Grade 12 A/L ICT · Lesson 7

7.7 Logical and Physical Design of the Proposed System

Syllabus 7.7. Design turns requirements into a blueprint. In **logical design** you redraw **DFDs for the proposed system**, write **elementary process descriptions in pseudocode**, design the **user interface** and the **logical data structure**. In **physical design** you specify **tables and records**, build a **data dictionary** and design the **database**.

1. Logical design

Logical design removes physical details (who, where, paper) from the current DFD and adds new requirements. Analysts build **bottom-up**: start from elementary processes, group them into level 1, then check the **context diagram** still balances.

EPD in pseudocode

```
PROCESS 2.1 Validate admission
  INPUT StudentID, Name, DateOfBirth
  IF StudentID length <> 6 THEN
     DISPLAY "Invalid ID"
  ELSE IF age < 5 THEN
     DISPLAY "Too young"
  ELSE
     WRITE record to D1 Students
  ENDIF
END PROCESS
```

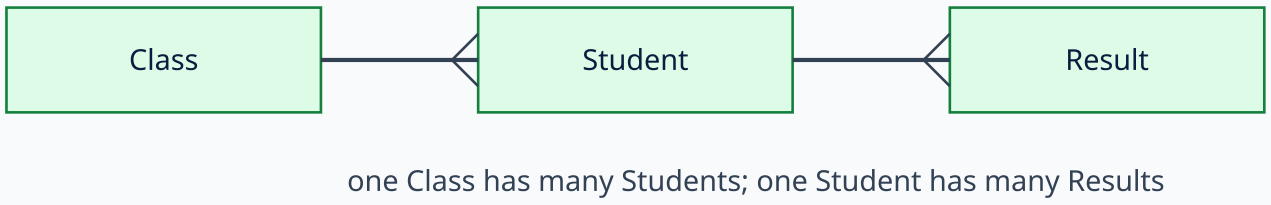
2. User interface design

- Consistent layout, colours and button positions.
- Clear labels, input masks and drop-down lists to reduce errors.
- Helpful error messages and confirmation before delete.

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3. Physical design and data dictionary

Logical data structure – one-to-many relationships



one Class has many Students; one Student has many Results

Proposed LDS

Field	Type	Size (bytes)
StudentID	Text	6
Name	Text	30
DateOfBirth	Date	8
ClassCode	Text	4
Phone	Text	10
Record total		58

🧱 **Worked example: Estimate the Student table size for 1500 records.**
Record size = 6 + 30 + 8 + 4 + 10 = **58 bytes**. Table = 58 × 1500 = **87,000 bytes ≈ 84.96 KB**.

A **data dictionary** stores metadata for every field: name, type, size, format, validation rule, primary/foreign key and description. The **database design** then sets primary keys (StudentID), foreign keys (ClassCode) and indexes.

💡 Logical = what data and processes; physical = exact tables, field types and sizes.

🚀 **Beyond the syllabus (2026 update)** *Not required for the exam – read for interest.* Low-code platforms in 2026 can generate forms and tables directly from a data dictionary.

Key Words

Logical design – Technology-independent design of processes and data.

Physical design – Design with actual tables, fields and programs.

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Logical DFD – DFD of the proposed system without physical details.	**Pseudocode** – Structured English for process logic.
User interface – Screens and forms users interact with.	**Data dictionary** – Store of metadata describing every field.
Record specification – Fields, types and sizes in one record.	**Table specification** – Structure, keys and indexes of a table.
Primary key – Field that uniquely identifies a record.	**Foreign key** – Field linking to a primary key in another table.
Validation rule – Check that input data is sensible.	**Bottom-up design** – Building from elementary processes up to context.

Sample Q&A

1. What is logical design?

> **Answer:** A technology-free design of what the new system processes and stores.

2. Activities in logical design?

> **Answer:** Logical DFDs, EPDs, UI design, logical data structure.

3. What does a data dictionary contain?

> **Answer:** Field name, type, size, format, validation and key information.

4. Record size for the Student table?

> **Answer:** 58 bytes.

5. Why use a foreign key?

> **Answer:** To link related tables, e.g. Student.ClassCode to Class.

6. Give two UI design rules.

> **Answer:** Consistency; clear error messages (also drop-downs to avoid typing errors).

