CHAPTER 07

The Systems Life Cycle

- Cambridge IGCSE ICT • Chapter 7
- Teaching slides + exam practice with model answers
- Based on the uploaded highlighted chapter

Learning objectives

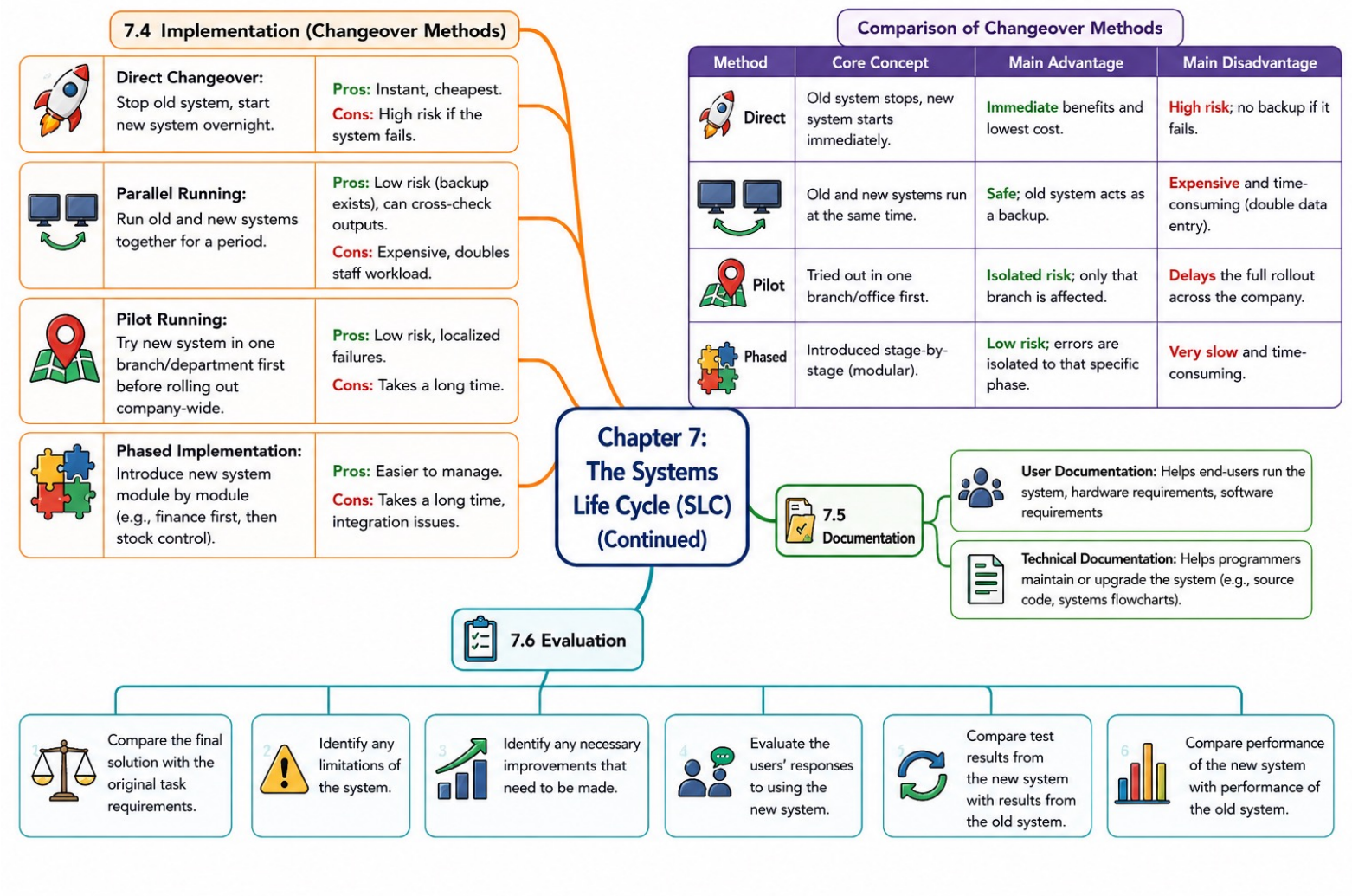
- Analysis, design, development and testing
- Implementation, documentation and evaluation
- Apply knowledge to exam-style scenarios

