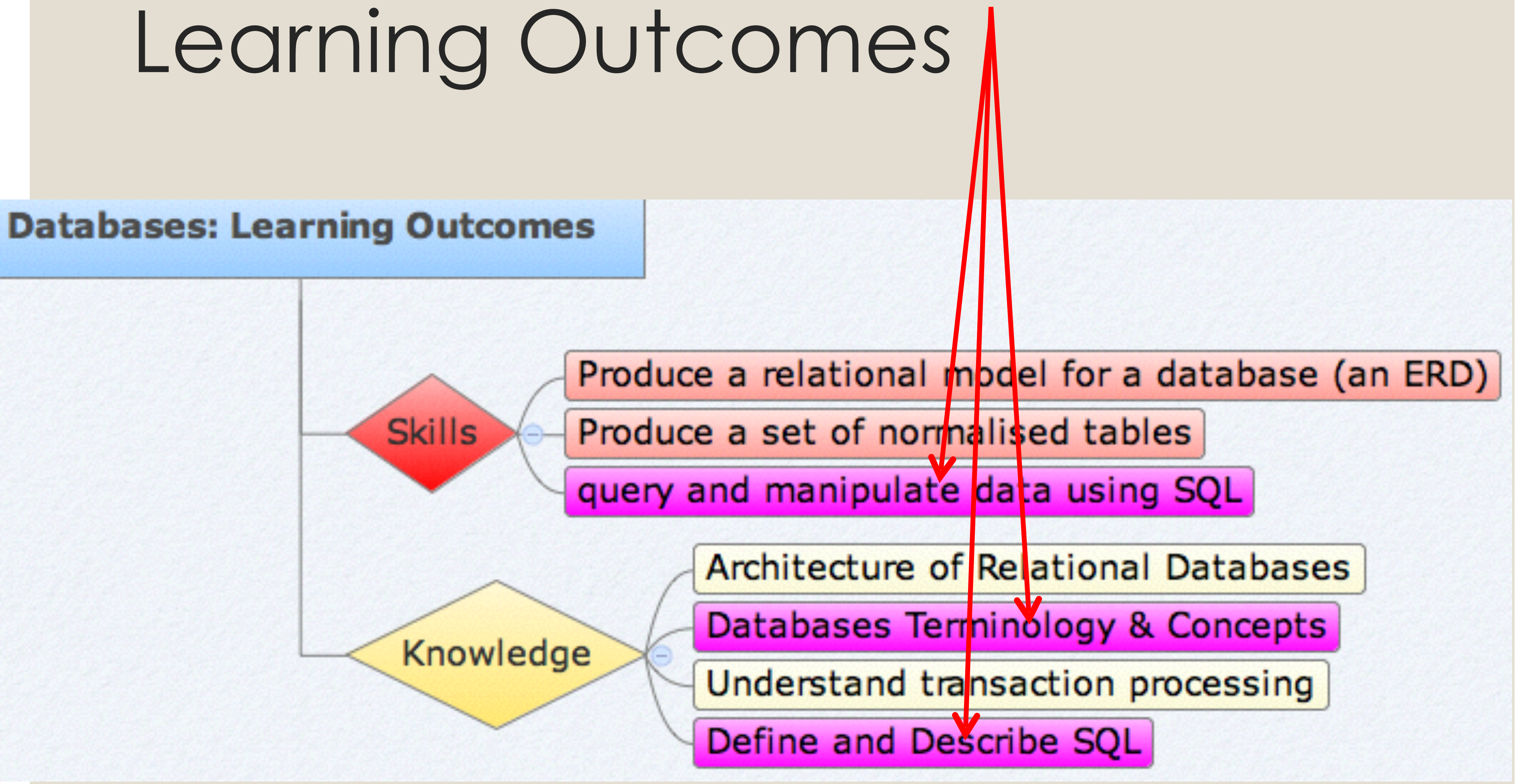
MODULE: DATABASE FUNDAMENTALS

Lecture 2:
Introduction to MySQL, Databases terminology, and SQL

Learning Outcomes


Databases: Learning Outcomes
Skills
Produce a relational model for a database (an ERD)
Produce a set of normalised tables
query and manipulate data using SQL
Knowledge
Architecture of Relational Databases
Databases Terminology & Concepts
Understand transaction processing
Define and Describe SQL

Recap on last week

- What is data?
- What is a database/schema?
- What is a table?
  - What is a row?
  - What is a cell?
- What is a DBMS?
- What is MySQL?

Objective for this lecture:

1. Cover a bit more terminology

2. Start on SQL
   - Retrieve data from the database:- the SELECT statement.
     - The SELECT command is used to list the contents of a table

Terminology

- Four additional terms before we start SQL:
    1. Columns and domains
    2. Primary Key
    3. Foreign Key
    4. Constraints

1. More on columns

- Each Column in a database table represents a different attribute.
  - Each column has a distinct name
  - Values in a column must all be of the same type, which is called the **Domain** of the attribute, e.g. Boolean, date, integer, character etc.
  - The Domain can also define VALID VALUES for each column, e.g. Employee_Age must be between 16 and 65; Car_Type must be one of (Ford, Toyota, Fiesta, Audi).
  - Columns contain only single values i.e no lists
  - The Order of columns has no significance.

2. Primary Key:

- Every row in a database table must have some value that UNIQUELY identifies that row, called the **PRIMARY KEY.**
  - No two rows in a table can have the same value in the primary key.
  - It is usually just one column, but can be made up of more than one column.

StudentID	First Name	Surname	Date of Birth	PhoneNumber
B00012345	John	Murphy	21/10/1980	0851234567
B00009786	Jane	Ryan	04/03/1975	0861298374

What is the primary key in each of these three tables?

ISBN	Book Title	Author
23422345	Introduction to Databases	Colin
43299384	The Boy in the Striped Pyjamas	Boyne, John

Account Number	Customer Number	Balance
23245675	Gray375	100
54366541	Gray375	2500

3. Foreign Key

- Rows in tables can be linked by having common fields – called **Primary Key / Foreign Key links**

    - A **FOREIGN KEY** is an attribute(s), which is the Primary Key in another table, as per supplier ID in the Parts table on the next slide.

Relational Database

Tables are linked by having common fields - **Primary Key / Foreign Key** links

Primary Key

Table1: Supplier

Supplier ID	Supplier Name	Supplier Address
S001	Dell	Limerick
S002	Hewlett Packard	London
S003	IBM	Dublin

Table 2: Parts table

Parts I.D.	Description	Qty on Hand	*Supplier I.D.*
P001	Keyboard	50	*S001*
P001	Mouse	100	*S001*
P003	Printer	25	*S003*

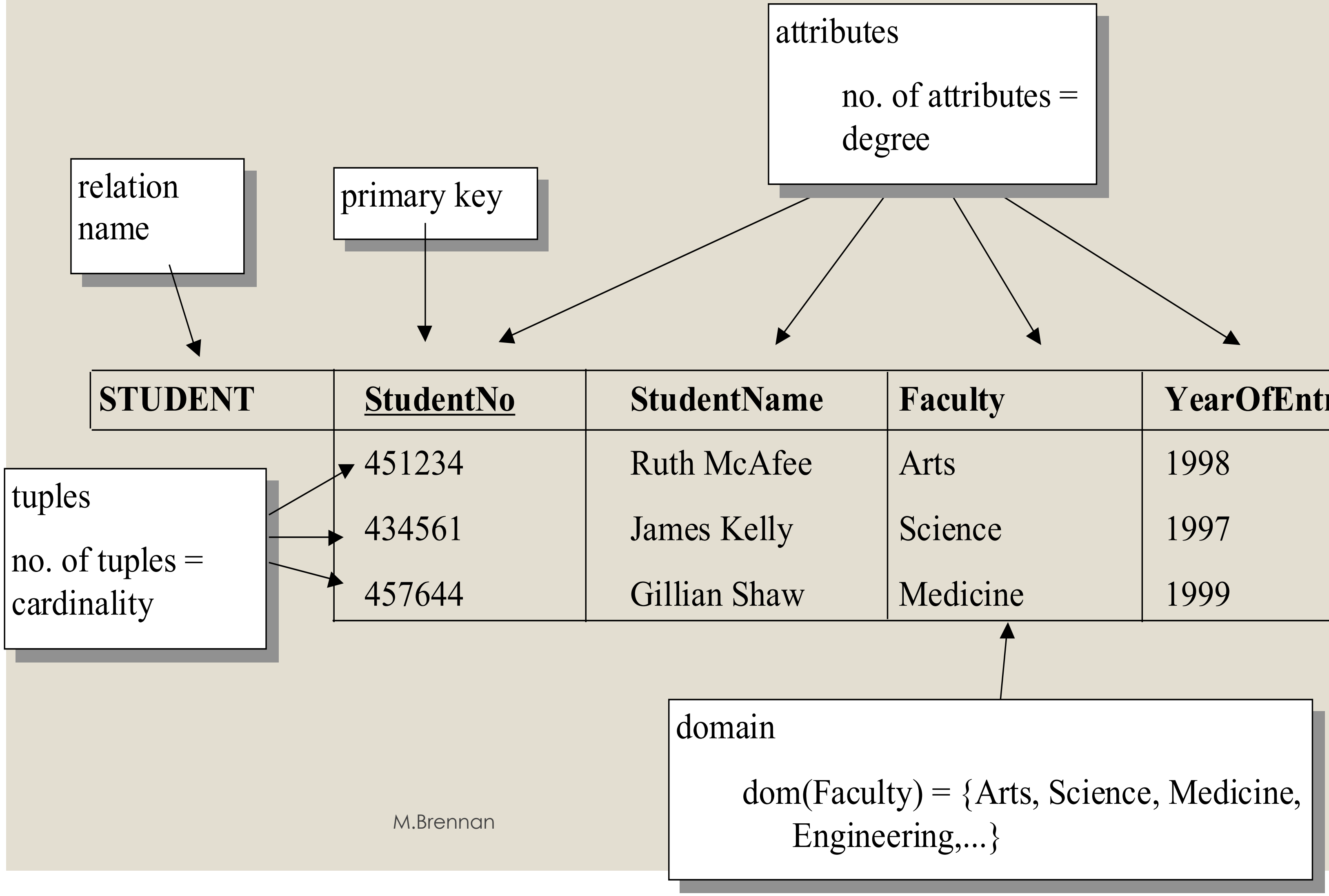
Foreign Key

The Relational DB Model

- **Degree of a Table**: number of columns

- **Cardinality of a Table:** number of rows

STUDENT table


attributes
no. of attributes = degree
relation name
primary key
tuples
no. of tuples = cardinality
domain
dom(Faculty) = {Arts, Science, Medicine, Engineering,...}

