixed positions stand for data (an early method)	Early computers, old voting and attendance machines
Magnetic strip reader	Reads data stored on a magnetic strip	Bank cards, hotel key cards
Bar code / QR code reader	Reads black and white bars or squares using light	Supermarkets, libraries, tickets
Sensors and data loggers	A sensor measures a physical quantity; a data logger records the readings over time	Weather stations, greenhouses, hospitals

🧱 **Worked example: Compare OMR with marking by hand**
A school has **1,800** MCQ answer sheets. An OMR reads **3,600** sheets per hour, a teacher marks **60** per hour. OMR time = 1,800 × 60 ÷ 3,600 = **30 minutes**. Hand time = 1,800 ÷ 60 = **30 hours**.

2. Data input methods

Method	Meaning	Example
Direct input	Data go straight from the source into the computer with no human typing	Bar code scan, sensor, OMR
Indirect input	Data are first written on paper, then typed in later	Census forms typed by clerks
Remote input	Data are entered far away and sent over a network	Online application form, ATM
Online input	Device is connected to the main computer while entering data	Booking a train seat
Offline input	Data are entered and stored first, then uploaded later	Meter reader's handheld device

3. Data validation



Validation checks that data are reasonable before processing.

© 2026 schoolict.net (Ruwan Mangala Suraweera) · All rights reserved

Validation is an automatic check done by the computer to make sure input data are sensible and follow the rules. It cannot prove data are correct (a valid mark 78 may still be typed wrongly) – that is checked by **verification** (double entry or checking against the source).

Check	What it checks	Example
Presence check	A required field is not left blank	Name must be entered
Data type check	Data are the right type (number, text, date)	Age must be a number
Range check	A value is between a lowest and highest value	Mark from 0 to 100
Length check	Data have the right number of characters	Mobile number has 10 digits
Format check	Data follow a pattern	Date as DD/MM/YYYY
Check digit	An extra digit calculated from the others finds typing errors	ISBN, bar codes

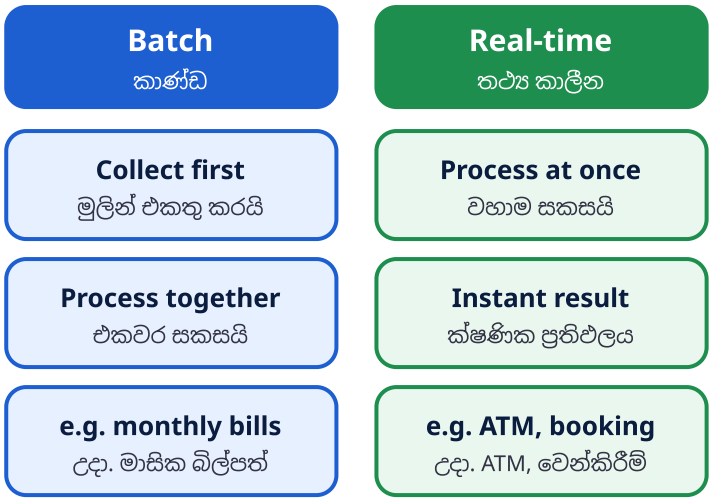
Worked example: the computer checks each student record in this order – presence (name), data type (age and mark are whole numbers), range (mark 0–100). It stops at the first check that fails.

ID	Name	Age	Mark	Result
S01	Nimal	17	78	Valid
S02	(blank)	17	65	Presence check failed
S03	Kamala	seventeen	80	Data type check failed
S04	Ruwan	18	105	Range check failed
S05	Fathima	17	-3	Range check failed
S06	Tharindu	16	0	Valid
S07	Saman	17	100	Valid

💡 Boundary values 0 and 100 are valid. Only S01, S06, S07 pass all checks.

© 2026 schoolict.net (Ruwan Mangala Suraweera) · All rights reserved

4. Data processing modes



Batch processing and real-time processing.

	Batch processing	Real-time processing
Meaning	Data are collected over a period and processed together as one group (batch)	Each item is processed immediately when it arrives
Response	Delayed	Instant
Examples	Electricity and water bills, payroll, exam results	ATM withdrawal, seat booking, traffic lights, air-bag control
Advantages	Uses the computer efficiently at quiet times; good for large volumes	Information is always up to date
Disadvantages	Information is not up to date between runs	Needs powerful, always-on systems; costly

> 🧮 **Worked example: Batch processing of electricity bills**
> Meter readings for **12,000** homes are collected during the month. At night the computer prints **400** bills per minute. Time = 12,000 ÷ 400 = **30 minutes**.

