Grade 13 A/L ICT · Lesson 8

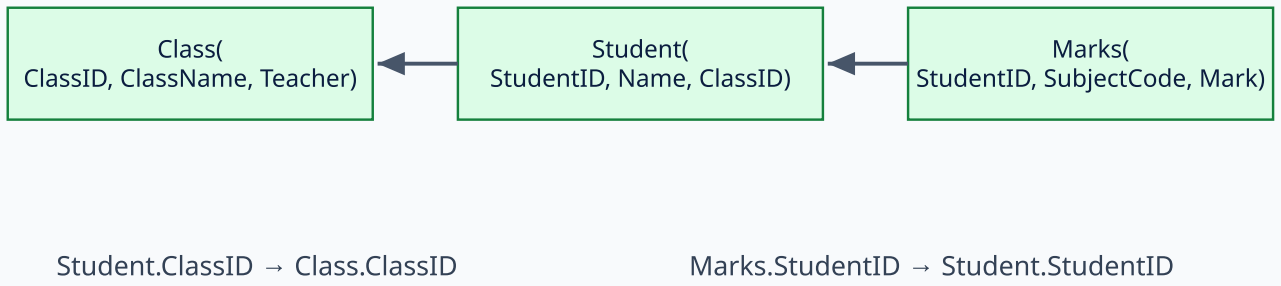
8.5 Logical Schema, Relation Instances and Keys

Syllabus 8.5. The **logical schema** describes the database as relations: each table name with its attributes, keys and **domains**. A **relation instance** is the data in a table at one moment. You learn **candidate**, **primary**, **alternate** and **foreign** keys.

1. Relational schema and instance

A **relational schema** is written as Name(attributes) with the primary key underlined, e.g. Student(StudentID, Name, ClassID). The schema rarely changes; the **instance** (rows) changes every time data is inserted, updated or deleted.

Logical schema: PK underlined, FK arrows



Logical schema of the school database

2. Keys

Candidate key
Minimal set of attributes that uniquely identifies each row.

Primary key
The candidate key chosen to identify rows.

Alternate key
A candidate key that was not chosen as primary.

Foreign key
Attribute that refers to the primary key of another table.

Composite key
Key made of two or more attributes, e.g. (StudentID, SubjectCode).

EmpID	NIC	Email	Name	Dept
E1	901234567V	nimal@co.lk	Nimal	IT

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E2	912345678V	kamala@co.lk	Kamala	HR
E3	923456789V	sunil@co.lk	Nimal	IT
E4	934567890V	amali@co.lk	Amali	IT

🧱 **Worked example: Find the candidate, primary and alternate keys of Employee from this instance.**
A program tested every set of columns for uniqueness. Single-column candidate keys: **EmpID, NIC, Email**. Name is not unique (two Nimal) and (Name, Dept) is not unique (Nimal, IT twice). Choose **EmpID** as primary key; **NIC, Email** are alternate keys.

3. Domains

A **domain** is the set of allowed values for an attribute: Mark is an integer 0–100, ClassID is 4 characters starting with C, Date is a valid calendar date. Domains are enforced with data types and CHECK constraints.

💡 A sample instance can prove a set is NOT a key (a duplicate appears), but the real rule comes from the business meaning.

🚀 **Beyond the syllabus (2026 update)** *Not required for the exam – read for interest.* In 2026 many systems use random UUIDs as surrogate primary keys so records from phones and the cloud never clash.

Key Words

Logical schema – Description of a database as relations, attributes and keys.

Relational schema – The name and attribute list of one relation.

Relation instance – The set of rows in a table at a given time.

Candidate key – Minimal attribute set that uniquely identifies rows.

Primary key – Candidate key chosen as the main identifier.

Alternate key – Candidate key not chosen as primary key.

Foreign key – Attribute referencing the primary key of another relation.

Composite key – Key consisting of more than one attribute.

Super key – Any attribute set that uniquely identifies rows, minimal or not.

Domain – Allowed values of an attribute.

Surrogate key – Artificial key such as an auto number with no business meaning.

Referential integrity – Every foreign key value matches an existing primary key.

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Sample Q&A

1. Schema vs instance?

> **Answer:** Schema is the structure; instance is the current rows.

2. Candidate keys of Employee?

> **Answer:** EmpID, NIC, Email.

3. Why is Name not a key?

> **Answer:** Two employees are named Nimal.

4. What is an alternate key?

> **Answer:** A candidate key not chosen as primary, e.g. NIC.

5. Give a composite key in the school database.

> **Answer:** (StudentID, SubjectCode) in Marks.

6. What is the domain of Mark?

> **Answer:** Integers from 0 to 100.