STUDENT	<u>**StudentNo**</u>	**StudentName**	**Faculty**	**YearOfEntry**
	451234	Ruth McAfee	Arts	1998
	434561	James Kelly	Science	1997
	457644	Gillian Shaw	Medicine	1999

4. Table Constraints

- When adding data to a table, the DBMS validates that data in accordance with a number of constraints which apply to data in the table. These constraints fall into four categories:
  - Domain constraints
  - Entity integrity constraint
  - NULL constraint
  - Referential integrity constraint

Domain Constraints

- The DBMS ensures all data added to a column is valid for the domain of that column. For example:
  - Numeric columns can only contain numeric data
  - Character columns can contain character data
  - If a domain definition puts further restrictions on the data allowed, they will also be checked by the DBMS, for example:
    - Age must be between 16 – 100
    - Sex two valid values: Male, Female
    - Sub. Paid two valid values: True/ False
    - Room four valid values: Single, Double, Family, Twin-bed

NULL constraint

Only allows a NULL value if a column is allowed to contain NULL values.

Note: NULL is different from blank or zero. Blank is a value, NULL is the absence of a value. Often NULL is used to indicate there is no value for that cell, blank is used if the value is unknown, for example

> If an employee table has an attribute Car_Registration. Null would be used for employees who do not have a car; a blank would be used if the employee does have a car, but the car registration number is not known.

Entity Integrity Constraint

- The DBMS ensures ALL primary key values are unique and not NULL.

Referential Integrity Constraint

- If the foreign key exists in a table, either the foreign key value must be NULL, or match a primary key value in its home table. For example any value in the supplierID column of the Parts table must be a valid supplier ID in the supplier table.

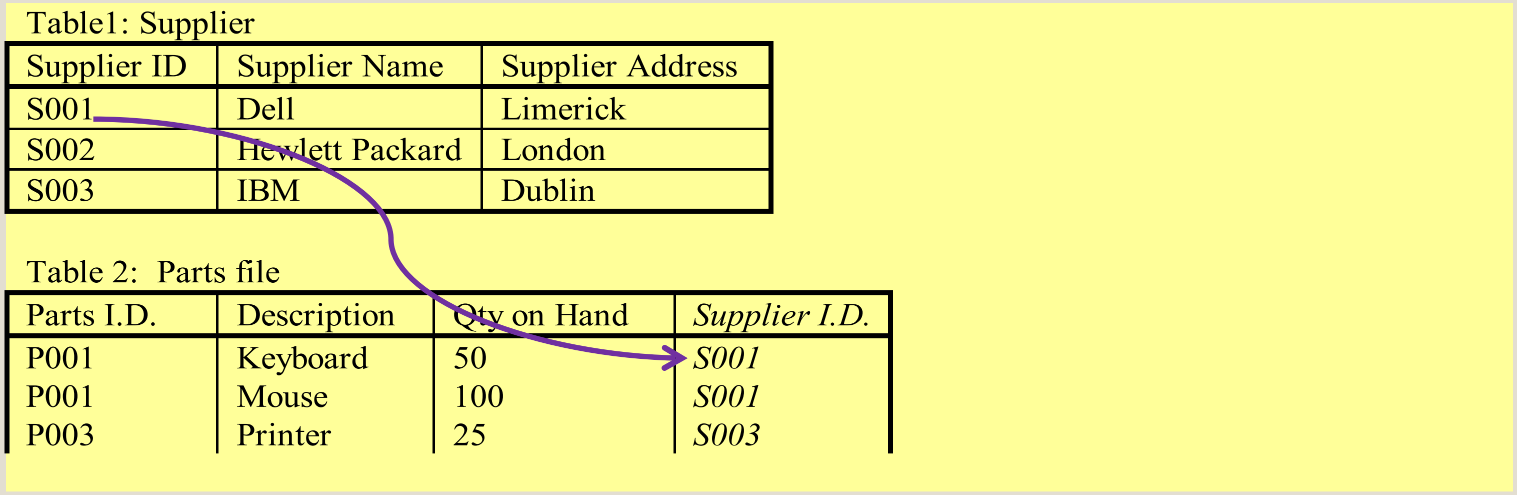


Table1: Supplier

Supplier ID	Supplier Name	Supplier Address
S001	Dell	Limerick
S002	Hewlett Packard	London
S003	IBM	Dublin

Table 2: Parts file

Parts I.D.	Description	Qty on Hand	*Supplier I.D.*
P001	Keyboard	50	*S001*
P001	Mouse	100	*S001*
P003	Printer	25	*S003*

Question - Time

Do you remember what the following terms mean?

Referential integrity

Tuple

Null Constraint

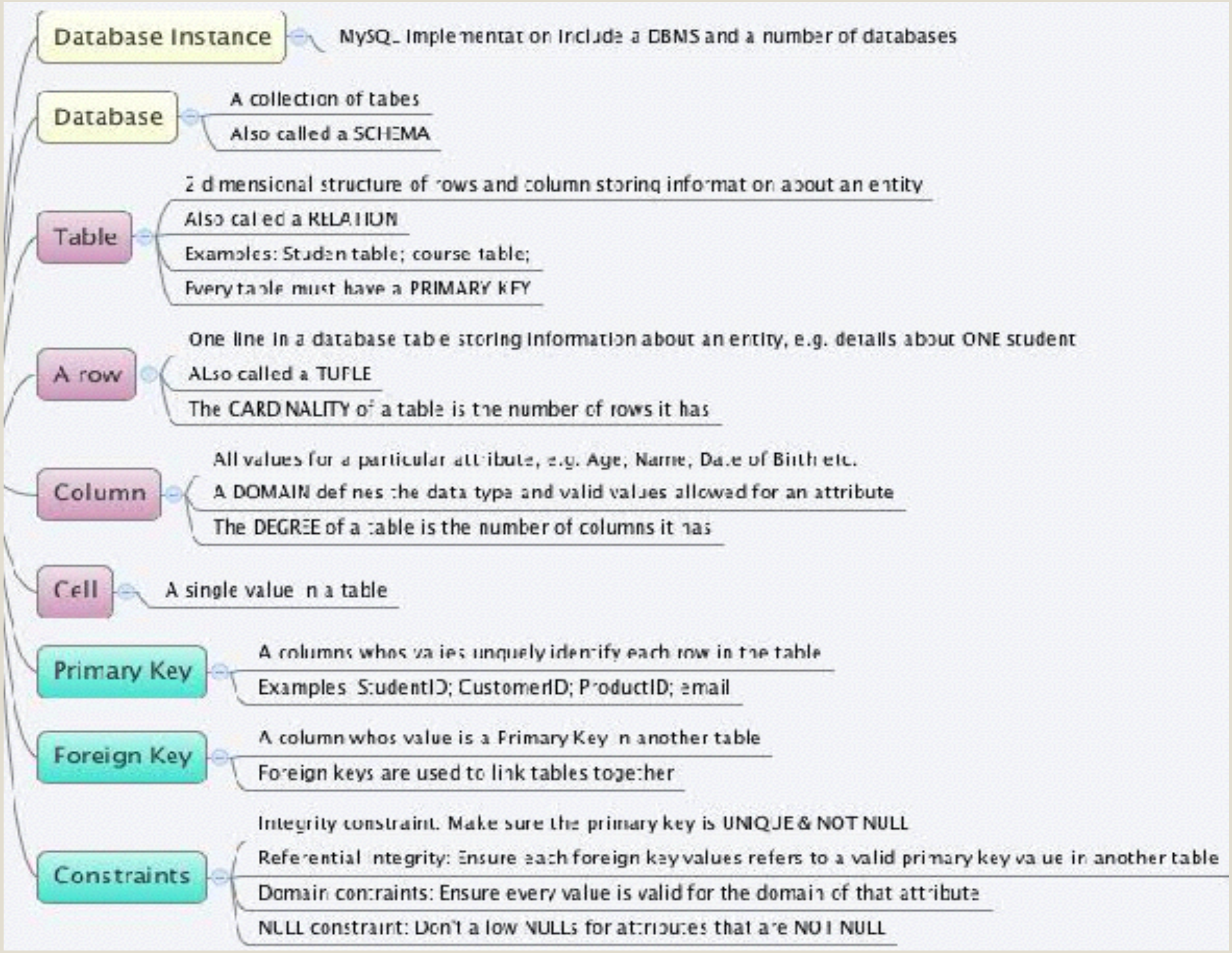
Entity integrity

A relation

Domain

Schema

Recap - terminology



- Database Instance
  - MySQL Implementation Include a DBMS and a number of databases
- Database
  - A collection of tabes
  - Also called a SCHEMA
- Table
  - 2 dimensional structure of rows and column storing information about an entity
  - Also called a RELATION
  - Examples: Studen table; course table;
  - Every table must have a PRIMARY KEY
- A row
  - One line in a database table storing information about an entity, e.g. details about ONE student
  - ALso called a TUPLE
  - The CARDINALITY of a table is the number of rows it has
- Column
  - All values for a particular attribute, e.g. Age, Name, Date of Birth etc.
  - A DOMAIN defines the data type and valid values allowed for an attribute
  - The DEGREE of a table is the number of columns it has
- Cell
  - A single value in a table
- Primary Key
  - A columns whos values uniquely identify each row in the table
  - Examples StudentID; CustomerID; ProductID; email
- Foreign Key
  - A column whos value is a Primary Key in another table
  - Foreign keys are used to link tables together
- Constraints
  - Integrity constraint. Make sure the primary key is UNIQUE & NOT NULL
  - Referential integrity: Ensure each foreign key values refers to a valid primary key value in another table
  - Domain contraints: Ensure every value is valid for the domain of that attribute
  - NULL constraint: Don't allow NULLs for attributes that are NOT NULL