Six stages of the life cycle

- 1 Analysis → 2 Design → 3 Development & testing
- 4 Implementation → 5 Documentation → 6 Evaluation
- Testing may lead back to design; evaluation can trigger improvements

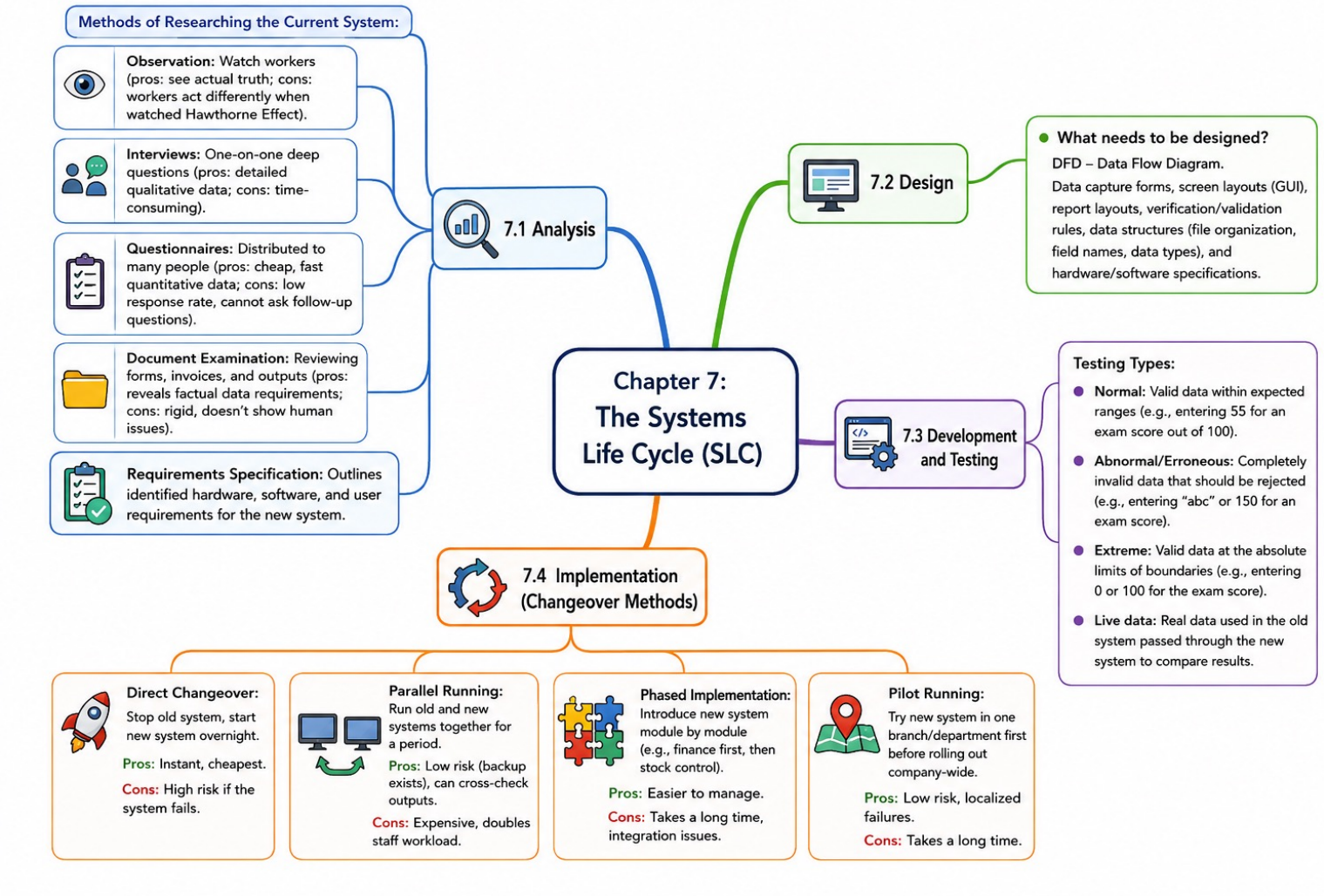
Chapter 7 • Visual mind map (Part 2)

Implementation, documentation and evaluation



Chapter 7 • Visual mind map (Part 1)

Analysis, design, testing and changeover methods



Why replace an existing system?