5. Output

Output gives the processed information to users in a useful form: **soft copy** (screen, sound, file) or **hard copy** (printout). Good output is clear, correct, on time and suitable for the user – for example reports, charts, bills, receipts, alerts and SMS messages.

6. Storage

Type	Meaning	Example
Local storage	Data kept on devices you own	Hard disk, SSD, flash drive
Cloud storage	Data kept on servers on the Internet	Google Drive, OneDrive

© 2026 schoolict.net (Ruwan Mangala Suraweera) · All rights reserved

Short-term storage	Holds data while being processed; usually lost when power is off	RAM, cache
Long-term storage	Keeps data for years	Hard disk, optical disc, magnetic tape, cloud archive

🚀 **Beyond the syllabus (2026 update)** *Not required for the exam – read for interest.* **AI-powered data gathering.** In 2026 many apps use AI vision: a phone camera reads a receipt and fills a form (OCR + AI), or a camera counts vehicles for traffic control. Data still need validation, because AI can misread.

Key Words

Data processing – The steps that turn raw data into information.

OMR – A device that senses marks in fixed boxes on a form.

OCR – Software that turns scanned letters into editable text.

MICR – Reading characters printed in magnetic ink on cheques.

Data logger – A device that records sensor readings over time.

Direct input – Data entered straight from the source without typing.

Validation – An automatic check that input data are sensible.

Verification – Checking that data were copied correctly from the source.

Range check – A check that a value is between a lowest and highest value.

Presence check – A check that a required field is not blank.

Batch processing – Collecting data and processing them together later.

Real-time processing – Processing each item immediately as it arrives.

Cloud storage – Keeping data on servers on the Internet.

Sample Q&A

1. List the steps of data processing in order.

> **Answer:** Data gathering, data input, validation, processing, output, storage.

2. Name four automatic data gathering tools.

> **Answer:** OMR, OCR, MICR, bar code reader (also magnetic strip readers, sensors and data loggers).

© 2026 schoolict.net (Ruwan Mangala Suraweera) · All rights reserved

3. Distinguish validation from verification.

> **Answer:** Validation checks data are sensible using rules; verification checks data were copied correctly from the source.

4. Why does mark 105 fail but mark 100 pass a range check of 0–100?

> **Answer:** 100 is the highest allowed value, so it is inside the range; 105 is above it.

5. Give two examples each of batch and real-time processing.

> **Answer:** Batch: electricity bills, payroll. Real-time: ATM withdrawal, train seat booking.

6. Compare local storage and cloud storage.

> **Answer:** Local storage is on your own devices and works without the Internet; cloud storage is on Internet servers and can be reached from anywhere but needs a connection.

MCQ

1. Which device is used to read bank cheques?

A. MICR
B. OMR
C. Plotter
D. Bar code reader
E. Data logger

2. MCQ answer sheets are best read by:

A. OMR
B. Magnetic strip reader
C. Speaker
D. MICR
E. OCR

3. An OMR reads 3,600 sheets per hour. Time for 1,800 sheets?

A. 18 minutes
B. 30 minutes
C. 60 minutes
D. 3 hours
E. 2 minutes

© 2026 schoolict.net (Ruwan Mangala Suraweera) · All rights reserved

4. A teacher marks 60 sheets per hour. Time for 1,800 sheets?

A. 60 hours
B. 3 hours
C. 18 hours
D. 300 hours
E. 30 hours

5. A record has a blank name. Which check fails?

A. Range check
B. Presence check
C. Data type check
D. Format check
E. Check digit

6. Age entered as “seventeen” fails the:

A. Data type check
B. Length check
C. Range check
D. Verification
E. Presence check

7. With a range of 0–100, which mark is INVALID?

A. 100
B. 105
C. 65
D. 78
E. 0

8. In the worked example, which records are valid?

A. S01 only
B. S04, S05
C. S01, S06, S07
D. All seven
E. S01, S02, S07

9. Which is an example of real-time processing?

A. Electricity bills
B. Monthly payroll
C. Yearly census report
D. ATM cash withdrawal
E. Exam result printing

© 2026 schoolict.net (Ruwan Mangala Suraweera) · All rights reserved

10. 12,000 bills are printed at 400 per minute. Time?