SQL – STRUCTURED QUERY LANGUAGE

Introduction to SQL

- Universal Language for
  - Creating Tables to hold the data (Data Definition Language – DDL: 6 commands)
  - Data Manipulation & Retrieval (Data Manipulation Language - DML: 8 commands)
  - Data Control – gives users permissions for the database (Data Control Language – DCL: 3 commands)

- Note: While SQL is a standard language, Database vendors support slight variations of SQL. Variations occur in the data types supported, and the functions support (to be covered in a later lecture)

DDL (Data Definition Language) used to define the table structure and attributes of the database table

SQL commands:-
- CREATE TABLE specifies attributes and constraints for a table.
- DROP TABLE
- ALTER TABLE
- TRUNCATE etc.

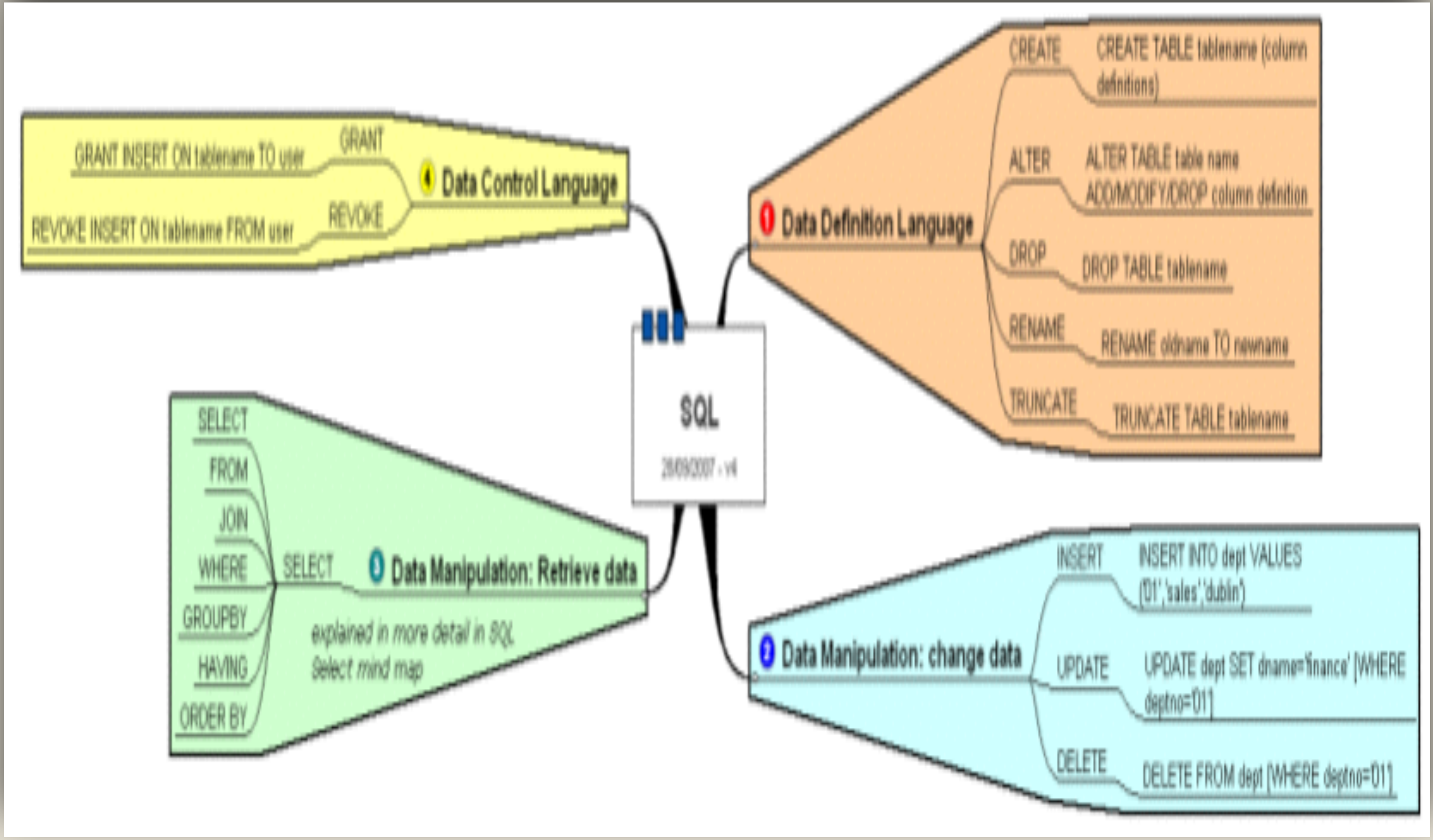
DML (Data Manipulation Language) used to retrieve, insert, modify or delete information within the database.

SQL commands:- SELECT, UPDATE, INSERT, DELETE

DCL (Data Control Language) - used to manage DB security, i.e. assign access rights to users

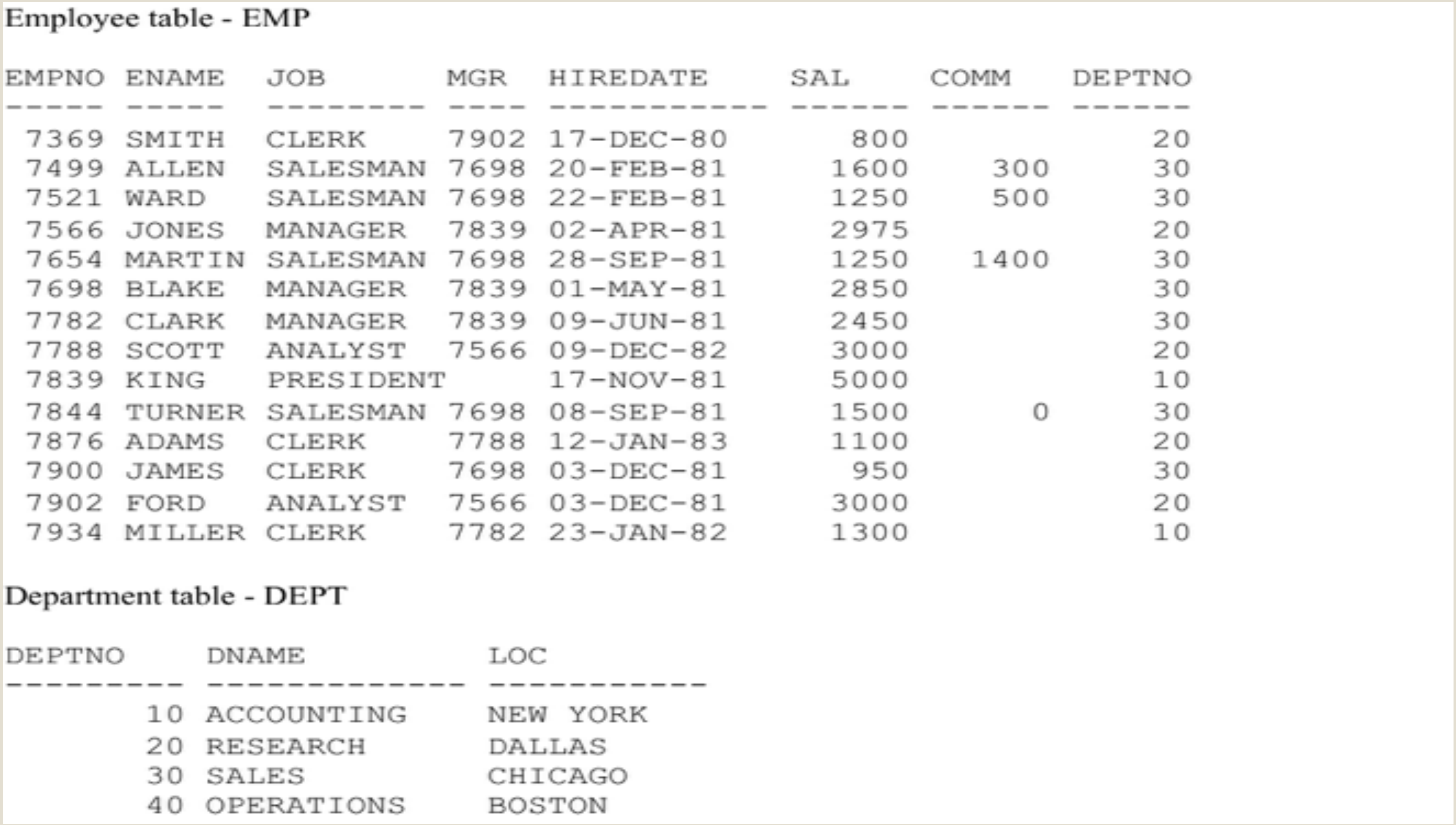
SQL commands:– GRANT, DENY, REVOKE

SQL in a Nutshell . . .


