G.C.E. O/L Grade 11 ICT

Lesson 2: Information Systems and SDLC

- 2.1 Information Systems: Components, Input, Process and Output
- 2.2 System Development Life Cycle (SDLC): Waterfall and Iterative Models

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G.C.E. O/L Grade 11 ICT · Lesson 2

2.1 Information Systems: Components, Input, Process and Output

Syllabus 11.1. Every day you use systems without noticing: the school admission system, the library, the supermarket bill counter, the railway e-ticket app and the O/L results website. In this note you will learn what a **system** is, its parts (**input, process, output**, with **storage, feedback and control**), the difference between **manual** and **computer-based** systems, the difference between **data** and **information**, and why good information helps people make good decisions. You will also draw a simple **data flow diagram**.

1. What is a system?

A **system** is a set of parts that work together to reach a **goal**. Your body, a bus route, a school and a mobile phone are all systems. If one part stops, the whole system is affected. For example, a school canteen is a system: the students order (input), the staff prepare food (process) and the students get their meal (output).

> 💡 Think of a rice cooker. Rice and water go in (input), it cooks (process), cooked rice comes out (output). The switch and timer **control** it, and the light that turns to “warm” is **feedback**.

2. Components of a system

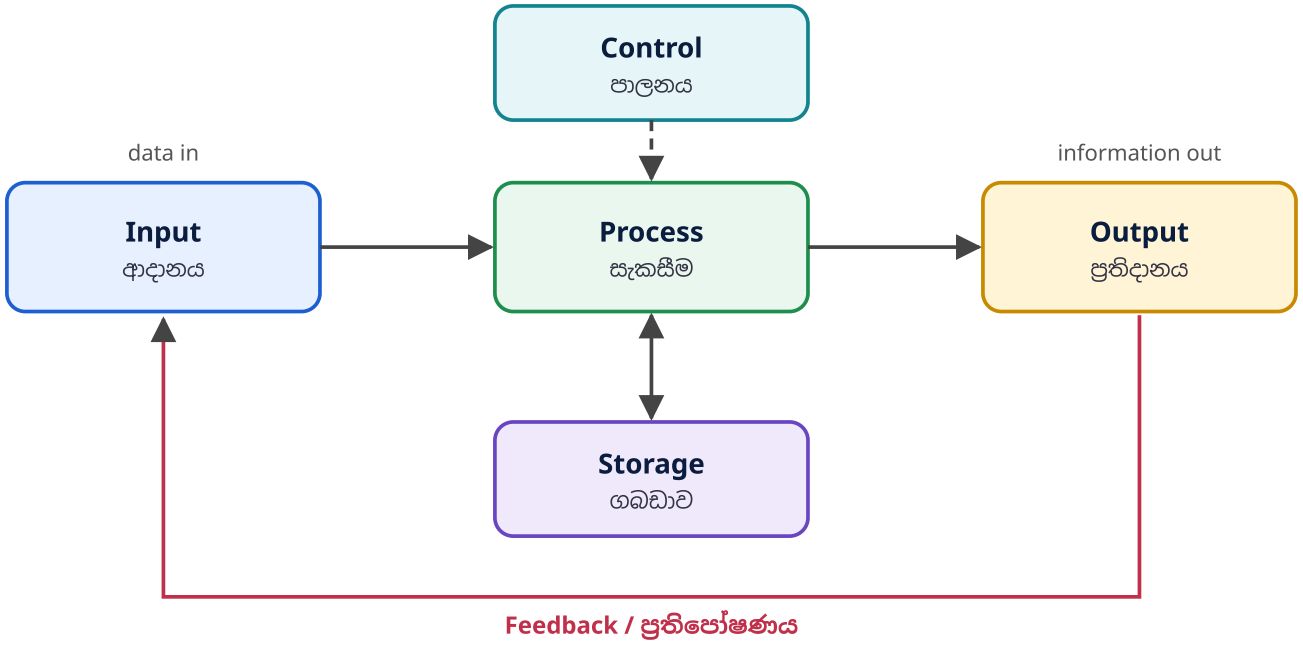


Figure 2.1 – The parts of a system: input, process, output, with storage, control and feedback.

Component	Meaning	Library example

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Input	Data that goes into the system	Member ID and book barcode
Process	Work done on the data	Record the loan, work out the due date
Output	Information that comes out	Receipt with the due date
Storage	Keeping data to use later	Books, Members and Loans tables
Feedback	Output used to check and improve the system	Many overdue books → send SMS reminders
Control	Rules that keep the system working correctly	Only 2 books per student; 14-day loan

3. Manual and computer-based systems

A **manual system** is done by people using paper, pens, registers and files. A **computer-based system** uses computers, software, networks and databases to do the same work. Many schools are moving their library from book cards to a computer system.

