Overview of Database Models

BASIC DEFINITIONS:

- **DATA**: KNOWN FACTS THAT CAN BE RECORDED AND HAVE AN IMPLICIT MEANING.
- **TABLE**: A COLLECTION OF DATA ELEMENTS ORGANIZED IN TERMS OF ROWS AND COLUMNS.
- **RECORD/TUPLE**: A SINGLE ENTRY IN A TABLE IS CALLED A RECORD OR A TUPLE.
- **FIELD**: A TABLE CONSISTS OF SEVERAL RECORDS(ROW), EACH RECORD CAN BE BROKEN INTO SEVERAL SMALLER ENTITIES KNOWN AS FIELDS.
- **DATABASE**: A COLLECTION OF RELATED DATA.
- **DATABASE MANAGEMENT SYSTEM (DBMS)**: A SOFTWARE PACKAGE/ SYSTEM TO FACILITATE THE CREATION AND MAINTENANCE OF A COMPUTERIZED DATABASE.
- **DATABASE SYSTEM**: THE DBMS SOFTWARE TOGETHER WITH THE DATA ITSELF. SOMETIMES, THE APPLICATIONS ARE ALSO INCLUDED.

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Overview of Database Models

DATABASE MODELS:

- DEFINE HOW THE LOGICAL STRUCTURE OF A DATABASE IS MODELED.
- ARE FUNDAMENTAL ENTITIES TO INTRODUCE ABSTRACTION IN A DBMS.
- DEFINE HOW DIFFERENT PARTS OF DATA ARE CONNECTED TO EACH OTHER AND HOW THESE ARE PROCESSED AND STORED INSIDE THE SYSTEM.

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Overview of Database Models

TYPES OF DATABASE MODELS:

- HIERARCHICAL MODEL
- NETWORK MODEL
- RELATIONAL MODEL
- OBJECT-ORIENTED MODEL

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Overview of Database Models (Contd.)

HIERARCHICAL MODEL:

- THE DATA IS ORGANIZED IN A TREE STRUCTURE.
- THERE IS A HIERARCHY OF PARENT AND CHILD DATA SEGMENTS.
- A PARENT CAN HAVE MANY CHILDREN, BUT A CHILD CAN HAVE A SINGLE PARENT.
- THIS STRUCTURE ALLOWS ONE-TO-MANY RELATIONSHIP BETWEEN TWO TYPES OF DATA.

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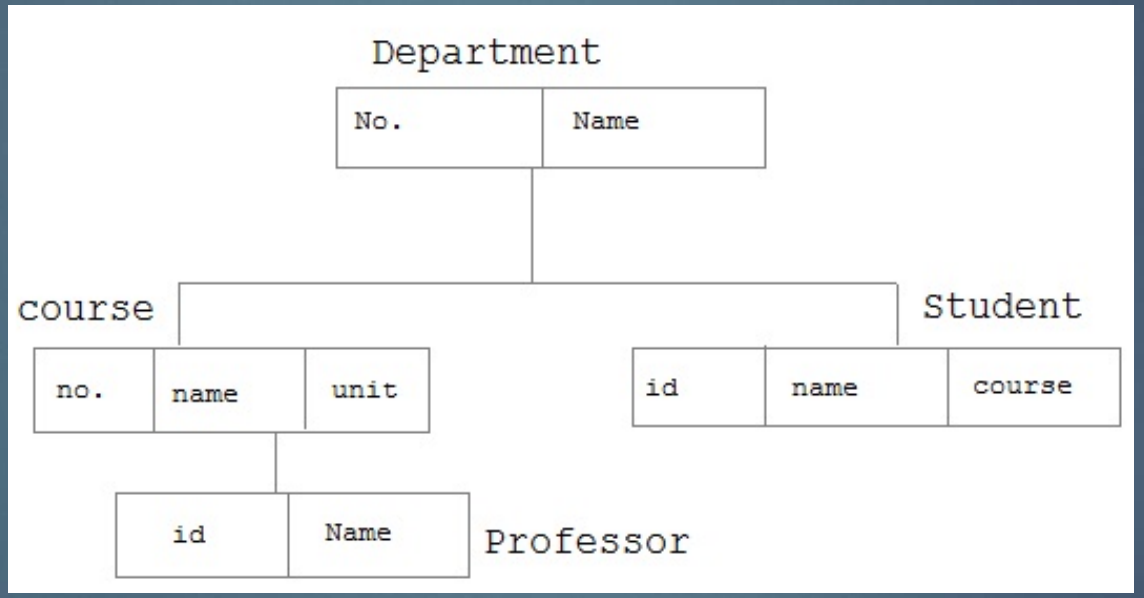
Overview of Database Models (Contd.)