SQL
28/09/2007 - v4
1 Data Definition Language
CREATE
CREATE TABLE tablename (column definitions)
ALTER
ALTER TABLE table name ADD/MODIFY/DROP column definition
DROP
DROP TABLE tablename
RENAME
RENAME oldname TO newname
TRUNCATE
TRUNCATE TABLE tablename
2 Data Manipulation: change data
INSERT
INSERT INTO dept VALUES ('01','sales','dublin')
UPDATE
UPDATE dept SET dname='finance' [WHERE deptno=01]
DELETE
DELETE FROM dept [WHERE deptno=01]
3 Data Manipulation: Retrieve data
SELECT
SELECT
FROM
JOIN
WHERE
GROUPBY
HAVING
ORDER BY
explained in more detail in SQL Select mind map
4 Data Control Language
GRANT
GRANT INSERT ON tablename TO user
REVOKE
REVOKE INSERT ON tablename FROM user

Sample Tables

- The slides in this section of the course are based on the following tables:



Employee table - EMP

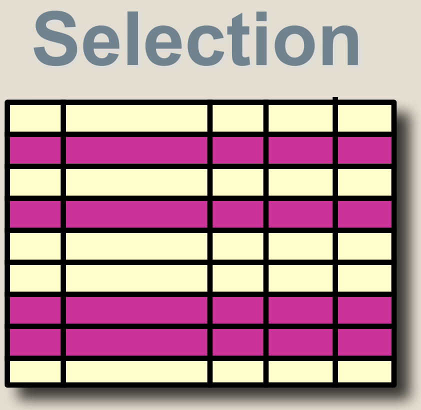
```
EMPNO ENAME  JOB       MGR  HIREDATE      SAL    COMM   DEPTNO
----- ------ --------- ---- ----------- ------ ------ ------
 7369 SMITH  CLERK     7902 17-DEC-80      800            20
 7499 ALLEN  SALESMAN  7698 20-FEB-81     1600    300     30
 7521 WARD   SALESMAN  7698 22-FEB-81     1250    500     30
 7566 JONES  MANAGER   7839 02-APR-81     2975            20
 7654 MARTIN SALESMAN  7698 28-SEP-81     1250   1400     30
 7698 BLAKE  MANAGER   7839 01-MAY-81     2850            30
 7782 CLARK  MANAGER   7839 09-JUN-81     2450            30
 7788 SCOTT  ANALYST   7566 09-DEC-82     3000            20
 7839 KING   PRESIDENT      17-NOV-81     5000            10
 7844 TURNER SALESMAN  7698 08-SEP-81     1500      0     30
 7876 ADAMS  CLERK     7788 12-JAN-83     1100            20
 7900 JAMES  CLERK     7698 03-DEC-81      950            30
 7902 FORD   ANALYST   7566 03-DEC-81     3000            20
 7934 MILLER CLERK     7782 23-JAN-82     1300            10
```

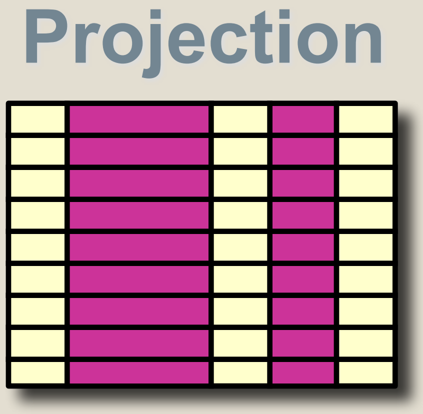
Department table - DEPT

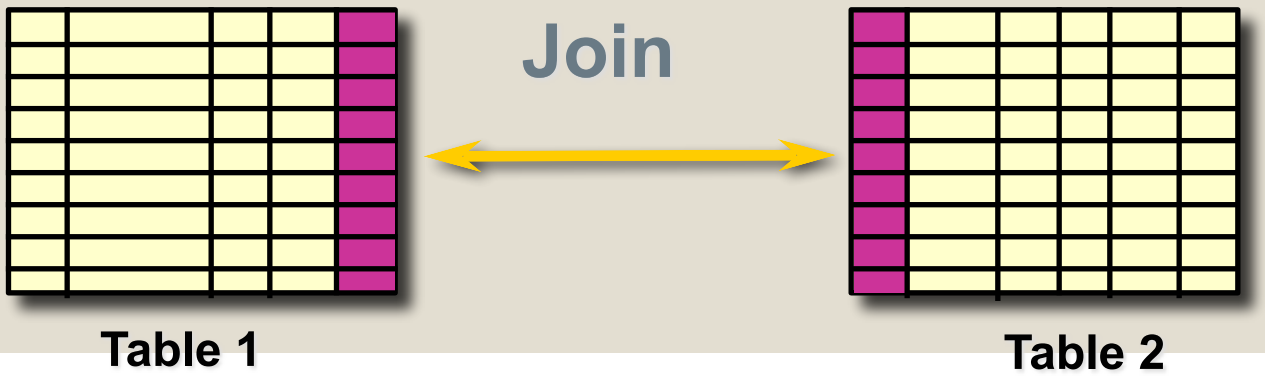
```
DEPTNO     DNAME          LOC
---------- -------------- -----------
        10 ACCOUNTING     NEW YORK
        20 RESEARCH       DALLAS
        30 SALES          CHICAGO
        40 OPERATIONS     BOSTON
```

Data Retrieval – SELECT Statement

- Three basic commands
  - **Selecting rows**
  - **Selecting columns**
  - **Join – get results from 2 or more tables**







Basic SELECT examples

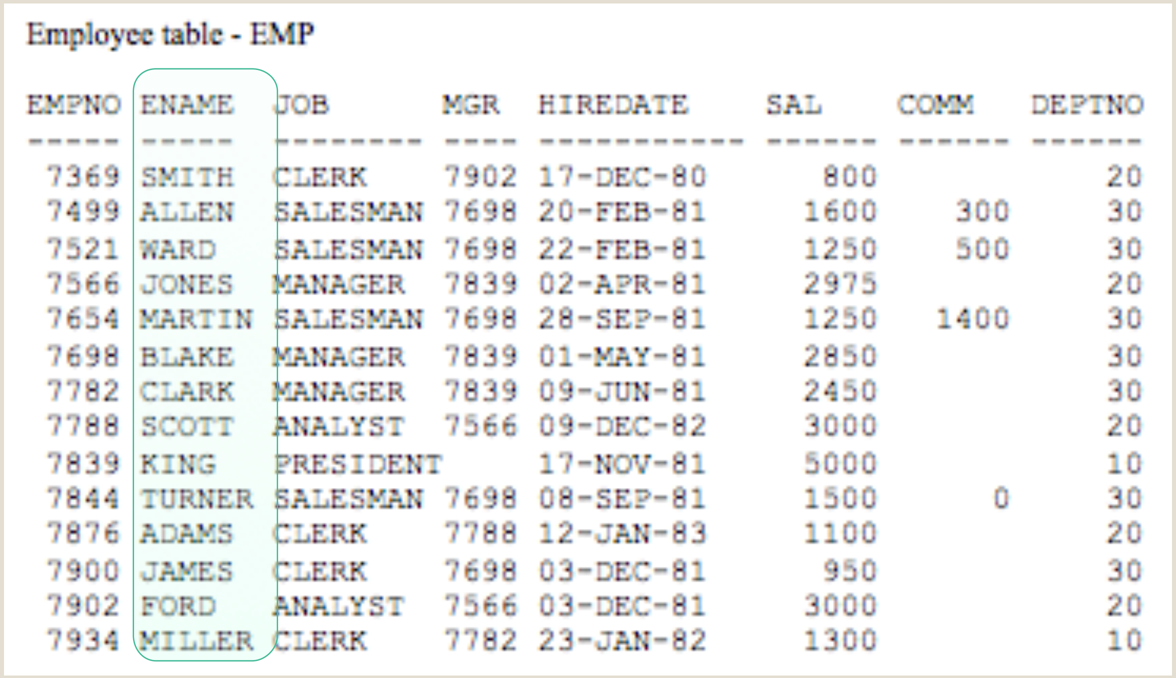
Display the name of each employee

SELECT ename

FROM emp;

Column Name

Table Name



Employee table - EMP

```
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 7566 JONES  MANAGER   7839 02-APR-81    2975             20
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 7902 FORD   ANALYST   7566 03-DEC-81    3000             20
 7934 MILLER CLERK     7782 23-JAN-82    1300             10
```
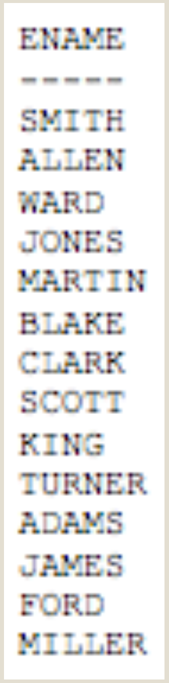

output



```
ENAME
-----
SMITH
ALLEN
WARD
JONES
MARTIN
BLAKE
CLARK
SCOTT
KING
TURNER
ADAMS
JAMES
FORD
MILLER
```

The table DOES NOT change, you are just selecting what data you want to view from the table.