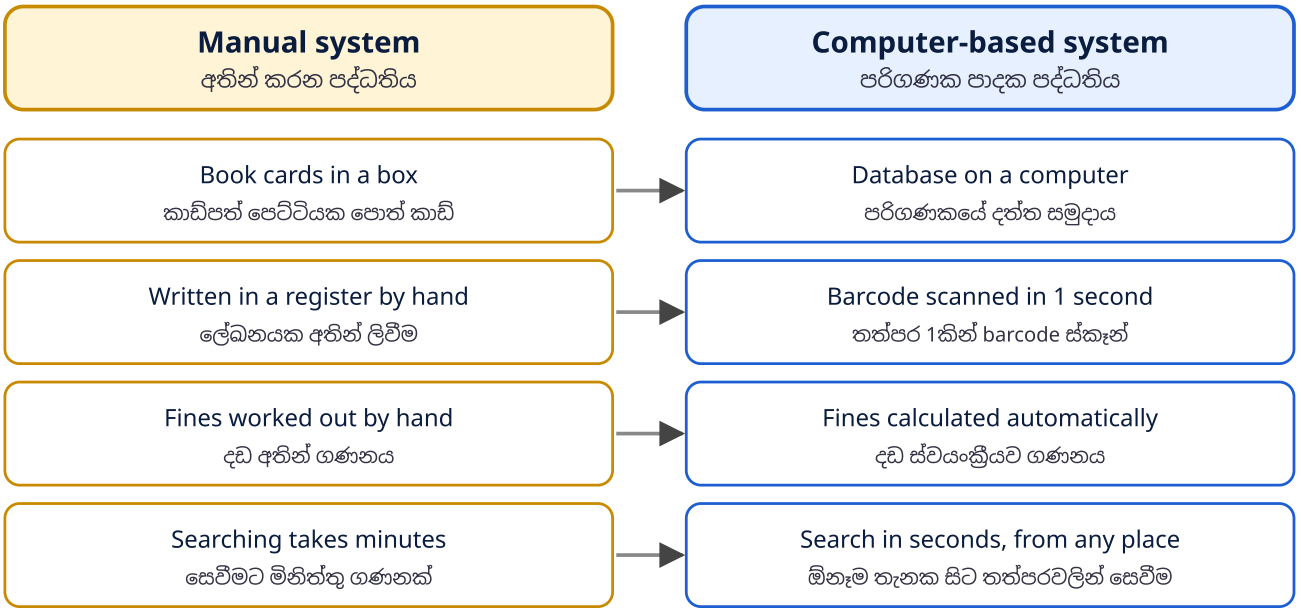


Figure 2.2 – The same library as a manual system and as a computer-based system.

Point	Manual system	Computer-based system
Speed	Slow	Very fast
Accuracy	Human errors are common	Accurate if the data entered is correct
Storage	Needs a lot of space for files	Large amounts on a small disk or the cloud
Searching	Slow, by hand	Fast search and sorting
Cost to start	Low	High (computers, software, training)
Needs electricity / skills	No	Yes

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4. Data and information

Data are raw facts with no meaning by themselves, such as 72, 45, 88. **Information** is data that has been **processed** so it has meaning and is useful, such as “Nimal’s average is 68.3 and he passed”. An **information system** is a system that collects data, processes it, stores it and gives out information to help people make decisions.

Data
දත්ත

Processing
සැකසීම

Information
තොරතුරු

Decision
තීරණය

5. Information and decision making

Managers, teachers, doctors and even students make better decisions when they have good information. A principal uses attendance information to find students who need help; a supermarket manager uses POS sales information to decide what to order; the Ministry uses O/L results to plan A/L classes. Bad information leads to bad decisions.

Quality of good information	Meaning
Accurate	No mistakes
Complete	Nothing important is missing
Timely	Available when it is needed
Relevant	Useful for the decision
Easy to understand	Clear and simple to read
Cost-effective	Worth more than the cost of producing it

6. Sri Lankan information systems

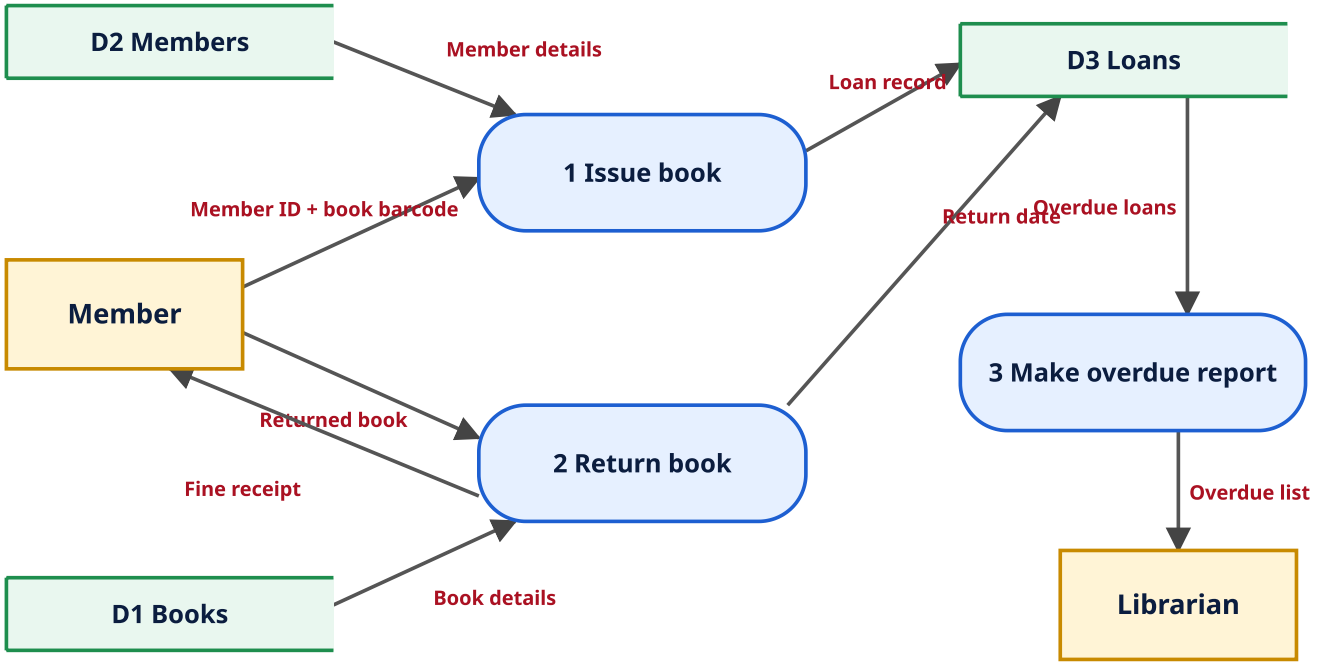
System	Input	Process	Output
School admission system	Application form, birth certificate, distance	Check rules, give marks, rank	Selected list
School library system	Member ID, book barcode	Record loan, find due date, fines	Receipt, overdue list
Supermarket POS	Barcode scans, loyalty card	Find price, add total, update stock	Bill, stock report
Railway e-ticketing	Route, date, seats, payment	Check seats, reserve, take payment	e-ticket with QR code / SMS