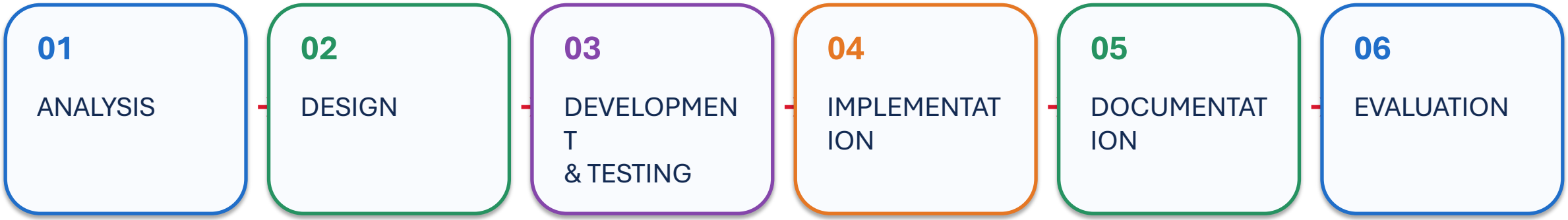
- Obsolete hardware or inability to repair equipment
- Changes in law, taxation or business needs
- Expansion; improved reliability or efficiency

7.1 Analysis: key tasks

- Research the current system
- Identify inputs, outputs, processing and problems
- Determine user and information requirements
- Specify hardware and software for the new system

Systems life cycle • Visual overview

A cyclical process: evaluation can trigger further analysis



REVIEW • IMPROVE • REPEAT

Research method: observation

- Watch staff using the existing system
- Advantages: reliable first-hand information; see actual inputs/outputs
- Disadvantages: Hawthorne effect; workers may change behaviour

Research method: interviews

- One-to-one questions and follow-up discussion
- Advantages: detailed responses; flexible questions; body language
- Disadvantages: time-consuming; costly; lack of anonymity

Research method: questionnaires

- Same questions distributed to many users
- Advantages: low cost, quick analysis, anonymity
- Disadvantages: low response rate; cannot probe vague answers

Research method: existing documents

- Inspect forms, manuals, records and accounts
- Advantages: discover file formats, volumes and existing procedures
- Disadvantages: time-consuming and analyst-intensive

User and information requirements

- User requirements: plain-language description of what users need
- Information requirements: what information is needed and when
- Analyst develops functional requirements specification

Research methods • Visual comparison

Choose a method based on the information needed

OBSERVE

Watch staff perform real tasks.
+ First-hand evidence
− Behaviour may change

INTERVIEW

Ask detailed questions.
+ Follow-up possible
− Slow and costly

QUESTIONNAIRE

Ask many users the same questions.
+ Fast and inexpensive
− Limited detail

DOCUMENTS

Review existing forms and files.
+ Reveals data needs
− Can take time

System specification

- Choose suitable input/output devices and justify each
- Consider operating system and application software
- Off-the-shelf: cheaper/faster but less tailored
- Bespoke: fits exact needs but costly and requires training

7.2 Design

- Design file structures, fields and primary keys
- Design data capture forms, screens and reports
- Specify validation routines

Files, records and fields

- File contains records; record contains fields
- Primary key uniquely identifies each record
- Specify field name, length, data type and codes

Data types

- Alphanumeric / text: codes, telephone numbers
- Character: single letter; Boolean: true/false
- Numeric: integer, real/decimal, currency
- Date/time: dates and times

Validation ≠ verification

- Validation checks whether input meets rules and is reasonable
- Validation does not prove the input is factually correct
- Verification checks whether data was copied or entered accurately

