Introduction to Relational Data

An introduction to relational data

- Relational data is data modeled using the **relational model**.
- In the relational model, data is expressed as **tuples**.
- A tuple is a set of attribute / value pairs.
- For example, a tuple might be:

```
(itemid = 5, orderid = 1, item = "Chair", amount = 200.00)
```

- A set of tuples that all share the same attributes is called a relation.

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Tuples expressed as tables

- A set of tuples (relations) are naturally represented as tables in a database. Each tuple is exposed as a row in the table. Unlike traditional tuples in programming however, rows in tables have an explicit ordering.

- The database schema defines the columns (headings) of each table. Each column is defined with a name and a data type for all values stored in that column across all rows in the table.

itemid	orderid	item	amount
4	1	Chair	200.00
5	1	Table	200.00
6	1	Lamp	123.12

Columns

A tuple as a row in a table

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Referential integrity

- A data store that organizes data using the relational model is referred to as a relational database.
- **Primary keys** uniquely identify rows within a table.
- **Foreign key fields** are used in one table to refer to a row in another table by referencing the primary key of the other table.
- Foreign keys are used to maintain **referential integrity**, ensuring that the referenced rows are not altered or deleted while the referencing row depends on them.

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A sample database model that shows relationships between tables

Items

itemid	orderid	item	amount
1	1	Chair	200.00
2	1	Table	200.00
3	1	Lamp	123.12
...	...	...	...

Customers

customerid	name	email
1	Sue Mathers	sue@hotmail.com
3	Frank Singh	frank@gmail.com
4	Sally Sargent	sally@yahoo.com
...	...	...

Orders

orderid	customerid	date	amount
1	4	11/1/2018	523.12
2	3	11/15/2018	32.99
3	1	11/21/2018	23.99
...	...	...	...

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Constraints

Relational databases support various types of constraints that help to ensure data integrity:

- **Unique constraints** ensure that all values in a column are unique.

- **Foreign key constraints** enforce a link between the data in two tables. A foreign key references the primary key or another unique key from another table. A foreign key constraint enforces referential integrity, disallowing changes that cause invalid foreign key values.

- **Check constraints**, also known as **entity integrity constraints**, limit the values that can be stored within a single column, or in a relationship to values in other columns of the same row.

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The Structured Query Language (SQL)

- Most relational databases use the Structured Query Language (SQL) language that enables a declarative approach to querying.

- The query describes the desired result, but not the steps to execute the query. The engine then decides the best way to execute the query. This differs from a procedural approach, where the query program specifies the processing steps explicitly.

- Relational databases can store executable code routines in the form of **stored procedures** and **functions**, which enables a mixture of declarative and procedural approaches.