EXAMPLE OF HIERARCHICAL MODEL:



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Overview of Database Models (Contd.)

NETWORK MODEL:

- ENTITIES ARE ORGANIZED IN A GRAPH, IN WHICH SOME ENTITIES CAN BE ACCESSED THROUGH SEVERAL PATH.
- A PARENT CAN HAVE MULTIPLE CHILDREN AND A CHILD CAN ALSO HAVE MULTIPLE PARENTS.
- THIS STRUCTURE ALLOWS MANY-TO-MANY RELATIONSHIP BETWEEN TWO TYPES OF DATA.

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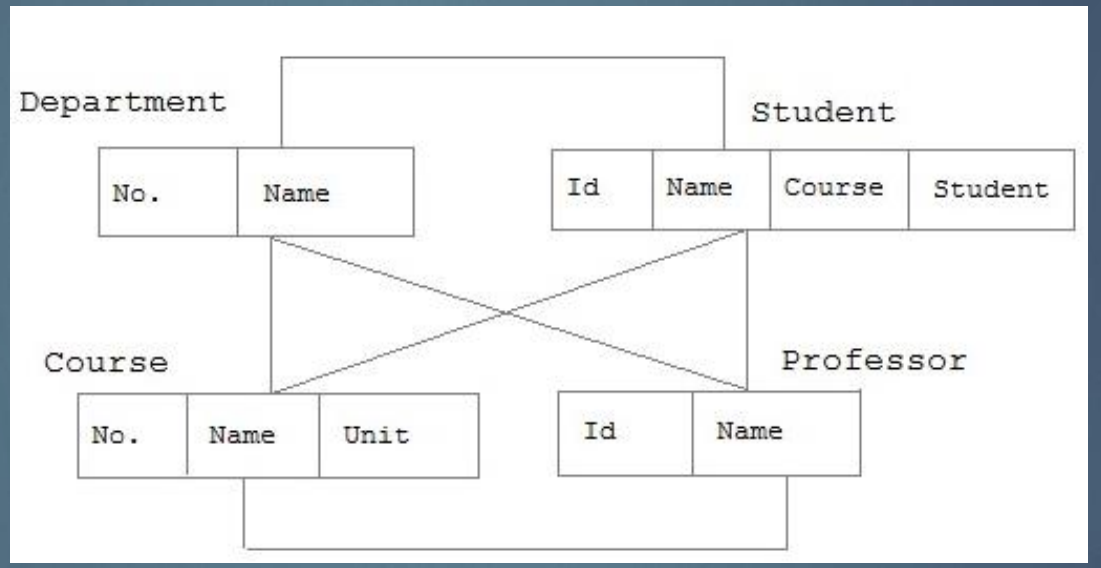
Overview of Database Models (Contd.)

EXAMPLE OF NETWORK MODEL:



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Overview of Database Models (Contd.)

RELATIONAL MODEL:

- ALL DATA IS REPRESENTED IN TERMS OF TUPLES, GROUPED INTO RELATIONS.
- THE TABLES OR RELATIONS ARE RELATED TO EACH OTHER.
- A DATABASE ORGANIZED IN TERMS OF THE RELATIONAL MODEL IS A RELATIONAL DATABASE.
- THE PURPOSE OF THE RELATIONAL MODEL IS TO PROVIDE A DECLARATIVE METHOD FOR SPECIFYING DATA AND QUERIES.