Six validation checks

- Range: allowed minimum/maximum
- Type/character: correct kind of data
- Length: required number of characters
- Format: expected pattern
- Presence: field not empty
- Check digit: calculated digit helps detect entry errors

Data capture forms

- Paper: clear labels, boxes, tick boxes, enough space
- Electronic: drop-downs, radio buttons, on-screen help
- Automatic validation and Save/Clear controls

Output design

- Readable screen layouts with clear labels and fonts
- Appropriate field sizes and good use of screen space
- Reports: clear columns, headers and relevant data

Data validation • Form design example

Visual example of how validation improves data entry

CUSTOMER REGISTRATION

Name [Required]
Date [dd/mm/yyyy]
Age [18 – 100]
Email [name@example.com]

VALIDATION RULES

Presence check → name not blank
Format check → date pattern
Range check → age limits
Type check → age is numeric

7.3 Development and testing

- Create modules, files, interfaces and validation rules
- Test modules individually; fix and retest
- Combine modules and test complete system

Test plan contents

- Test case and input data
- Type of data: normal, extreme or abnormal
- Expected outcome and actual outcome
- Action required if outcomes differ

Normal / extreme / abnormal

- Normal: valid data inside accepted limits
- Extreme: valid data at boundary limits
- Abnormal: invalid data; must be rejected
- Example: range 21–50°C → 35 normal; 21/50 extreme; 20/51 abnormal

Live data testing

- Use real data with known outcomes
- Compare new-system results with existing-system results
- Investigate and correct mismatches

7.4 Implementation

- Transfer existing data and documents
- Train staff to use the new system
- Select a suitable changeover method

Test data • Boundary visual

Example: a temperature field accepts 21°C to 50°C

ABNORMAL

20°C → Reject
51°C → Reject
“fifty” → Reject

EXTREME

21°C → Accept
50°C → Accept

NORMAL

25°C → Accept
35°C → Accept

Direct changeover

- Stop old system and immediately start new system
- Advantage: fast and low operating cost
- Disadvantage: very high risk if new system fails

Parallel running

- Run old and new systems together temporarily
- Advantage: old system is available as backup
- Disadvantage: extra cost and duplicate data entry

Pilot running

- Introduce new system at one branch or location first
- Advantage: problems affect a limited area
- Disadvantage: rollout takes time

Phased implementation

- Introduce new functions or parts one at a time
- Advantage: test each phase before expanding
- Disadvantage: time-consuming and needs staged evaluation

7.5 Documentation

- Technical: code, algorithms, file structures, validation, system requirements
- User: installation, logging in, saving, printing, troubleshooting
- Audience and purpose determine the documentation

7.6 Evaluation

- Compare solution with original requirements
- Gather user feedback using observation, interviews and questionnaires
- Compare performance, time taken and accuracy with old system
- Identify limitations and improvements

Exam practice 1 • 4 marks

- State four methods used to investigate an existing system.
- Think: write an answer using precise ICT terminology.

Changeover methods • Visual comparison

Four approaches to replacing an existing system

DIRECT

OLD ——— STOP
NEW START →
Fast, but high risk

PARALLEL

OLD ———→
NEW ———→
Backup, but costly

PILOT

Branch A: NEW
Other branches: OLD
Limited impact

PHASED

Module A → B → C
Introduce in stages
Slower rollout

Exam practice 1 • 4 marks • Model answer

- Observation
- Interviews
- Questionnaires
- Examination of existing documents

Exam practice 2 • 4 marks

- Explain two disadvantages of using questionnaires.
- Think: write an answer using precise ICT terminology.

Exam practice 2 • 4 marks • Model answer

- Responses may be few, so results may not represent users.
- Questions are fixed, so the analyst cannot ask follow-up questions.

Exam practice 3 • 4 marks

- Explain why a primary key is needed and give one example.
- Think: write an answer using precise ICT terminology.

Exam practice 3 • 4 marks • Model answer

- It uniquely identifies each record in a file.
- It prevents ambiguity when records share other details.
- Example: unique product_code or order reference number.