MCQ

1. The rows of a table at one moment form a

A. relation instance
B. domain
C. relational schema
D. candidate key
E. data model

2. A minimal set of attributes that identifies rows is a

A. candidate key
B. tuple
C. domain
D. degree
E. foreign key

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3. A candidate key not chosen as primary is a

A. surrogate key
B. alternate key
C. foreign key
D. super key only
E. composite key

4. Number of single-column candidate keys in the Employee instance

A. 1
B. 2
C. 4
D. 5
E. 3

5. Why is (Name, Dept) not a key of Employee?

A. Name is a foreign key
B. (Nimal, IT) appears twice
C. keys cannot use text
D. it has two columns
E. Dept is numeric

6. (StudentID, SubjectCode) in Marks is a

A. composite primary key
B. alternate key
C. domain
D. derived attribute
E. foreign key only

7. The allowed values 0–100 for Mark are its

A. degree
B. domain
C. instance
D. schema
E. cardinality

8. Every FK value matching an existing PK is

A. redundancy
B. a domain
C. referential integrity
D. a super key
E. normalisation

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9. Which term means: “Description of a database as relations, attributes and keys”?

A. Composite key
B. Relation instance
C. Surrogate key
D. Logical schema
E. Alternate key

10. Which term means: “The name and attribute list of one relation”?

A. Foreign key
B. Super key
C. Relational schema
D. Referential integrity
E. Candidate key

11. Which term means: “The set of rows in a table at a given time”?

A. Domain
B. Composite key
C. Logical schema
D. Relation instance
E. Primary key

12. Which term means: “Minimal attribute set that uniquely identifies rows”?

A. Super key
B. Candidate key
C. Relational schema
D. Alternate key
E. Surrogate key

13. Which term means: “Candidate key chosen as the main identifier”?

A. Domain
B. Relation instance
C. Foreign key
D. Primary key
E. Referential integrity

14. Which term means: “Candidate key not chosen as primary key”?

A. Logical schema
B. Composite key
C. Candidate key
D. Surrogate key
E. Alternate key

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15. Which term means: “Attribute referencing the primary key of another relation”?

A. Super key
B. Referential integrity
C. Foreign key
D. Relational schema
E. Primary key

16. Which term means: “Key consisting of more than one attribute”?

A. Domain
B. Relation instance
C. Composite key
D. Logical schema
E. Alternate key

17. Which term means: “Any attribute set that uniquely identifies rows, minimal or not”?

A. Surrogate key
B. Relational schema
C. Foreign key
D. Candidate key
E. Super key

18. Which term means: “Allowed values of an attribute”?

A. Domain
B. Relation instance
C. Composite key
D. Primary key
E. Referential integrity

19. Which term means: “Artificial key such as an auto number with no business meaning”?

A. Super key
B. Alternate key
C. Candidate key
D. Logical schema
E. Surrogate key

20. Which term means: “Every foreign key value matches an existing primary key”?

A. Relational schema
B. Primary key
C. Domain
D. Referential integrity
E. Foreign key

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Structured Questions

1. Define logical schema and relation instance. *(2 marks)*

> Logical schema relations and keys; instance current rows.

2. Write the relational schema of the school database with keys. *(3 marks)*

> Class(ClassID…); Student(StudentID…, ClassID FK); Marks(StudentID, SubjectCode, Mark).

3. Identify candidate, primary and alternate keys of Employee. *(3 marks)*

> Candidate EmpID, NIC, Email; primary EmpID; alternate NIC, Email.

4. Distinguish foreign key and composite key. *(2 marks)*

> FK references another PK; composite key has several attributes.

5. Explain domain with two examples. *(3 marks)*

> Allowed values; Mark 0–100; ClassID 4 characters.

Summary

- Logical schema = relations, attributes and keys.
- Instance = rows at one moment.
- Candidate keys are minimal unique sets.
- One candidate becomes primary; others are alternate.
- Foreign keys reference primary keys.

MCQ answer key – 8.5

1. **A** – Instance.
2. **A** – Candidate.
3. **B** – Alternate.
4. **E** – EmpID, NIC, Email.
5. **B** – Duplicate.
6. **A** – Composite.
7. **B** – Domain.
8. **C** – Referential integrity.
9. **D** – Logical schema – Description of a database as relations, attributes and keys.
10. **C** – Relational schema – The name and attribute list of one relation.
11. **D** – Relation instance – The set of rows in a table at a given time.
12. **B** – Candidate key – Minimal attribute set that uniquely identifies rows.
13. **D** – Primary key – Candidate key chosen as the main identifier.
14. **E** – Alternate key – Candidate key not chosen as primary key.
15. **C** – Foreign key – Attribute referencing the primary key of another relation.

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16. **C** – Composite key – Key consisting of more than one attribute.
17. **E** – Super key – Any attribute set that uniquely identifies rows, minimal or not.
18. **A** – Domain – Allowed values of an attribute.
19. **E** – Surrogate key – Artificial key such as an auto number with no business meaning.
20. **D** – Referential integrity – Every foreign key value matches an existing primary key.

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