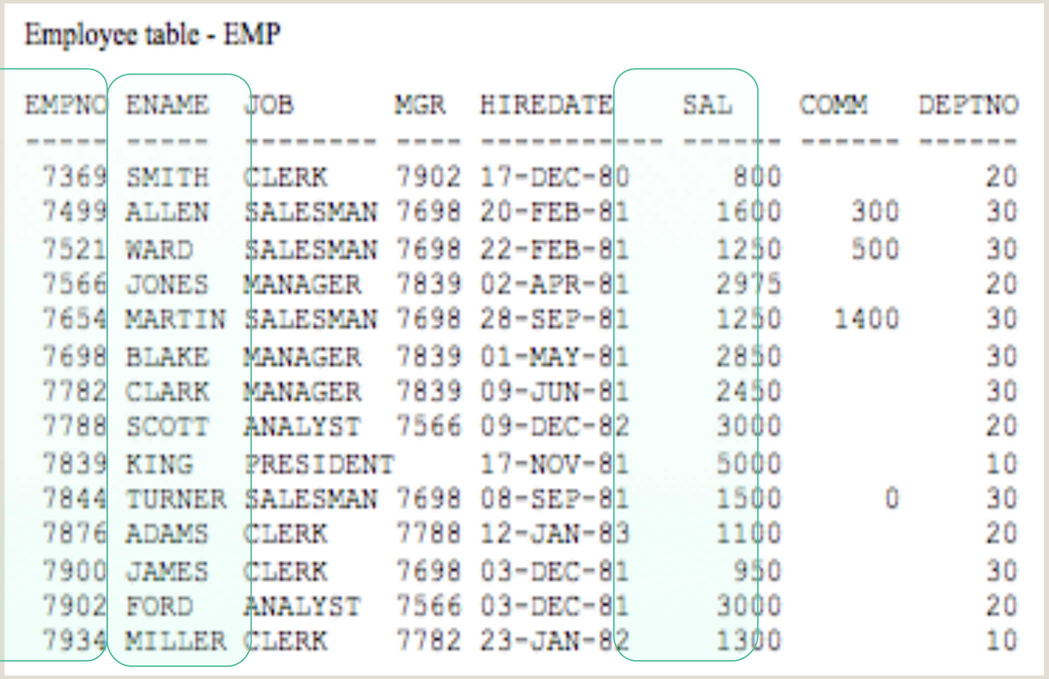
Basic SELECT examples

Display the employee number, name and salary of each employee

```
SELECT empno, ename, sal
FROM  emp;
```

Column Names

Table Name



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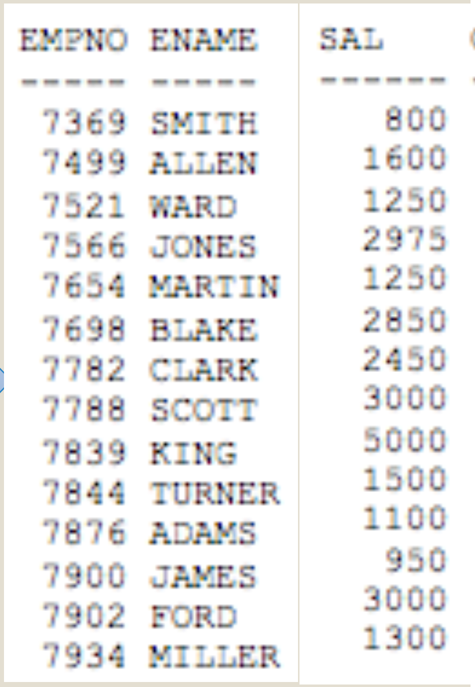
 7902 FORD   ANALYST   7566 03-DEC-81   3000           20
 7934 MILLER CLERK     7782 23-JAN-82   1300           10
```

output



```
EMPNO ENAME      SAL
----- -----   ------
 7369 SMITH      800
 7499 ALLEN     1600
 7521 WARD      1250
 7566 JONES     2975
 7654 MARTIN    1250
 7698 BLAKE     2850
 7782 CLARK     2450
 7788 SCOTT     3000
 7839 KING      5000
 7844 TURNER    1500
 7876 ADAMS     1100
 7900 JAMES      950
 7902 FORD      3000
 7934 MILLER    1300
```

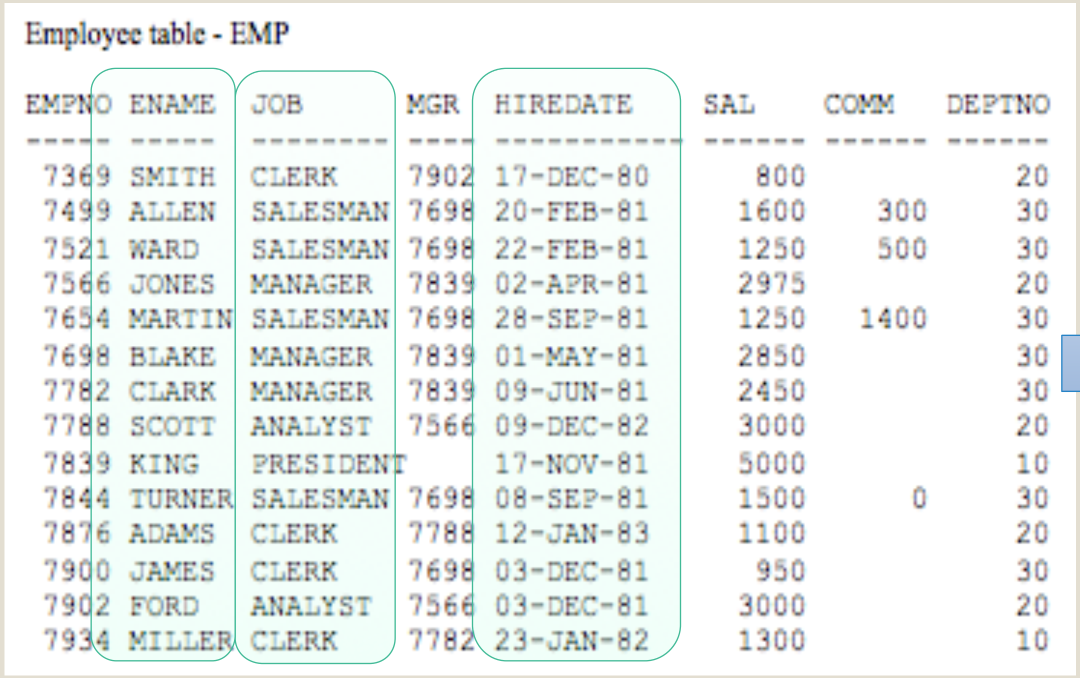
Basic SELECT examples

List all employee's names, positions and date they were hired.

```
SELECT  ename, job, hiredate
FROM emp;
```

Column Names

Table Name



Employee table - EMP

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 7934 MILLER CLERK     7782 23-JAN-82   1300             10
```
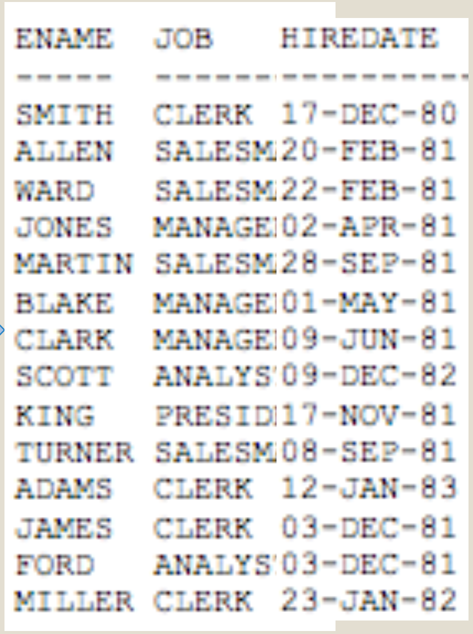

output



```
ENAME  JOB    HIREDATE
----- ------ ----------
SMITH  CLERK  17-DEC-80
ALLEN  SALESM 20-FEB-81
WARD   SALESM 22-FEB-81
JONES  MANAGE 02-APR-81
MARTIN SALESM 28-SEP-81
BLAKE  MANAGE 01-MAY-81
CLARK  MANAGE 09-JUN-81
SCOTT  ANALYS 09-DEC-82
KING   PRESID 17-NOV-81
TURNER SALESM 08-SEP-81
ADAMS  CLERK  12-JAN-83
JAMES  CLERK  03-DEC-81
FORD   ANALYS 03-DEC-81
MILLER CLERK  23-JAN-82
```

List all data in the employee table.

```
SELECT  *
FROM emp;
```

An * is short hand for listing ALL columns in the table

List the department numbers in the employee table

```
SELECT  deptno
FROM    emp;
```

Display the departments that employees work in. Do not show duplicate department numbers

```
SELECT  DISTINCT deptno
FROM   emp;
```

output

```
Deptno
----------
10
20
30
```

- The syntax of the most basic form of SELECT is:

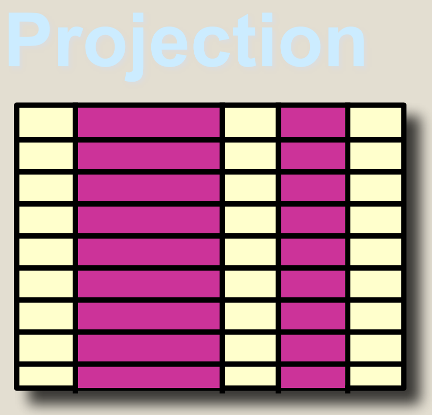
```
SELECT [DISTINCT] {*, column_name [alias], ...}
FROM table;
```

- SELECT specifies the columnlist / attributes, separated by commas
- DISTINCT – eliminates duplicate rows in resultset
- * (asterisk) is a wildcard character to list all attributes
- FROM specifies the table

Note:-

- SQL statements are not case sensitive
- Programming convention is to show all reserved words in uppercase
- Statements can be on one or more lines
- Can use tabs to enhance readability
- Clauses are usually put on a new line
- Use of the semicolon at the end of a SQL statement is optional

Exercises



- List all locations on the department table
- List all salaries on the employee table
- List all salaries, but do not show duplicate salaries
- List each employee by name, and also show their salary
- List each employee by name, showing salary and commission as well.
- Show all columns on the department table

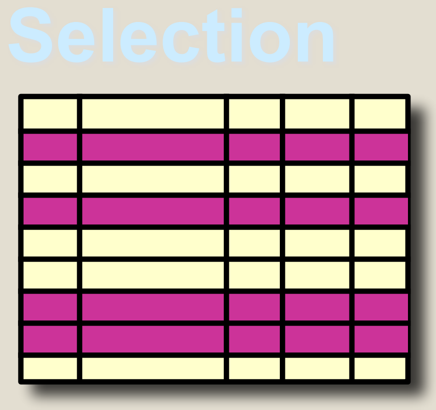
2. Selecting particular rows

- To select particular rows, you add a 'WHERE' clause to the SELECT statement specifying which rows to select