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e-channelling (doctor booking)	Doctor, hospital, date, patient details	Find free slot, give number	Appointment number SMS
Exams Department results system	Index number, marks from examiners	Combine marks, give grades	Results online (doenets.lk) and result sheets

7. Data flow diagrams (DFD)

A **data flow diagram** shows how data moves through a system. It uses four symbols: an **external entity** (a person or organisation outside the system, such as a Member), a **process** (work that changes data, such as “Issue book”), a **data store** (where data is kept, such as Loans) and a **data flow** (an arrow with the name of the data).



Rectangle = external entity · rounded box = process · open box = data store · arrow = data flow

Figure 2.3 – A simple data flow diagram of the school library system.

- **External entities (2):** Member, Librarian.
- **Processes (3):** 1 Issue book, 2 Return book, 3 Make overdue report.
- **Data stores (3):** D1 Books, D2 Members, D3 Loans.
- **Data flows (9):** every arrow is named, e.g. “Member ID + book barcode”, “Overdue list”.

NEW 2026 **2026:** Most Sri Lankan systems are now online and on phones – railway e-tickets with a QR code, e-channelling a doctor by app, O/L results by index number on doenets.lk, and school admission applications online. More data means personal data must be protected under the **Personal Data Protection Act No. 9 of 2022 (PDPA)**.

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Key Words

System – A set of parts working together to reach a goal.

Input – Data that goes into a system.

Process – Work done to change data into information.

Output – The information a system gives out.

Storage – Keeping data and information to use later.

Feedback – Using output to check and improve the system.

Control – Rules that make sure the system works correctly.

Data – Raw facts with no meaning by themselves.

Information – Processed data that is meaningful and useful.

Information system – A system that collects, processes, stores and gives out information.

Manual system – A system run by people using paper and files.

Data flow diagram – A diagram showing how data moves between entities, processes and stores.

Sample Q&A

1. What is a system?

> **Answer:** A set of parts that work together to reach a goal.

2. Name the three main components of a system.

> **Answer:** Input, process and output.

3. What is the difference between data and information?

> **Answer:** Data are raw facts; information is processed data that has meaning and is useful.

4. Give two advantages of a computer-based system over a manual system.

> **Answer:** It is faster and searches quickly; it stores large amounts of data in little space (also: fewer errors).

5. Give the input, process and output of a supermarket POS.

> **Answer:** Input: barcode scans; process: find prices and add the total, update stock; output: the bill.

6. Name the four symbols of a data flow diagram.

> **Answer:** External entity, process, data store and data flow.

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MCQ

1. A set of parts that work together to reach a goal is a…

A. system
B. printer
C. program only
D. database field

2. In a library system, scanning a book barcode is…

A. output
B. feedback
C. input
D. storage

3. The receipt showing the due date is…

A. input
B. control
C. output
D. a data store

4. Using the output to check and improve a system is called…

A. feedback
B. storage
C. coding
D. input

5. The rule “only 2 books per student” is an example of…

A. output
B. control
C. feedback
D. data

6. Which of these is data, not information?

A. Nimal’s average is 68.3
B. Class 11A has the highest average
C. Book BK-101 is 3 days late
D. 72, 45, 88

7. Information is…

A. always on paper
B. a type of hardware
C. processed data that is meaningful
D. raw facts only

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8. Which is an advantage of a manual system?

A. Very fast searching
B. Low cost to start
C. Stores millions of records in little space
D. No human errors

9. Information that arrives after the decision was made is not…

A. timely
B. accurate
C. printed
D. stored

10. In a DFD, "D3 Loans" is a…

A. process
B. data flow
C. data store
D. external entity

11. In the library DFD, the Member is a…

A. data store
B. control
C. process
D. external entity

12. In a DFD, a named arrow shows a…

A. data flow
B. process
C. data store
D. printer

13. For the railway e-ticketing system, the output is…

A. the route and date chosen
B. an e-ticket with a QR code
C. the payment card number
D. the train engine

14. The Department of Examinations results system gives out…

A. doctor appointments
B. supermarket bills
C. train seats
D. results by index number

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15. Sri Lanka’s law that protects personal data is the…

A. Education Ordinance of 1939
B. Personal Data Protection Act No. 9 of 2022
C. Copyright Act of 1880
D. Motor Traffic Act

Structured Questions

1. (i) Define a system. (1 mark)
(ii) Name the three main components of a system and give a library example of each. (3 marks) *(4 marks)*

> (i) A set of parts working together to reach a goal (1). (ii) Input – member ID and book barcode (1); process – record the loan and find the due date (1); output – receipt with the due date (1).