Exam practice 4 • 6 marks

- Name suitable validation checks for an online form.
- Think: write an answer using precise ICT terminology.

Exam practice 4 • 6 marks • Model answer

- Presence check: required name cannot be blank.
- Format check: date entered as dd/mm/yyyy.
- Length check: password contains exactly eight characters.
- Range check: age or temperature is within allowed limits.
- Type check: numeric field does not contain letters.
- Check digit: detect errors in an identification code.

Exam practice 5 • 6 marks

- A temperature field accepts 21°C to 50°C. Give two examples of each test type.
- Think: write an answer using precise ICT terminology.

Exam practice 5 • 6 marks • Model answer

- Normal: 35, 45 → accepted.
- Extreme: 21, 50 → accepted.
- Abnormal: 20, 51 → rejected.

Exam practice 6 • 6 marks

- Compare direct changeover and parallel running.
- Think: write an answer using precise ICT terminology.

Exam practice 6 • 6 marks • Model answer

- Direct: only new system operates; lower cost and immediate benefits.
- Direct: high risk because old system is unavailable if failure occurs.
- Parallel: both systems run together; old system remains a backup.
- Parallel: more costly and time-consuming due to duplicate work.

Exam practice 7 • 4 marks

- Distinguish pilot and phased implementation.
- Think: write an answer using precise ICT terminology.

Exam practice 7 • 4 marks • Model answer

- Pilot: full new system introduced in one branch/location first.
- Phased: individual parts/functions introduced gradually.
- Pilot limits impact to one site; phased limits impact to one part.

Exam practice 8 • 4 marks

- Give two items in technical documentation and two in user documentation.
- Think: write an answer using precise ICT terminology.

Exam practice 8 • 4 marks • Model answer

- Technical: program code and file structures.
- Technical: validation rules and test data (alternatives).
- User: instructions for installing/running software.
- User: troubleshooting guide and error-message meanings.

Exam practice 9 • 4 marks

- Describe how the new system should be evaluated.
- Think: write an answer using precise ICT terminology.

Exam practice 9 • 4 marks • Model answer

- Compare results against original requirements.
- Observe users and measure task completion time.
- Collect feedback using interviews/questionnaires.
- Compare new-system results with old-system results.

Exam practice 10 • 5 marks

- A company cannot risk losing orders. Recommend a changeover method.
- Think: write an answer using precise ICT terminology.

Exam practice 10 • 5 marks • Model answer

- Parallel running is suitable because the old system stays available.
- If the new system fails, the company can continue taking orders.
- Outputs can be compared while staff learn the new system.
- Trade-off: increased staffing cost and duplicate entry.

Exercise 7a • Data types: answers

- A21DD45678 → alphanumeric
- Y → character (or Boolean if restricted to Y/N)
- Sample_data_items → text
- T or F only → Boolean
- 01214444555 → alphanumeric/text (telephone number)
- 200 → integer; €55 → currency; 24.12 → real
- 22/10/2020 → date; 21:45 → time

Exercise 7b • Password validation

- xxxxnnxx: four letters, two digits, two letters
- Length check: ABcd12EF accepted; ABcd12E rejected
- Format check: ABCD12EF accepted; ABCD1XEF rejected
- Type/character check: letters in x positions, digits in n positions

Exercise 7d • Sample classifications

- Month 12 and 1: extreme; 07: normal
- Month 15, 1.6, 0, 13, March: abnormal
- Day 1 and 31: extreme; 18 and 30: normal
- Day Tuesday, 45, 0: abnormal
- Year examples depend on the specified valid year range
- 0001/1854/2021 cannot be classified uniquely without year limits

Exam technique • Maximise marks

- For “state/name”: provide distinct correct terms
- For “describe”: give a clear feature or process
- For “explain”: add a reason or consequence
- For “compare”: address both alternatives
- For scenarios: apply the answer to the business context

Chapter 7 • Final recap

- ANALYSIS → DESIGN → DEVELOPMENT/TESTING
- → IMPLEMENTATION → DOCUMENTATION → EVALUATION
- Revise research methods, validation, test data and changeover
- SrWL • www.wailinhtet.com