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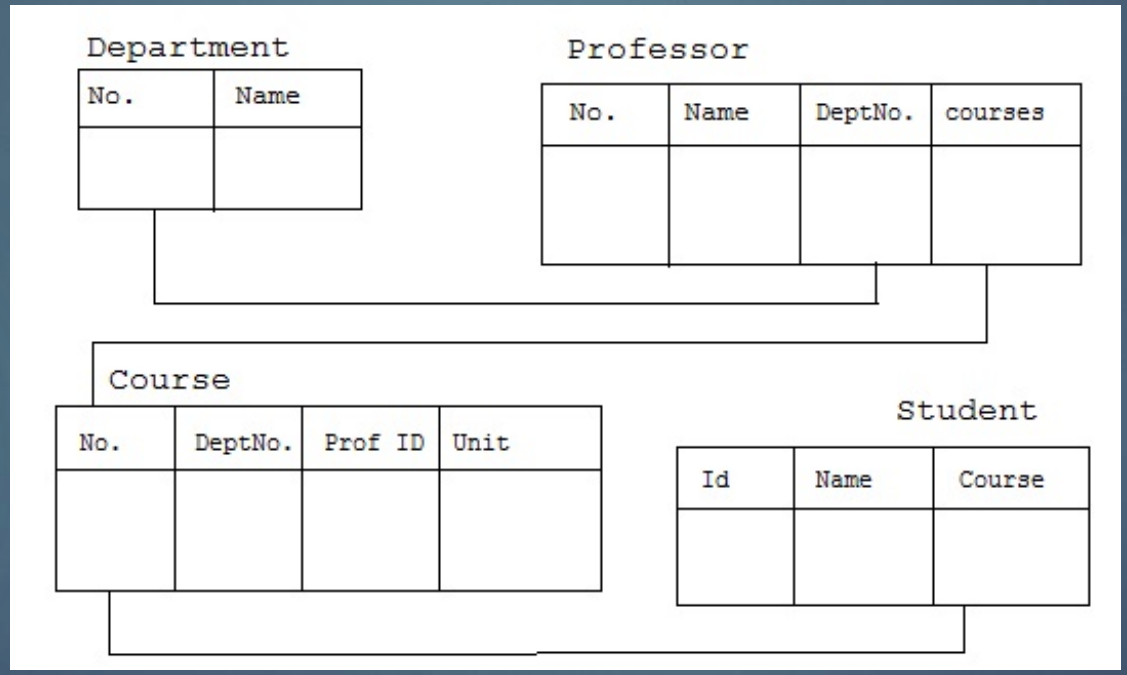
Overview of Database Models (Contd.)

EXAMPLE OF RELATIONAL MODEL:



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Overview of Database Models (Contd.)

OBJECT-ORIENTED MODEL:

- BOTH DATA AND THEIR RELATIONSHIP ARE CONTAINED IN A SINGLE STRUCTURE KNOWN AS AN OBJECT.
- AN OBJECT INCLUDES INFORMATION ABOUT RELATIONSHIP BETWEEN THE FACTS WITHIN THE OBJECT, AS WELL AS INFORMATION ABOUT ITS RELATIONSHIP WITH OTHER OBJECTS.
- AN OBJECT IS THE ABSTRACTION OF THE REAL- WORD ENTITY. AN OBJECT REPRESENTS ONLY ONE OCCURRENCE OF ENTITY.
- ATTRIBUTES DESCRIBE THE PROPERTY OF AN OBJECT.
- OBJECTS THAT ARE SIMILAR IN CHARACTERISTICS ARE GROUPED IN CLASS.

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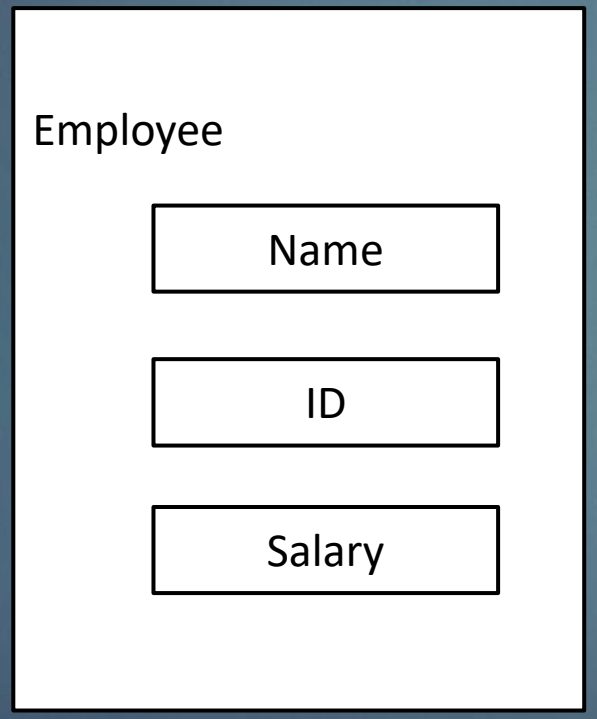
Overview of Database Models (Contd.)