A. 300 minutes
B. 12 minutes
C. 30 minutes
D. 3 minutes
E. 48 minutes

11. Entering data on a handheld device and uploading it later is:

A. Verification
B. Real-time output
C. Online input
D. Offline input
E. Cloud storage

12. RAM is an example of:

A. Cloud storage
B. Short-term storage
C. Hard copy
D. An input device
E. Long-term storage

13. Which term means: “The steps that turn raw data into information”?

A. OCR
B. Verification
C. Direct input
D. Data processing
E. Batch processing

14. Which term means: “A device that senses marks in fixed boxes on a form”?

A. Validation
B. Range check
C. MICR
D. Real-time processing
E. OMR

15. Which term means: “Software that turns scanned letters into editable text”?

A. Data logger
B. Presence check
C. OCR
D. Cloud storage
E. Verification

© 2026 schoolict.net (Ruwan Mangala Suraweera) · All rights reserved

16. Which term means: “Reading characters printed in magnetic ink on cheques”?

A. Data processing
B. Direct input
C. MICR
D. Batch processing
E. Range check

17. Which term means: “A device that records sensor readings over time”?

A. Validation
B. Presence check
C. Real-time processing
D. OMR
E. Data logger

18. Which term means: “Data entered straight from the source without typing”?

A. Direct input
B. Batch processing
C. Verification
D. OCR
E. Cloud storage

19. Which term means: “An automatic check that input data are sensible”?

A. Real-time processing
B. MICR
C. Range check
D. Data processing
E. Validation

20. Which term means: “Checking that data were copied correctly from the source”?

A. Presence check
B. Cloud storage
C. Data logger
D. Verification
E. OMR

Structured Questions

1. Name and explain the steps of data processing in the correct order. *(6 marks)*

> Gathering – collect data; input – enter into the computer; validation – check data are sensible; processing – calculate, sort, compare; output – give information; storage – keep for later

© 2026 schoolict.net (Ruwan Mangala Suraweera) · All rights reserved

2. Select a suitable data gathering tool for each: (a) bank cheques (b) MCQ answer sheets (c) supermarket goods (d) greenhouse temperature. Give a reason for one. *(5 marks)*

> (a) MICR; (b) OMR; (c) bar code reader; (d) temperature sensor with data logger; reason e.g. MICR ink cannot easily be forged

3. Records are checked in the order presence, data type, range (mark 0–100). State the result for: S02 (name blank), S03 (age "seventeen"), S04 (mark 105), S07 (mark 100). *(4 marks)*

> S02 – Presence check failed; S03 – Data type check failed; S04 – Range check failed; S07 – Valid (100 is the boundary)

4. Compare batch processing and real-time processing with one example and one advantage of each. *(6 marks)*

> Batch – data grouped and processed later; example electricity bills; advantage efficient for large volumes; real-time – processed at once; example ATM; advantage information always up to date

5. 12,000 electricity bills are processed as a batch at 400 bills per minute. (a) Find the time. (b) Explain why billing suits batch processing. *(4 marks)*

> (a) 12000 ÷ 400 = 30 minutes; (b) readings are collected over a month; no instant answer is needed; can run at night when the computer is free

Summary

- Data processing: gather → input → validate → process → output → store.
- Automatic gathering tools: OMR, OCR, MICR, cards, magnetic strips, bar codes, sensors, loggers.
- Validation checks data are sensible; verification checks they were copied correctly.
- Batch processing groups data; real-time processing acts at once.
- Storage can be local or cloud, short-term or long-term.

MCQ answer key – 1.5

1. **A** – Magnetic ink characters.
2. **A** – Marks in fixed boxes.
3. **B** – 1800 × 60 ÷ 3600 = 30.
4. **E** – 1800 ÷ 60 = 30.
5. **B** – Required field is empty.
6. **A** – Text, not a number.
7. **B** – 105 > 100.
8. **C** – S02–S05 fail a check.
9. **D** – Balance is updated at once.
10. **C** – 12000 ÷ 400 = 30.

© 2026 schoolict.net (Ruwan Mangala Suraweera) · All rights reserved

11. **D** – Not connected while entering.
12. **B** – Lost when power is off.
13. **D** – Data processing – The steps that turn raw data into information.
14. **E** – OMR – A device that senses marks in fixed boxes on a form.
15. **C** – OCR – Software that turns scanned letters into editable text.
16. **C** – MICR – Reading characters printed in magnetic ink on cheques.
17. **E** – Data logger – A device that records sensor readings over time.
18. **A** – Direct input – Data entered straight from the source without typing.
19. **E** – Validation – An automatic check that input data are sensible.
20. **D** – Verification – Checking that data were copied correctly from the source.

© 2026 schoolict.net (Ruwan Mangala Suraweera). All rights reserved.