SELECT [DISTINCT] {*, column_name [alias], ...}

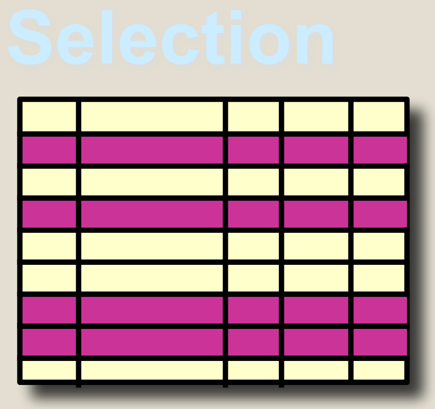
FROM table

[WHERE conditionlist];



- The WHERE clause consists of
  - a column name
  - a comparison operator
  - a column name, constant or list of values

Where condition



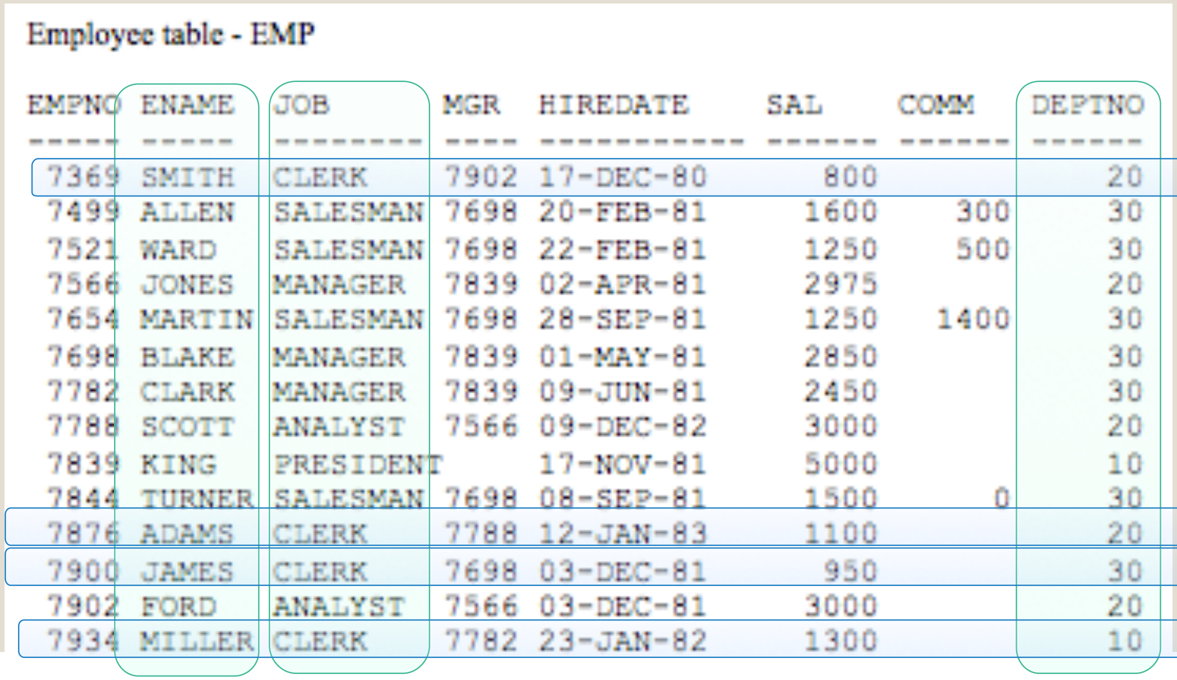
- The SELECT statement retrieves all the rows that **match** the conditions you specified in **the WHERE clause**
  - You can have more than one condition, separated by logical operators (AND, OR, NOT)
- If no rows match the criteria specified in the WHERE clause, you get a message that tells you that no rows were returned.

Examples of WHERE clause

- Display the name, job title and department numbers of all employees who are clerks.

```
SELECT ename, job, deptno
FROM emp
WHERE job='CLERK';
```

ENAME	JOB	DEPTNO
JAMES	CLERK	10
SMITH	CLERK	20
ADAMS	CLERK	20
MILLER	CLERK	30


Employee table - EMP

```
EMPNO ENAME  JOB       MGR  HIREDATE     SAL   COMM   DEPTNO
----- -----  --------- ---- ----------- ------ ------ ------
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 7654 MARTIN SALESMAN  7698 28-SEP-81    1250   1400      30
 7698 BLAKE  MANAGER   7839 01-MAY-81    2850             30
 7782 CLARK  MANAGER   7839 09-JUN-81    2450             30
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 7844 TURNER SALESMAN  7698 08-SEP-81    1500      0      30
 7876 ADAMS  CLERK     7788 12-JAN-83    1100             20
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```
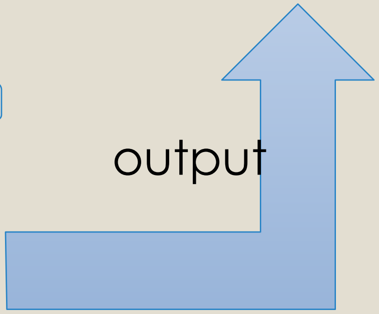



Note:

- **Character strings and dates are enclosed in single quotes**

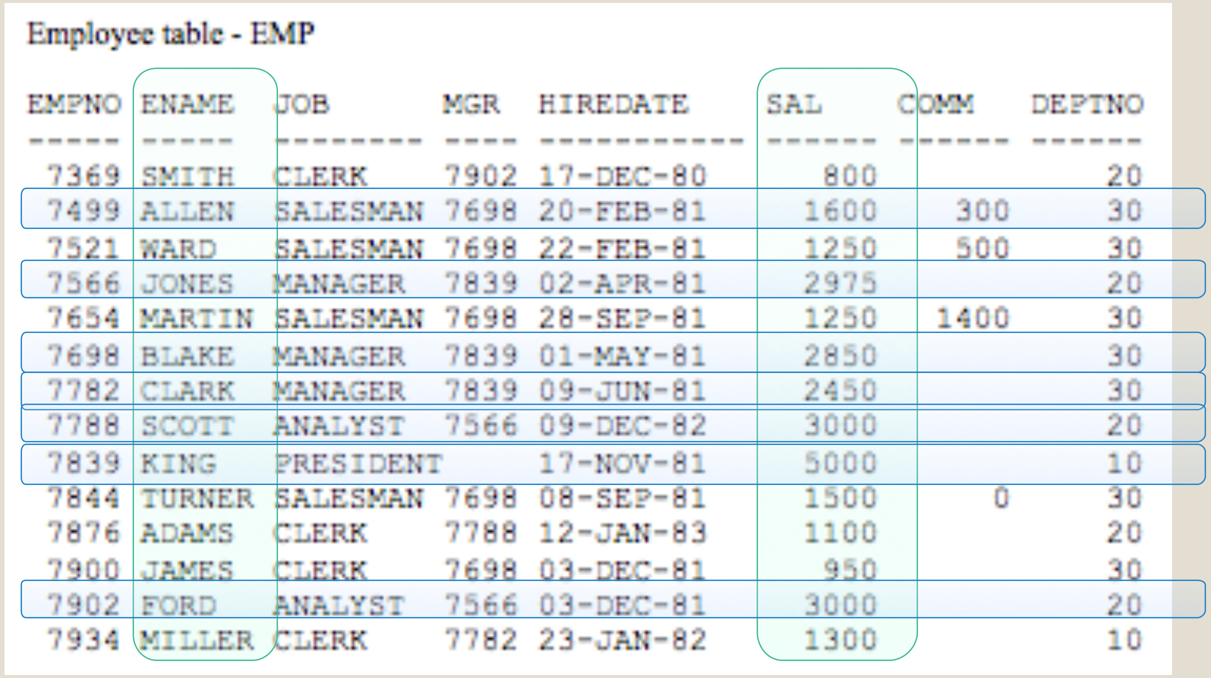
Where Conditions

- Comparison Operators:
  - =, >, >=, <, <=, <> (not equal to), != (not equal to), IS NULL, IS NOT NULL
- Ranges
  - BETWEEN, NOT BETWEEN
- Lists
  - IN, NOT IN
- Character Matches
  - LIKE, NOT LIKE
- Combinations of the above
  - AND, OR, NOT
  - AND evaluates to true if all expressions are true
  - OR evaluates to true if any of the expressions are true
  - NOT evaluates to false if the expression is true and true if the expression is false.

Examples – comparison operators

Display the names and salaries for employees earning at least 1500

```
SELECT ename, sal
FROM emp
WHERE sal >= 1500;
```



Employee table - EMP

```
EMPNO ENAME  JOB       MGR  HIREDATE    SAL    COMM   DEPTNO
----- -----  --------- ---- ----------- ------ ------ ------
 7369 SMITH  CLERK     7902 17-DEC-80      800            20
 7499 ALLEN  SALESMAN  7698 20-FEB-81     1600    300     30
 7521 WARD   SALESMAN  7698 22-FEB-81     1250    500     30
 7566 JONES  MANAGER   7839 02-APR-81     2975            20
 7654 MARTIN SALESMAN  7698 28-SEP-81     1250   1400     30
 7698 BLAKE  MANAGER   7839 01-MAY-81     2850            30
 7782 CLARK  MANAGER   7839 09-JUN-81     2450            30
 7788 SCOTT  ANALYST   7566 09-DEC-82     3000            20
 7839 KING   PRESIDENT      17-NOV-81     5000            10
 7844 TURNER SALESMAN  7698 08-SEP-81     1500      0     30
 7876 ADAMS  CLERK     7788 12-JAN-83     1100            20
 7900 JAMES  CLERK     7698 03-DEC-81      950            30
 7902 FORD   ANALYST   7566 03-DEC-81     3000            20
 7934 MILLER CLERK     7782 23-JAN-82     1300            10
```

Examples – comparison operators

Display the names and salaries of all employees whose monthly salary is less than or equal to the commission they earn

```
SELECT ename, sal
FROM emp
WHERE sal <= comm;
```

List all employees who are not clerks

```
SELECT empno, ename
    FROM emp
    WHERE job <> ‘clerk’
```

Example – checking for NULL

Which employees are NOT on Commission?