EXAMPLE OF OBJECT-ORIENTED MODEL :



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Introduction to RDBMS

A RELATIONAL DATABASE MANAGEMENT SYSTEM (RDBMS):

- IS A DATABASE MANAGEMENT SYSTEM BASED ON RELATIONAL MODEL INTRODUCED BY E.F CODD.
- REPRESENTS DATA IN TERMS OF TUPLES(ROWS).
- IS USED TO MANAGE RELATIONAL DATABASE.

RELATIONAL DATABASE:

- IS A COLLECTION OF ORGANIZED SET OF TABLES FROM WHICH DATA CAN BE ACCESSED EASILY.
- CONSISTS OF NUMBER OF TABLES AND EACH TABLE HAS ITS OWN PRIMARY KEY.

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Database Keys

- **SUPER KEY** IS DEFINED AS A SET OF ATTRIBUTES WITHIN A TABLE THAT UNIQUELY IDENTIFIES EACH RECORD WITHIN A TABLE. SUPER KEY IS A SUPERSET OF CANDIDATE KEY.
- **A CANDIDATE KEY:**
  - Is a subset of a super key.
  - Is a single field or the least combination of fields that uniquely identifies each record in the table. The least combination of fields distinguishes a candidate key from a super key.
  - Must contain unique values.
  - Must not contain null values.
  - Contains the minimum number of fields to ensure uniqueness.
  - Must uniquely identify each record in the table.

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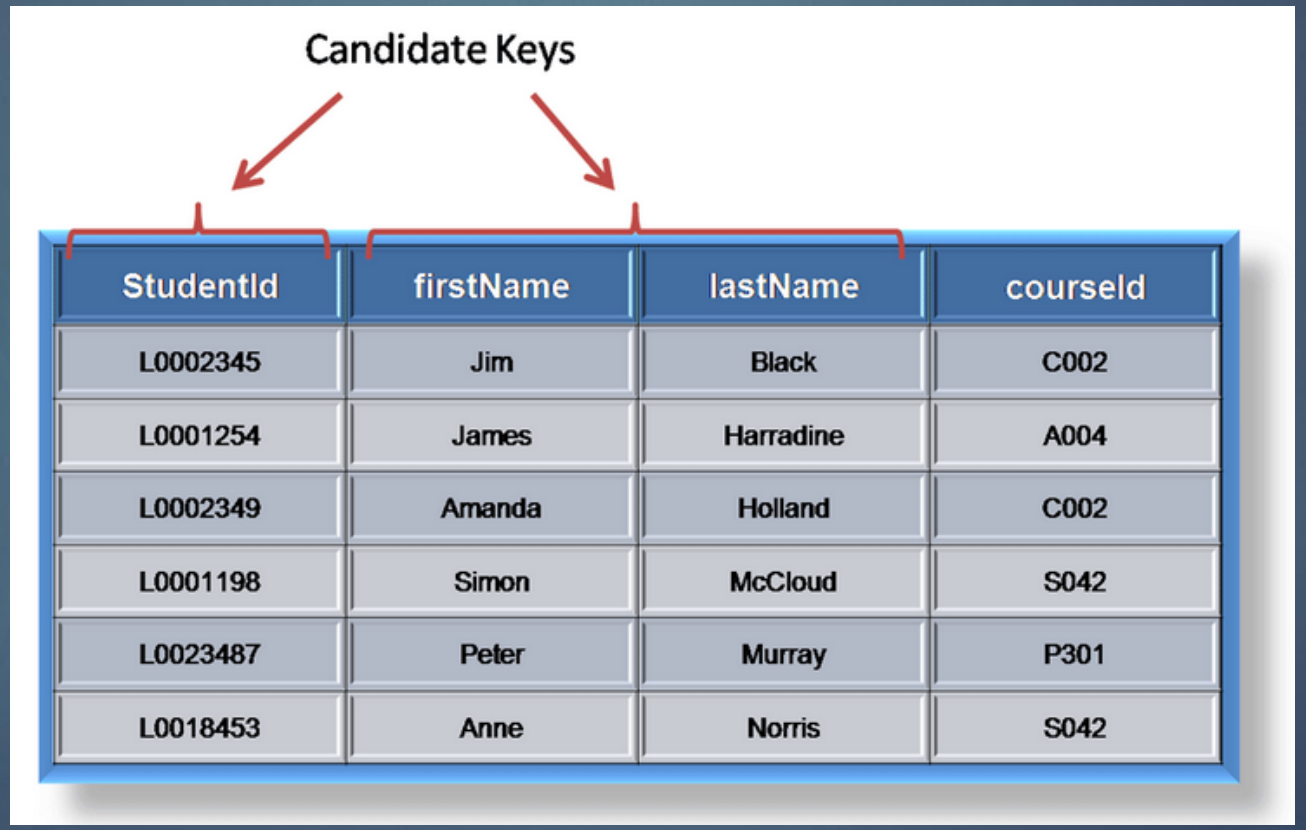
Database Keys

