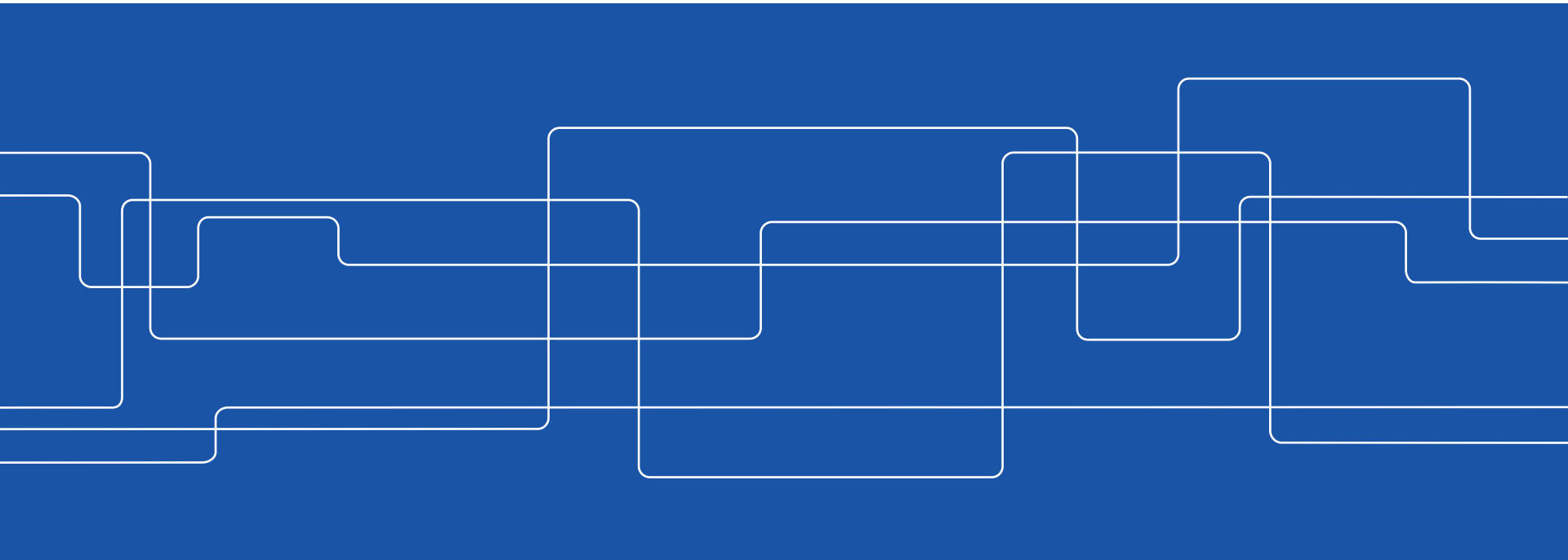
KTH ROYAL INSTITUTE
OF TECHNOLOGY

Lecture 10
Structured Query Language



Summary from previous lecture

1. Entity-relation diagrams: entity, relation, attributes.
2. Database structure:
   - Tables are known as ”Relations”
   - Rows are ”Tuples”
   - Columns are ”Attributes”
3. Normalisation of database.

Contents

- SQL description:
  - SQL definition
  - SQL datatypes
- SQL Syntax
  - Relation calculus
  - SQL commands

SQL definition

SQL stands for “Structured Query Language.” The Structured Query Language is a relational database language. By itself, SQL does not make a DBMS. SQL is a medium which is used to communicate to the DBMS.

Some of the features of SQL:

– SQL is a language used to interact with the database
– SQL is a data access language
– SQL is based on relational tuple calculus
– SQL is a standard relational database management language
– SQL is a “nonprocedural” or “declarative” language.

SQL coding

Most DBMS allow SQL to be used in two distinct ways:

- Interactive SQL. SQL commands can be typed at the command line directly. The DBMS interprets and processes the SQL commands immediately, and the results are displayed.
- Programmatic SQL. SQL statements are embedded in a host language such as Java, C, Python etc. The host language provides the necessary looping and branching structures and the interface with the user, while SQL provides the statements to communicate with the DBMS.

Datatypes in SQL

1. String (text):

- CHAR datatype (fixed-length character data):
  CHAR (n)
- VARCHAR datatype (variable-length character string):
  VARCHAR (n)

2. Numbers:

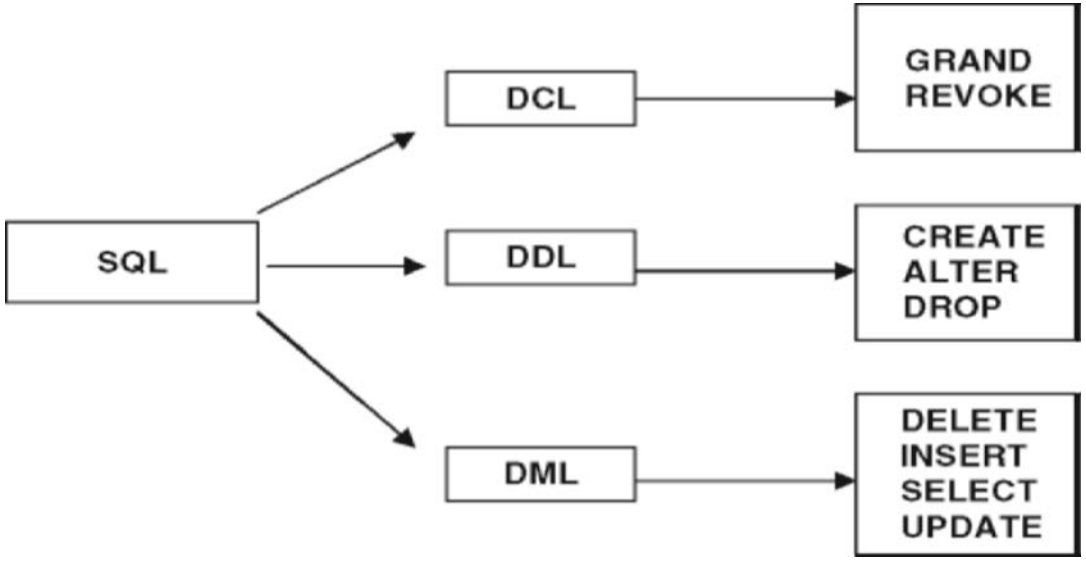
- INTEGER datatype (default 10 digits):
  INTEGER(p)
- FLOAT datatype (default mantissa 16):
  FLOAT(p)