2. Explain the difference between data and information with an example from a school. (3 marks) *(3 marks)*

> Data are raw facts, e.g. marks 72, 45, 88 (1). Information is processed data that is meaningful (1), e.g. “average 68.3 – pass” (1).

3. Give two advantages and one disadvantage of changing a school library from a manual system to a computer-based system. (3 marks) *(3 marks)*

> Advantages: faster issuing and searching; fines calculated automatically; less storage space (any two, 2). Disadvantage: high start-up cost / needs electricity and trained staff (1).

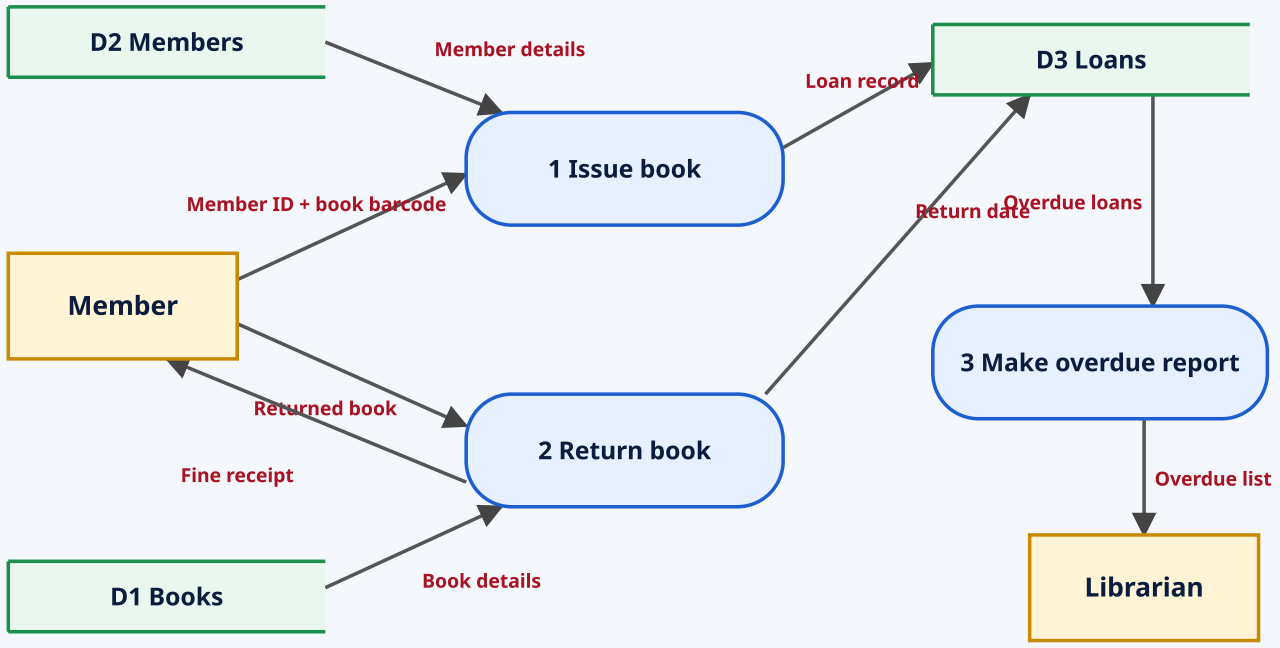
4. List four qualities of good information and explain why one of them matters for a principal’s decision. (5 marks) *(5 marks)*

> Accurate, complete, timely, relevant, easy to understand, cost-effective (any four, 4). E.g. attendance information must be timely so the principal can help a student before the exam (1).

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5. Look at the library DFD (Figure 2.3). (i) Name one external entity, one process and one data store. (ii) Which data flows from "3 Make overdue report" to the Librarian? (4 marks) *(4 marks)*

(i) Member or Librarian (1); 1 Issue book / 2 Return book / 3 Make overdue report (1); D1 Books / D2 Members / D3 Loans (1). (ii) Overdue list (1).



Rectangle = external entity · rounded box = process · open box = data store · arrow = data flow

Figure 2.3 – Library DFD.

Summary

- System = parts working together for a goal.
- Input → Process → Output, with storage, feedback and control.
- Manual = paper; computer-based = faster, accurate, costly to start.
- Data = raw facts; information = processed, meaningful data.
- Good information: accurate, complete, timely, relevant, clear, cost-effective.
- Good information → good decisions.
- DFD: entity, process, data store, data flow.
- Sri Lankan IS: admission, library, POS, e-ticket, e-channelling, results.

MCQ answer key – 2.1

1. **A** – That is the definition of a system.
2. **C** – Data goes into the system.
3. **C** – Information comes out.
4. **A** – Feedback loops back.
5. **B** – Rules control the system.

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6. **D** – Raw numbers with no meaning.
7. **C** – Data + processing = information.
8. **B** – No computers to buy.
9. **A** – Good information is timely.
10. **C** – D = data store.
11. **D** – Outside the system.
12. **A** – Arrows carry data.
13. **B** – The ticket comes out.
14. **D** – Results are its output.
15. **B** – PDPA 2022.