EXAMPLE OF CANDIDATE KEY:



StudentId	firstName	lastName	courseId
L0002345	Jim	Black	C002
L0001254	James	Harradine	A004
L0002349	Amanda	Holland	C002
L0001198	Simon	McCloud	S042
L0023487	Peter	Murray	P301
L0018453	Anne	Norris	S042

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Database Keys (Contd.)

PRIMARY KEY:

- IS A CANDIDATE KEY THAT IS MOST APPROPRIATE TO BE THE MAIN REFERENCE KEY FOR THE TABLE.
- IS USED THROUGHOUT THE DATABASE TO HELP ESTABLISH RELATIONSHIPS WITH OTHER TABLES.
- MUST CONTAIN UNIQUE VALUES, MUST NEVER BE NULL AND SHOULD UNIQUELY IDENTIFY EACH RECORD IN THE TABLE.

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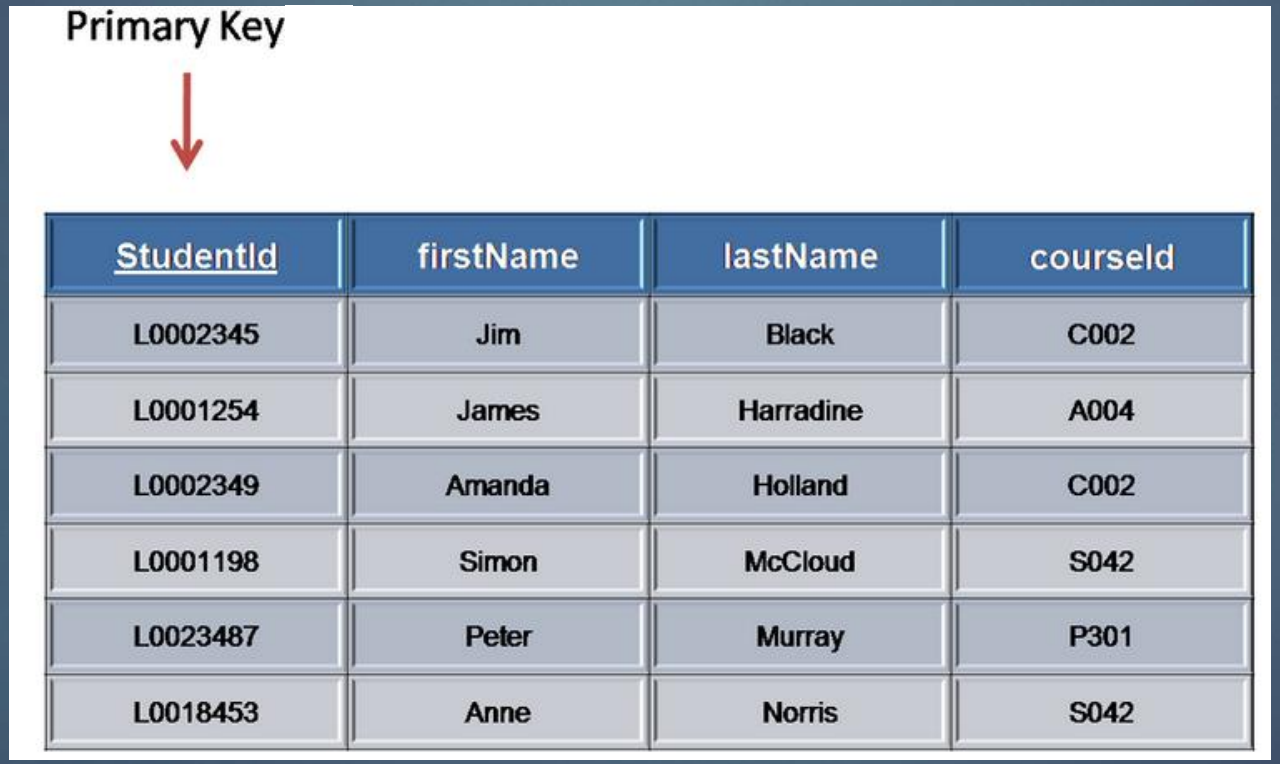
Database Keys (Contd.)