```
SELECT ename
  FROM emp
  WHERE comm IS NULL;
```

Which employees are on Commission?

```
SELECT ename
  FROM emp
  WHERE comm IS NOT NULL;
```

Examples – BETWEEN (for numeric data & dates)

List the names of employees who earn between 1000 and 1500 a month.

```
SELECT ename
FROM emp
WHERE sal BETWEEN 1000 AND 1500;
```

Show all details for employees hired during 1982 (i.e. between Jan 1st 1982 and Dec 31st 1982)

```
SELECT *
FROM emp
WHERE hiredate BETWEEN '1982-01-01' AND '1982-12-31’
```

BETWEEN checks for an inclusive range.

Date format is
YYYY-MM-DD
Year, month, day

Examples – IN, NOT IN
check if a value is one of a list of values

Give employee details for employees whose manager number is 7902, 7566, or 7788

```
        SELECT empno, ename
        FROM emp
        WHERE mgr IN (7902, 7566, 7788);
```

Numeric Data

Return all employees who are not managers, clerks or salesmen.

```
    SELECT empno, ename, job
        FROM emp
        WHERE job NOT IN (‘manager’, ‘clerk’, ’salesman’);
```

Character Data

Exercises

- Write SQL statements for the following:
  - display the name and salary of all employees earning more than $2850
  - display the name and department for employee number 7566
  - display the name, job and start date for employees hired between Feb 20th 1981 and May 1st, 1981.

Select . . . (which columns do you want to show in the output?)

From . . . (what is the name of the table?)

Where . . . (which rows should be displayed in the output?)

Exercise – using a different table.
Table name: student

StudentID	Surname	Course	Age	County
B00012345	Murphy	BN002	19	Dublin 15
B00034593	Doyle	BN104	34	Meath
B00043894	Hope	BN002	27	Dublin 7
B00345640	Keily	BN103	19	Dublin 15

- Which students are enrolled in the Certificate in Computing (BN002)?
- We need to send a mail shot to students not living in Dublin 15. List all such students.
- Are any students under 18?

Wildcard searches using LIKE
(for strings - varchar)

- Use LIKE operator to find patterns in strings (varchar). Typically look for a specific pattern in the values of the rows in a given table
- Condition can contain
  1. characters or number
  2. % denotes a string of any length (0 or more)
  3. _ (underscore) denotes any single character
  4. search for a character in a range [a–e] (any character between a and e)
  5. search for a set of characters [abc] (character must be either a, b or c)

HTTP://WWW.YOUTUBE.COM/WATCH?V=FCRY-MZNSJA&FEATURE=PLAYER_EMBEDDED#!

Get all employees whose name <u>begins</u> with the letter S

```
SELECT ename
FROM emp
WHERE ename LIKE ‘S%’;
```

Get all employees whose name <u>ends</u> with the letter S

```
SELECT ename
FROM emp
WHERE ename LIKE ‘%S’;
```

Get all employees whose name <u>contains</u> the character sequence ae

```
SELECT ename
FROM emp
WHERE ename LIKE ‘%ae%’;
```

Find all employees whose name begins with any character and the last four characters are *anet* *(5 letters in name)*

```
SELECT ename
FROM emp
WHERE ename LIKE ‘_anet’;
```

Find all employees whose name begins either with J or S

```
SELECT ename
FROM emp
WHERE ename LIKE ‘[js]%’;
```

Limitations of MySQL

- Note: currently MySQL only supports using % and _ with the like operator, but not character ranges such as [a-e]. To do more complex pattern matching with MySQL, you need to use the REGEXP operator instead of LIKE. This will interpret patterns based on Java's Regular Expression (REGEX) syntax. This is outside the scope of the module, but as an example, a query looking for all employee names beginning with J or S would be written as:

```
Select ename

From emp

Where ename REGEXP '^[JS]'
```

Exercises

- List all employees working in a department whose number starts with the digits ‘76’
- Which employees have the letter A in their name?
- Which employees have names that start with a letter from the first half of the alphabet (A to M)?
- Which names start with the letters B or C?

Exercise – Product table of furniture available in IKEA

ProductID	Description	Range	Aisle	Section
10203097	TV Bench	BENNO	18	A
30133942	TV Bench with Panel	BENNO	18	B
70104438	TV Bench	**GREVBÄCK**	18	F
60105339	Corner TV Bench	**LACK**	18	D
10065958	Coffee Table	LACK	15	H
07305310	DVD Tower	BENNO	2	J

- Based on the table above, write queries for the following:
  - List all products in the BENNO range
  - List all products in Aisle's 15 or higher
  - List all products in sections A, B and C
  - List all the types of TV Benches available

Combining conditions

Where clauses can include more than one condition, conditions can be joined using logical operators: AND, OR

Operators are evaluated in the following order - **Rules of Precedence**

1. Comparison Operators
2. NOT
3. AND
4. OR

Use parentheses / brackets to override rules

Example – combining conditions

Display the employee number, name, position and salary of all employees earning at least 1100 per month employed as clerks.

```
SELECT empno, ename, job, sal
FROM emp
WHERE sal>=1100
AND job=‘CLERK’;
```

Rows meeting both search conditions are returned.

Example – combining conditions

List the name, job and salary for staff who are employed either as salesmen or presidents and who earn more than 1500 a month.

```
SELECT ename, job, sal
FROM    emp
WHERE job=‘SALESMAN’
OR       job=‘PRESIDENT’
AND     sal>1500;
```

Example: Combining conditions

- Return all employees whose name begins with ‘b’ and are not employed as clerks, presidents or managers

```
SELECT empno, ename, job
FROM emp
WHERE ename LIKE ‘b%’
AND job NOT IN (‘clerk’, ‘manager’, ‘president’);
```

Exercise

- Display the name, job, and salary for all employees whose job is Clerk or Analyst and their salary is not equal to $1000, $3000, or $5000.
- Display the name of all employees who have 'LL' in their name and are in department 30 or their manager is 7782.
  - Is the English ambigious?

Derived Columns

- You can derive a new column from existing numeric or date fields using arithmetic expressions as shown below. This does not make any change to the database table itself.

  SELECT ename, sal, (sal *12) +100 AS 'Annual Salary'

  FROM emp;

```
ENAME              SAL  Annual Salary
---------- ---------- ----------
KING              5000      60100
BLAKE             2850      34300
CLARK             2450      29500
JONES             2975      35800
MARTIN            1250      15100
ALLEN             1600      19300
...
```

Operator Precedence:

*, /, +, -

Renaming Column Headings

- In the last slide, the new column was display under a column heading of 'Total Salary'.
- The display name of a column can be changed in three ways:

```
SELECT ename AS NAME, sal SALARY, sal*12 AS
  'Total Salary'  FROM emp;
```

1. With AS

2. Without AS

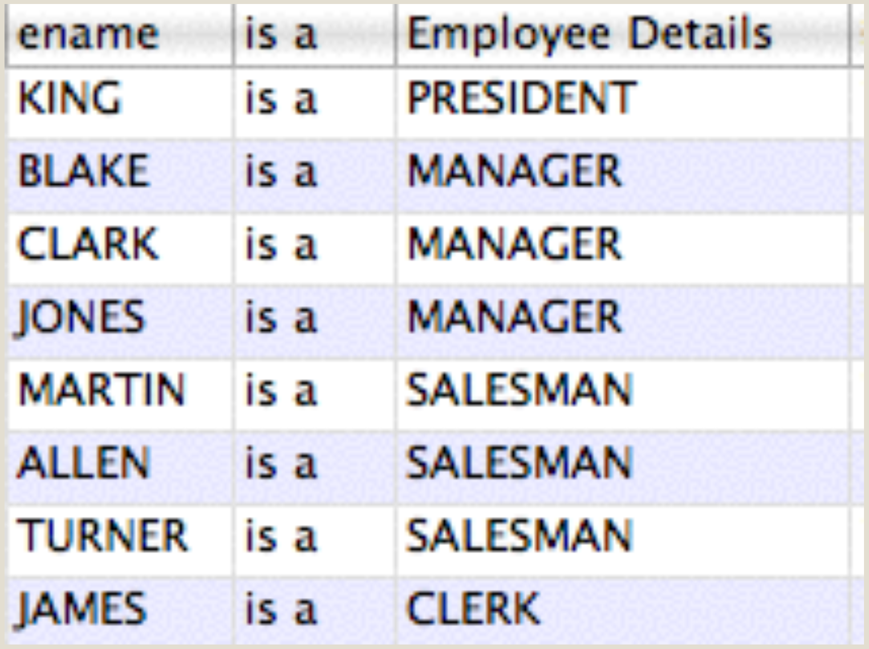
3. If the new name includes a blank, then it must be in quotes

```
NAME        SALARY      Total Salary
----------  ----------  ------------
KING              5000         60000
BLAKE             2850        34200
CLARK             2450        29400
JONES             2975        35700
```

Adding text to the output

- Characters, numbers or dates can be outputted as part of each row:

SELECT ename,' is a ‘, job AS ‘Employee Details’
FROM emp;



ename	is a	Employee Details
KING	is a	PRESIDENT
BLAKE	is a	MANAGER
CLARK	is a	MANAGER
JONES	is a	MANAGER
MARTIN	is a	SALESMAN
ALLEN	is a	SALESMAN
TURNER	is a	SALESMAN
JAMES	is a	CLERK

Sorting rows for output

- ORDER BY clause SORTS output, and should be the **last** clause in a SELECT statement

```
SELECT [DISTINCT] {*, column_name [alias], ...}
FROM table
[WHERE condition(s)];
[ORDER BY {column, expression} [ASC|DESC]];
```

The default sort method is Ascending.

Sorting rows for output

Display each employee’s name, position, department and the date they were hired. Sort the output in ascending order according to hiredate.