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2.2 System Development Life Cycle (SDLC): Waterfall and Iterative Models

Syllabus 11.2. A new information system is not built in one day. It goes through a set of steps called the **Systems Development Life Cycle (SDLC)**: requirements identification, design, implementation, testing, deployment and maintenance. In this note we follow **one case study** – a new **school library management system** for a Sri Lankan school – through every phase. You will also compare the **phased (waterfall)** and **iterative incremental** life cycles and see what changed in 2026.

1. The six phases of the SDLC

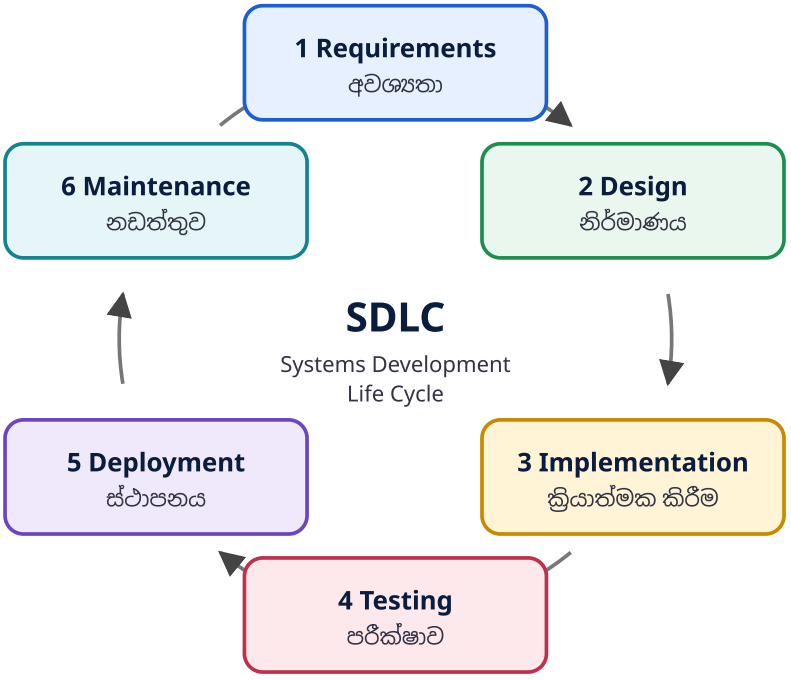


Figure 2.4 – The SDLC: six phases that repeat as the system grows.

💡 Think of building a house. First you ask the family what they need (requirements), an architect draws the plan (design), masons build it (implementation), you check the taps and wires (testing), the family moves in (deployment) and later you repair and extend it (maintenance).

Phase	Case study: school library system
1. Requirements identification	Interview the librarian, give questionnaires to students, observe the issue desk, read the old book cards; feasibility study.

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2. Design	Design the Book and Member tables, the issue screen, the overdue report and the barcode input.
3. Implementation	Programmers write the code and build the database.
4. Testing	Test issuing and returning books with normal, boundary and invalid data.
5. Deployment	Install it in the library, enter all books, train the staff, change over from the cards.
6. Maintenance	Fix a fine-calculation bug, add SMS reminders, make the search faster.

2. Phase 1 – Requirements identification

The analyst finds out **what the users need** and the problems of the present system. In our school, the librarian says book cards get lost, fines are worked out wrongly and no one knows which books are overdue. First a **feasibility study** checks whether the project is worth doing.

Feasibility	Question
Technical	Do we have the computers, network and skills?
Economic	Is the benefit worth the cost?
Operational	Will the librarian and students use it?
Legal	Does it follow the law, e.g. the PDPA 2022?
Schedule	Can it be finished in time, e.g. before the new school year?

Fact finding – four ways to collect the requirements:

Method	Library example	Good point
Interview	Talk to the librarian and the principal	Detailed answers; can ask more questions
Questionnaire	Give a form to 200 students	Many people quickly and cheaply
Observation	Watch the issue desk at the interval	See what really happens
Document review	Read old book cards, registers and fine receipts	Shows the real data used

3. Phase 2 – Design

Design plans **how** the new system will work, before any code is written.

Input design
ආදාන නිර්මාණය

Output design
ප්‍රතිදාන නිර්මාණය

Database design
දත්ත සමුදාය නිර්මාණය

Interface design
අතුරුමුහුණත් නිර්මාණය

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4. Phase 3 – Implementation (coding)

Programmers turn the design into a working program: they create the database tables and write the code for issuing, returning and reports. They write comments and keep the code in version control (e.g. Git) so changes are not lost.

> NEW 2026 **2026 – AI-assisted development:** tools such as GitHub Copilot or ChatGPT can suggest code. Use them responsibly: understand and test every line, never paste real student data into an AI tool, check licences, and say when AI helped.

5. Phase 4 – Testing

Testing finds errors **before** the users do. It is done at four levels, from small parts to the whole system:

Level	What is tested	Library example
Unit testing	One module on its own	The fine calculation function
Integration testing	Modules working together	Issue screen saves into the Loans table
System testing	The whole system, incl. speed and security	100 loans at once; wrong password blocked
User acceptance testing	Real users check it meets their needs	The librarian tries a normal school day

Test data for the field “Mark (0–100)” – choose all three kinds:

Kind	Example values	Expected result
Normal	45, 72	Accepted
Boundary	0, 100	Accepted
Invalid	-5, 105, abc	Rejected with an error message

- **Normal** – ordinary values inside the range.
- **Boundary** – values at the edges of the range (0 and 100).
- **Invalid** – values that must be rejected (−5, 105, “abc”).

> NEW 2026 **2026 – security testing:** test for weak passwords, check that one student cannot see another student’s records, and keep personal data safe as the **PDPA 2022** requires.