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MCQ

1. Designing exact tables and field sizes is

A. pilot deployment
B. logical design
C. black box testing
D. physical design
E. feasibility

2. Metadata about every field is kept in the

A. data dictionary
B. test log
C. Gantt chart
D. context diagram
E. BSO report

3. A field that uniquely identifies a record is a

A. process
B. primary key
C. foreign key
D. validation rule
E. data flow

4. Record size of the Student table is

A. 70 bytes
B. 116 bytes
C. 58 bytes
D. 5 bytes
E. 48 bytes

5. 1500 records of 58 bytes need

A. 87,000 bytes
B. 88,500 bytes
C. 174,000 bytes
D. 1,500 bytes
E. 8,700 bytes

6. Building from elementary processes up to the context diagram is

A. black box
B. top-down testing
C. direct changeover
D. bottom-up design
E. phased deployment

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7. Process logic in structured English is

A. a foreign key
B. an entity
C. a Gantt bar
D. a data store
E. pseudocode

8. Using drop-down lists on forms mainly

A. increases storage
B. removes primary keys
C. reduces input errors
D. deletes validation
E. slows the system

9. Which term means: “Technology-independent design of processes and data”?

A. Validation rule
B. Logical design
C. Data dictionary
D. Logical DFD
E. Table specification

10. Which term means: “Design with actual tables, fields and programs”?

A. Pseudocode
B. Record specification
C. Physical design
D. Primary key
E. Bottom-up design

11. Which term means: “DFD of the proposed system without physical details”?

A. Foreign key
B. User interface
C. Logical design
D. Logical DFD
E. Table specification

12. Which term means: “Structured English for process logic”?

A. Physical design
B. Validation rule
C. Primary key
D. Data dictionary
E. Pseudocode

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13. Which term means: “Screens and forms users interact with”?

A. Logical DFD
B. User interface
C. Bottom-up design
D. Record specification
E. Foreign key

14. Which term means: “Store of metadata describing every field”?

A. Logical design
B. Validation rule
C. Table specification
D. Pseudocode
E. Data dictionary

15. Which term means: “Fields, types and sizes in one record”?

A. Physical design
B. Record specification
C. Primary key
D. Bottom-up design
E. User interface

16. Which term means: “Structure, keys and indexes of a table”?

A. Table specification
B. Logical DFD
C. Data dictionary
D. Logical design
E. Foreign key

17. Which term means: “Field that uniquely identifies a record”?

A. Validation rule
B. Pseudocode
C. Physical design
D. Primary key
E. Record specification

18. Which term means: “Field linking to a primary key in another table”?

A. Foreign key
B. Bottom-up design
C. User interface
D. Logical DFD
E. Table specification

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19. Which term means: “Check that input data is sensible”?

A. Pseudocode
B. Data dictionary
C. Validation rule
D. Primary key
E. Logical design

20. Which term means: “Building from elementary processes up to context”?

A. Record specification
B. User interface
C. Physical design
D. Foreign key
E. Bottom-up design

Structured Questions

1. Describe logical design and its activities. *(5 marks)*

> Technology-free; logical DFDs; EPDs; UI design; LDS.

2. Write an EPD in pseudocode to validate a 6-character StudentID. *(2 marks)*

> IF length <> 6 THEN error ELSE write record ENDIF.

3. List contents of a data dictionary entry. *(6 marks)*

> Name; type; size; format; validation; key; description.

4. Calculate the Student record and table size. *(2 marks)*

> 58 bytes; 58 × 1500 = 87,000 bytes ≈ 84.96 KB.

5. Distinguish primary and foreign keys with an example. *(2 marks)*

> Primary StudentID unique; foreign ClassCode links to Class table.

Summary

- Logical design is technology-free.
- Build bottom-up from elementary processes.
- EPDs are written in pseudocode.
- Data dictionary holds field metadata.
- Record size = sum of field sizes.

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MCQ answer key – 7.7

1. **D** – Physical.
2. **A** – Data dictionary.
3. **B** – Primary key.
4. **C** – Sum of fields.
5. **A** – Record × count.
6. **D** – Bottom-up.
7. **E** – Pseudocode.
8. **C** – Fewer errors.
9. **B** – Logical design – Technology-independent design of processes and data.
10. **C** – Physical design – Design with actual tables, fields and programs.
11. **D** – Logical DFD – DFD of the proposed system without physical details.
12. **E** – Pseudocode – Structured English for process logic.
13. **B** – User interface – Screens and forms users interact with.
14. **E** – Data dictionary – Store of metadata describing every field.
15. **B** – Record specification – Fields, types and sizes in one record.
16. **A** – Table specification – Structure, keys and indexes of a table.
17. **D** – Primary key – Field that uniquely identifies a record.
18. **A** – Foreign key – Field linking to a primary key in another table.
19. **C** – Validation rule – Check that input data is sensible.
20. **E** – Bottom-up design – Building from elementary processes up to context.

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