EXAMPLE OF PRIMARY KEY:



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L0001198	Simon	McCloud	S042
L0023487	Peter	Murray	P301
L0018453	Anne	Norris	S042

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Database Keys (Contd.)

- A **FOREIGN KEY** IS GENERALLY A PRIMARY KEY FROM ONE TABLE THAT APPEARS AS A FIELD IN ANOTHER TABLE, WHERE THE FIRST TABLE HAS A RELATIONSHIP TO THE SECOND.
- FOR EXAMPLE, IF WE HAD A TABLE A WITH A PRIMARY KEY X THAT LINKED TO A TABLE B WHERE X WAS A FIELD IN B, THEN X WOULD BE A FOREIGN KEY IN B.

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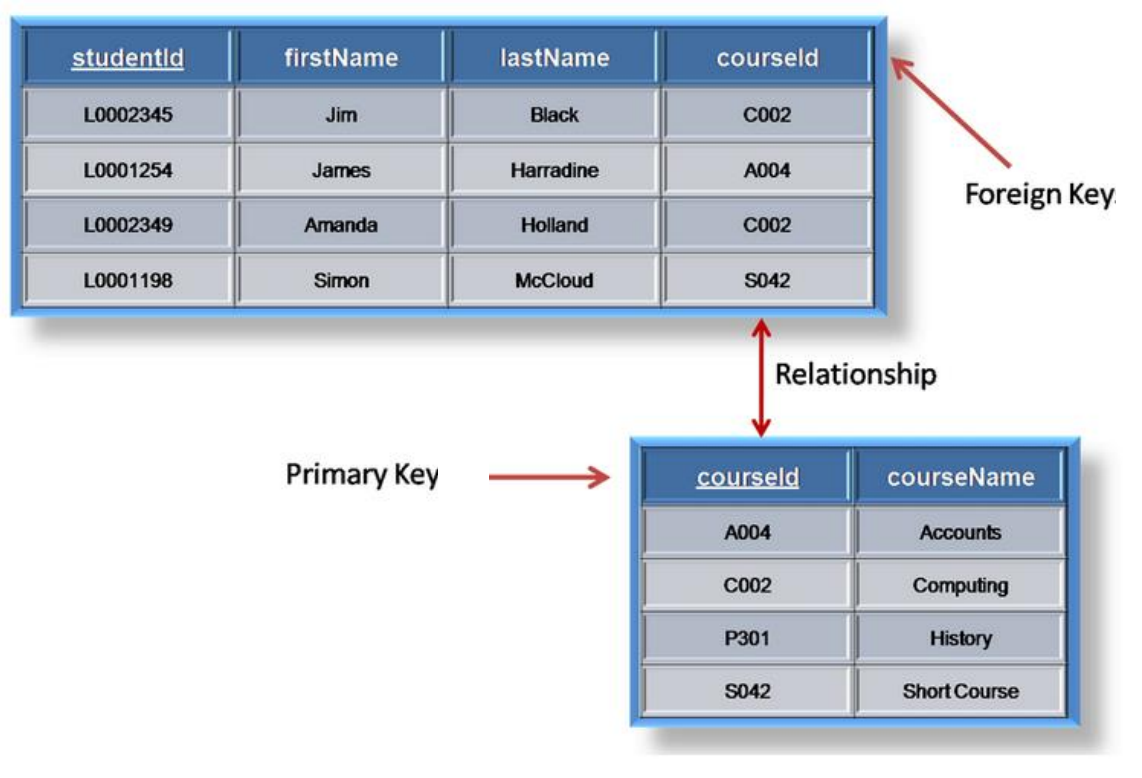
Database Keys (Contd.)

EXAMPLE OF FOREIGN KEY:



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Database Keys (Contd.)

- **ALTERNATE KEY** IS ANY CANDIDATE KEY WHICH IS NOT SELECTED TO BE THE PRIMARY KEY.
- **COMPOUND KEY** (ALSO CALLED A COMPOSITE KEY OR CONCATENATED KEY) IS A KEY THAT CONSISTS OF 2 OR MORE ATTRIBUTES.

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