6. Phase 5 – Deployment

The system is installed, the old data (all book cards) is entered, users are trained and a user guide is given. Moving from the old system to the new one is called **changeover**. There are four

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methods:

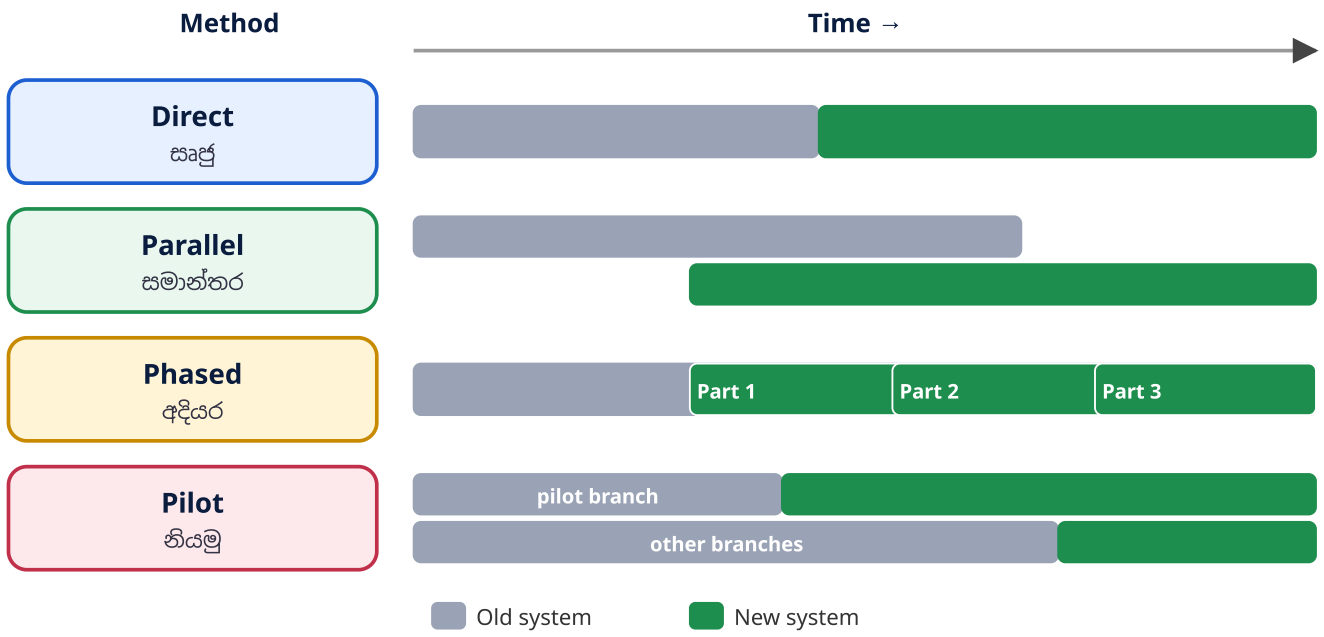


Figure 2.5 – The four changeover methods on a timeline (grey = old system, green = new system).

Method	How	Advantage	Disadvantage
Direct	Old system stops, new starts the same day.	Cheap and quick	High risk if the new system fails
Parallel	Old and new run together for a time.	Safest – old system is a backup	Double work and cost
Phased	New system is brought in one part at a time.	Problems are small and easy to fix	Takes a long time
Pilot	New system is tried in one place first, then everywhere.	Tested in real use with little risk	Other places wait

NEW 2026 **2026 – cloud deployment and app updates:** many systems now run in the **cloud**, so the school needs no server – users open it in a browser. Mobile apps are updated through Google Play / App Store, often every few weeks.

7. Phase 6 – Maintenance

Type	Meaning	Library example
Corrective	Fixing errors (bugs) found after deployment.	Fine shown as Rs. 50 instead of Rs. 5 per day is fixed.
Adaptive	Changing the system to suit a new environment or rule.	Updating the app for a new Android version or the PDPA rules.
Perfective	Improving the system or adding features users ask for.	Adding SMS reminders and a faster search.

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8. Phased (waterfall) and iterative incremental life cycles

In the **phased (waterfall)** life cycle each phase is finished before the next begins, like water falling down steps. In the **iterative incremental** life cycle the system is built in small parts (**increments**); each cycle plans, builds and tests one part, and users try a working version after every cycle.