```
SELECT ename, job, deptno, hiredate
FROM    emp
ORDER BY    hiredate;
```

```
ENAME      JOB           DEPTNO HIREDATE
---------- --------- ---------- ---------
SMITH      CLERK             20 17-DEC-80
ALLEN      SALESMAN          30 20-FEB-81
...
14 rows selected.
```

Sorting rows for output

Display each employee's name, position, department and the date they were hired. Sort the by date, with the most recently employed listed first.

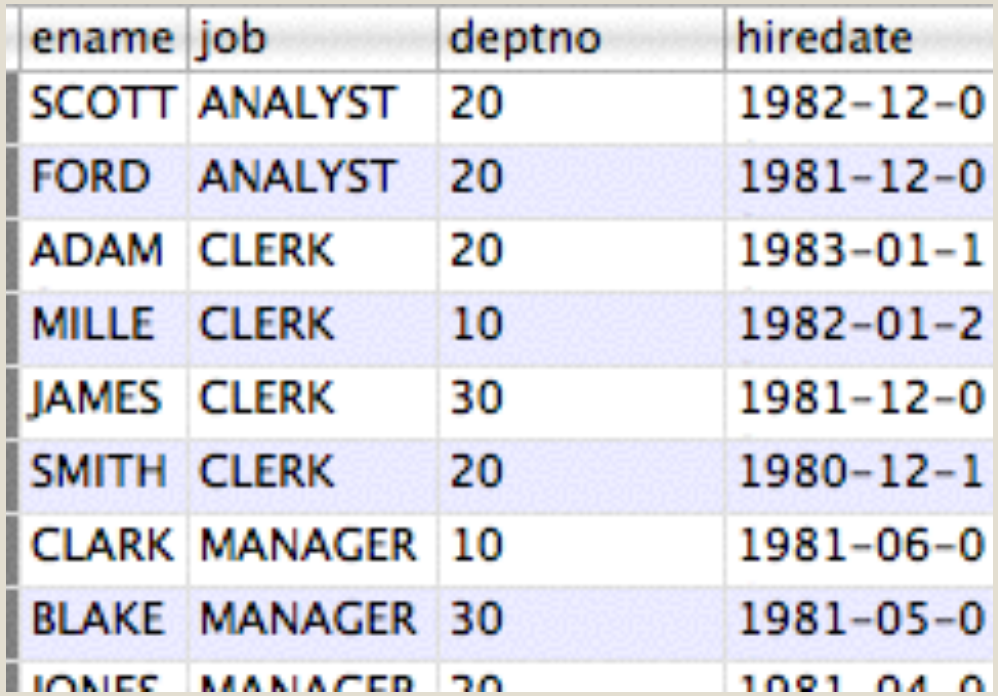
```
SELECT ename, job, deptno, hiredate
FROM  emp
ORDER BY hiredate DESC;
```

```
ENAME      JOB           DEPTNO HIREDATE
---------- --------- ---------- ---------
ADAMS      CLERK             20 12-JAN-83
SCOTT      ANALYST           20 09-DEC-82
MILLER     CLERK             10 23-JAN-82
JAMES      CLERK             30 03-DEC-81
FORD       ANALYST           20 03-DEC-81
KING       PRESIDENT         10 17-NOV-81
MARTIN     SALESMAN          30 28-SEP-81
...
14 rows selected.
```

Using multiple expressions in the ORDER BY clause

Display each employee’s name, position, department and the date they were hired. Sort by job in alphabetical order with the most recently employed in each job category listed first.

```
SELECT ename, job,
    deptno, hiredate
FROM emp
ORDER BY job ASC,
    hiredate DESC;
```



ename	job	deptno	hiredate
SCOTT	ANALYST	20	1982-12-0
FORD	ANALYST	20	1981-12-0
ADAM	CLERK	20	1983-01-1
MILLE	CLERK	10	1982-01-2
JAMES	CLERK	30	1981-12-0
SMITH	CLERK	20	1980-12-1
CLARK	MANAGER	10	1981-06-0
BLAKE	MANAGER	30	1981-05-0
JONES	MANAGER	20	1981-04-0

How will the results of the following query be ordered?

```
SELECT ename, job, deptno, sal
FROM   emp
ORDER BY deptno DESC, sal;
```

Limit (or Top N) clause

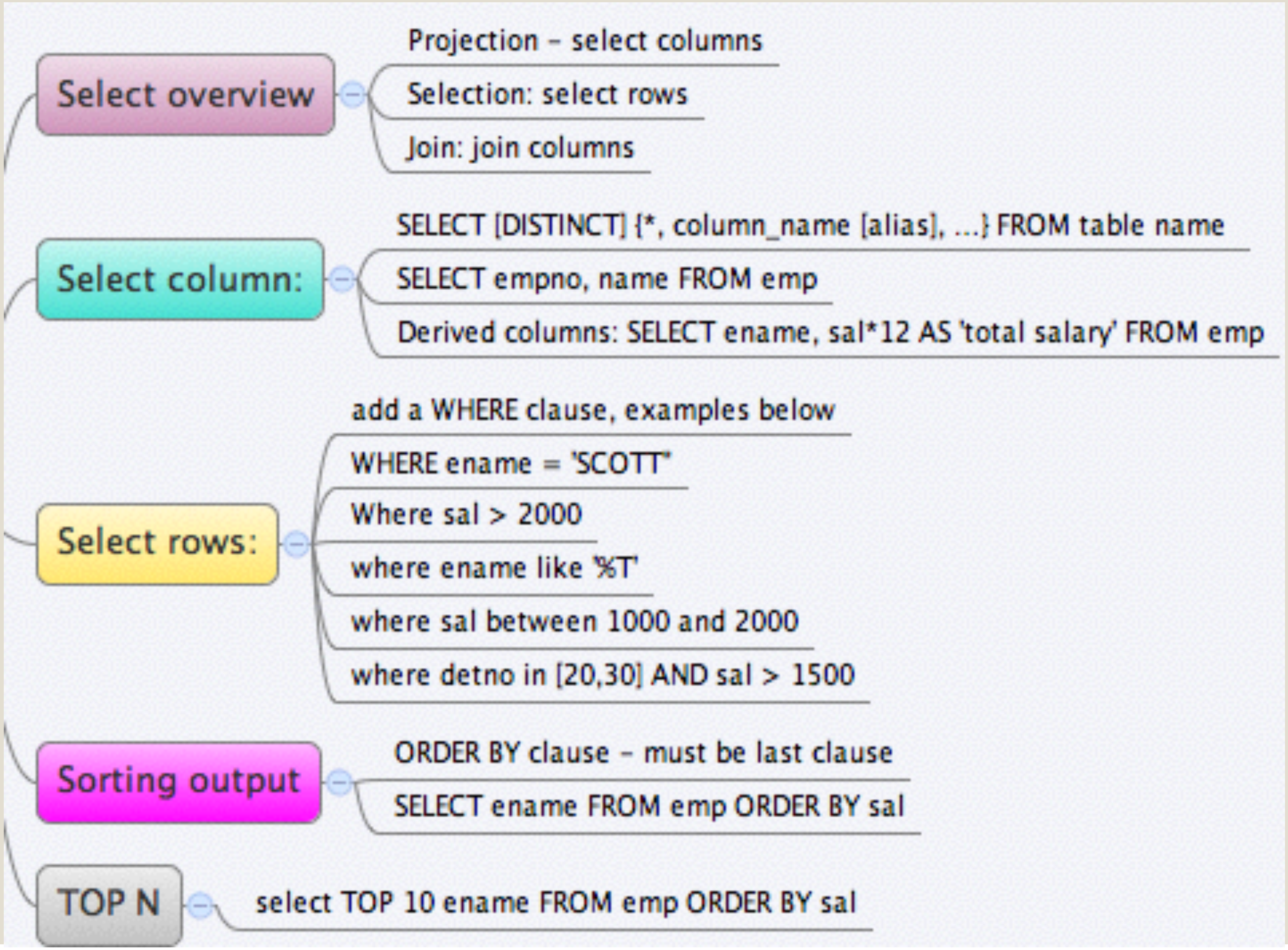
- LIMIT is used to limit the number of rows returned by a query as follows

```
SELECT ename, sal
FROM emp
ORDER BY sal DESC
LIMIT 10;
```

Exercises

1. Give a list of the name and salary of each employee earning more that $1500, and working in department 10 or 30. Label the columns ‘Employee’ and ‘Monthly Salary’
2. Show a list of unique salary values from the employee table in descending sequence
3. Show the top 3 salary values.
4. List each employees name, department, an their total earnings for the year where total earnings is (sal*12 + comm). Name the columns ‘Employee’, ‘Department’ and ‘Yearly Earnings’

Summary



- Projection – select columns
- Selection: select rows
- Join: join columns

- SELECT [DISTINCT] {*, column_name [alias], ...} FROM table name
- SELECT empno, name FROM emp
- Derived columns: SELECT ename, sal*12 AS 'total salary' FROM emp

- add a WHERE clause, examples below
- WHERE ename = 'SCOTT'
- Where sal > 2000
- where ename like '%T'
- where sal between 1000 and 2000
- where detno in [20,30] AND sal > 1500

- ORDER BY clause – must be last clause
- SELECT ename FROM emp ORDER BY sal

- select TOP 10 ename FROM emp ORDER BY sal