3. DATE Datatype

SQL commands

SQL commands can be classified into three types:

1. Data Definition Language commands (DDL)
2. Data Manipulation Language commands (DML)
3. Data Control Language commands (DCL)



Create Table Command

Steps in Table Creation

1. Identify datatypes for attributes
2. Identify columns that can and cannot be null
3. Identify columns that must be unique
4. Identify primary key–foreign key mates
5. Determine default values
6. Identify constraints on columns (domain specifications)
7. Create the table

Create Table. Syntax

- **Table definition**

```
CREATE TABLE <tablename>
(column-name1 data-type-1 [constraint],
 column-name2 data-type-2 [constraint],
 column-nameN data-type-N [constraint]);
```

- **Table populating**

```
INSERT INTO <tablename> VALUES
('&columnname1', '&columnname2', '&columnnameN' );
```

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Tuple Relational Calculus

List of main operations used to manipulate Relations:

- INSERT
- DELETE
- UPDATE
- SELECT
- JOIN
- UNION

INSERT command

INSERT is a unary operation – it operates on a single Relation and adds a Tuple to a Relation.

```
INSERT INTO Relation VALUES ('&attribute1',…)
```

ID	Name	Grade
1	Jill	D
2	Bob	B
3	Steve	C

ID	Name	Grade
1	Jill	D
2	Bob	B
3	Steve	C
4	Lars	A

DELETE command

DELETE is a unary operation – it operates on a single Relation and deletes a Tuple fulfilling criteria from a Relation

```
DELETE tuple FROM Relation WHERE attribute# = x
```

ID	Name	Grade
1	Jill	D
2	Bob	B
3	Steve	C
4	Lars	A

ID	Name	Grade
1	Jill	D
2	Bob	B
4	Lars	A

UPDATE command

UPDATE is a unary operation – it operates on a single Relation and modifies an attribute in Tuple fulfilling criteria in a Relation

```
UPDATE Relation SET t.a2=data WHERE t.a1=x
```

ID	Name	Grade
1	Jill	D
2	Bob	B
4	Lars	A

ID	Name	Grade
1	Jill	D
2	Bob	B
4	Lars	E

SELECT command

SELECT is a unary operation – it operates on a single Relation. The SELECT operation creates a new relation R2 from relation R1. The Tuples in R1 is a subset of R2

SELECT *&attribute1, &attribute2* FROM *tablename*;

ID	Name	Grade
1	Jill	D
2	Bob	B
4	Lars	E

ID	Name	Grade
2	Bob	B
4	Lars	E

SELECT command

Extension to SELECT command:

- SELECT * FROM R1 **WHERE** a1=6;
- SELECT * FROM R1 **GROUP BY** a1;
- SELECT * FROM R1 **ORDER BY** a1 (ASC, DESC);
- SELECT * FROM R1 **HAVING** a2>3;
- SELECT a1,a3 FROM R3 WHERE *a2* **IN** (*value1*,*value2*);

JOIN command

JOIN is a binary operation – it operates two Relations. The JOIN operation creates a new relation R3 from relations R1 & R2 based on common attributes (keys).

SELECT R1.a1, R1.a2, R2.a2 **FROM** R1 **JOIN** R2 **ON** R1.A2=R2.A1

Course	Professor
EH2745	Nordström
EH2751	Nordström
EJ2301	Soulard
EG2200	Amelin

X

Professor	Office
Nordström	Osquldas väg 10, floor 7
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Soulard	Teknikringen 33, floor 1

Not Normalised??

Course	Professor	Office
EH2745	Nordström	Osquldas väg 10, floor 7
EH2751	Nordström	Osquldas väg 10, floor 7
EJ2301	Soulard	Teknikringen 33, floor 1
EG2200	Amelin	Reknikringen 35, floor 2

UNION command

UNION is a binary operation – it operates on two Relations R1 and R2 and creates a new relation R3 in which each tuple is either in R1, in the R2, or in both R1 and R2. The two relations must have the same attributes.

SELECT *a1, a2* **FROM** R*1;*
UNION
SELECT *a1, a2* **FROM** R*2;*

Warehouse	Adress
Building3	King St 23
Building4	Queens Rd 2

+

Warehouse	Adress
Building1	Diagon Alley 3
Building2	Main St 12

Warehouse	Adress
Building1	Diagon Alley 3
Building2	Main St 12
Building3	King St 23
Building4	Queens Rd 2