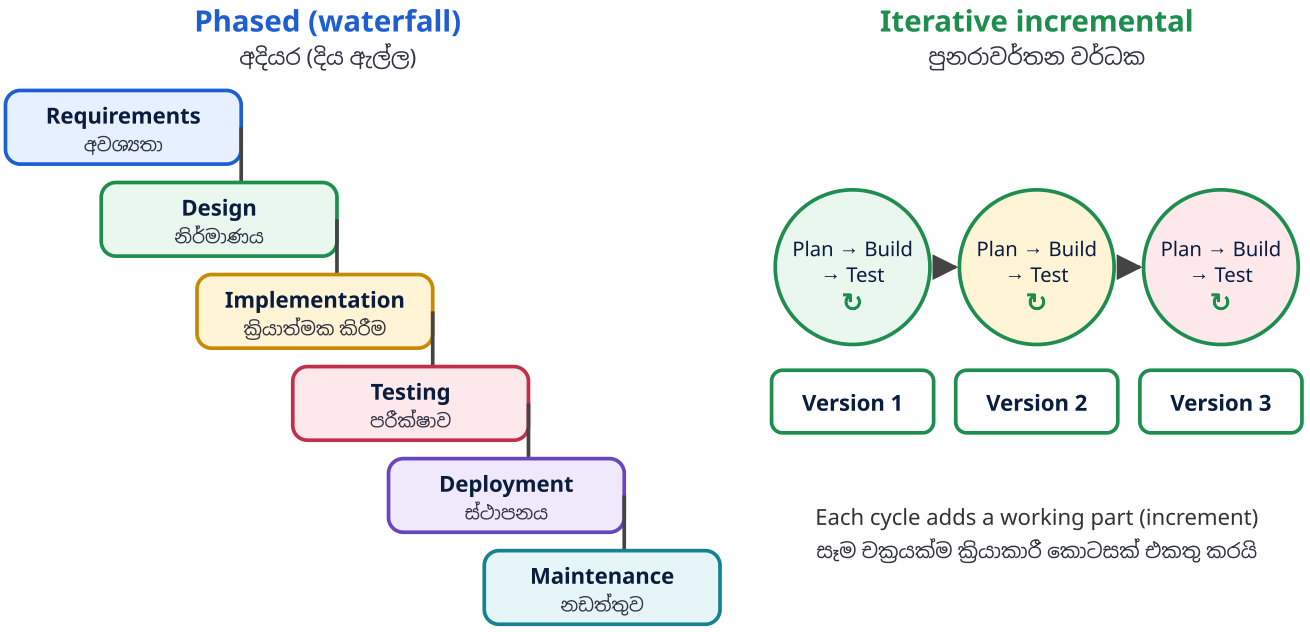


Figure 2.6 – Waterfall steps (left) and iterative incremental loops (right).

Point	Phased (waterfall)	Iterative incremental
Order	Phases run once, one after another	Phases repeat in small cycles
Working version	Only at the end	After every increment
Changing requirements	Hard and costly	Easy – next cycle
User feedback	Mostly at the end	Often, after each increment
Risk	High – problems found late	Lower – problems found early
Best for	Small, clear, fixed projects	Large or changing projects, apps

Library example: with **iterative** development, version 1 only issues and returns books, version 2 adds fines, version 3 adds SMS reminders and reports. The librarian gives feedback after each version.

> NEW 2026 **Extra (beyond the syllabus) – Agile / Scrum:** a popular iterative method in 2026. Work is done in short **sprints** (1–4 weeks); a **product owner** keeps a list of features (**backlog**), and the team meets for a short **daily stand-up**. You do not need Scrum words for the O/L exam.

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Key Words

SDLC – Systems Development Life Cycle – the phases used to build a system.

Feasibility study – Checks if a project is possible and worth doing.

Fact finding – Collecting requirements by interview, questionnaire, observation and document review.

Design – Planning inputs, outputs, database and interface.

Implementation – Writing the code and building the system.

Unit testing – Testing one module on its own.

User acceptance testing – Real users check the system meets their needs.

Boundary data – Test values at the edges of a valid range.

Changeover – Moving from the old system to the new one.

Parallel changeover – Old and new systems run together for a time.

Adaptive maintenance – Changing a system to suit a new environment or rule.

Iterative incremental – Building a system in small repeated cycles, one part at a time.

Sample Q&A

1. What does SDLC stand for?

> **Answer:** Systems Development Life Cycle.

2. List the six phases of the SDLC in order.

> **Answer:** Requirements identification, design, implementation, testing, deployment, maintenance.

3. Name four fact-finding methods.

> **Answer:** Interview, questionnaire, observation and document review.

4. For a mark field 0–100, give one normal, one boundary and one invalid test value.

> **Answer:** Normal 45; boundary 0 or 100; invalid −5, 105 or “abc”.

5. Which changeover method is safest and why?

> **Answer:** Parallel – the old system still runs, so it is a backup if the new one fails.

6. Give one difference between the waterfall and iterative incremental life cycles.

> **Answer:** Waterfall does each phase once and gives a working system only at the end; iterative repeats cycles and gives a working version after each increment.

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MCQ

1. The first phase of the SDLC is…

A. testing
B. requirements identification
C. deployment
D. maintenance

2. Which phase comes straight after design?

A. Requirements identification
B. Maintenance
C. Deployment
D. Implementation

3. Checking whether a project is worth its cost is… feasibility.

A. economic
B. schedule
C. technical
D. legal

4. Watching the librarian at the issue desk is the fact-finding method called…

A. document review
B. observation
C. interview
D. questionnaire

5. The best way to collect views from 200 students quickly is…

A. a questionnaire
B. unit testing
C. an interview with each one
D. observation

6. Planning the Books, Members and Loans tables is part of…

A. observation
B. corrective maintenance
C. database design
D. deployment

7. Testing the fine calculation function on its own is…

A. unit testing
B. user acceptance testing
C. system testing
D. integration testing

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8. The librarian trying the new system on a normal day is…

A. integration testing
B. unit testing
C. document review
D. user acceptance testing

9. For a mark field that accepts 0 to 100, which value is boundary data?

A. 105
B. 100
C. abc
D. 72

10. For the same field, “abc” is…

A. invalid data
B. boundary data
C. a data store
D. normal data

11. Old and new systems running together for a time is… changeover.

A. phased
B. pilot
C. parallel
D. direct

12. Trying the new system in one branch first is… changeover.

A. corrective
B. parallel
C. pilot
D. direct

13. Updating the library app for a new Android version is… maintenance.

A. parallel
B. adaptive
C. corrective
D. perfective

14. In the waterfall life cycle, a working system is usually ready…

A. before requirements
B. after every sprint
C. after each increment
D. only at the end

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15. A responsible way to use an AI coding assistant is to…

A. paste real student data into it
B. submit its code without reading
C. understand and test the code it suggests
D. skip testing

Structured Questions

1. List the six phases of the SDLC in order and give one library example for any two of them. (6 marks) *(6 marks)*

> Requirements identification, design, implementation, testing, deployment, maintenance (4 for all six in order). Examples, e.g. requirements – interview the librarian; maintenance – fix the fine bug (1 each, 2).

2. Name two fact-finding methods and give one advantage of each for the school canteen ordering system. (4 marks) *(4 marks)*

> Questionnaire (1) – collects views of many students quickly (1). Observation (1) – shows the real queue at the interval (1). (Interview / document review also accepted.)

3. A field accepts a student's age from 10 to 19. Give one normal, two boundary and one invalid test value. (4 marks) *(4 marks)*

> Normal, e.g. 15 (1); boundary 10 and 19 (2); invalid, e.g. 25, −1 or "ten" (1).

4. (i) Describe direct and parallel changeover. (2 marks)
(ii) Which would you choose for the O/L results system? Give a reason. (2 marks) *(4 marks)*

> (i) Direct – the old system stops and the new starts at once (1); parallel – both run together for a time (1). (ii) Parallel (1) – results are very important, so the old system is a backup if the new one fails (1).

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5. Compare the waterfall and iterative incremental life cycles under two headings, and name the three types of maintenance. (5 marks) *(5 marks)*

E.g. order – waterfall phases once in sequence, iterative repeats cycles (1); changing requirements – hard in waterfall, easy in iterative (1). Corrective, adaptive, perfective (1 each, 3).

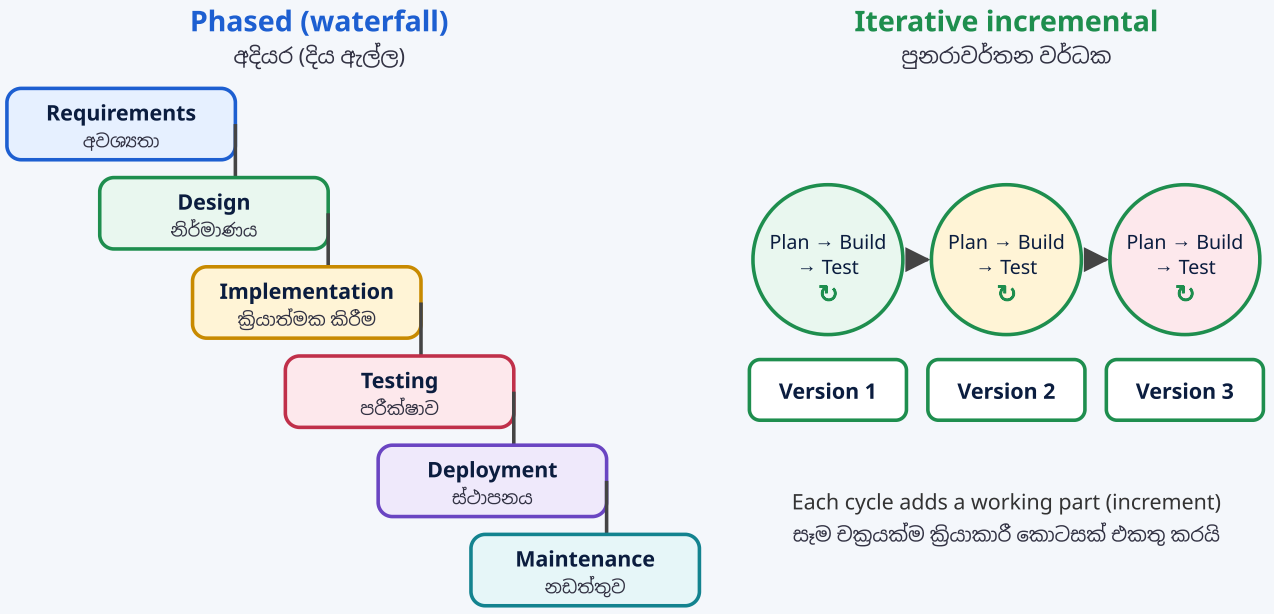


Figure 2.6 – Waterfall and iterative.

Summary

- SDLC: requirements → design → implementation → testing → deployment → maintenance.
- Feasibility: technical, economic, operational, legal, schedule.
- Fact finding: interview, questionnaire, observation, document review.
- Design: input, output, database, interface.
- Testing: unit → integration → system → user acceptance.
- Test data: normal, boundary, invalid.
- Changeover: direct, parallel, phased, pilot; maintenance: corrective, adaptive, perfective.
- Waterfall = once in order; iterative = small repeated cycles.

MCQ answer key – 2.2

1. **B** – Find the needs first.
2. **D** – Design → implementation (coding).
3. **A** – Cost vs benefit.
4. **B** – You watch.
5. **A** – Many people, cheaply.
6. **C** – Design phase.
7. **A** – One module = unit.

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8. **D** – Real users accept it.
9. **B** – At the edge of the range.
10. **A** – Must be rejected.
11. **C** – Both together.
12. **C** – One place first.
13. **B** – New environment.
14. **D** – Phases run once in order.
15. **C** – Understand, test, protect data.

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