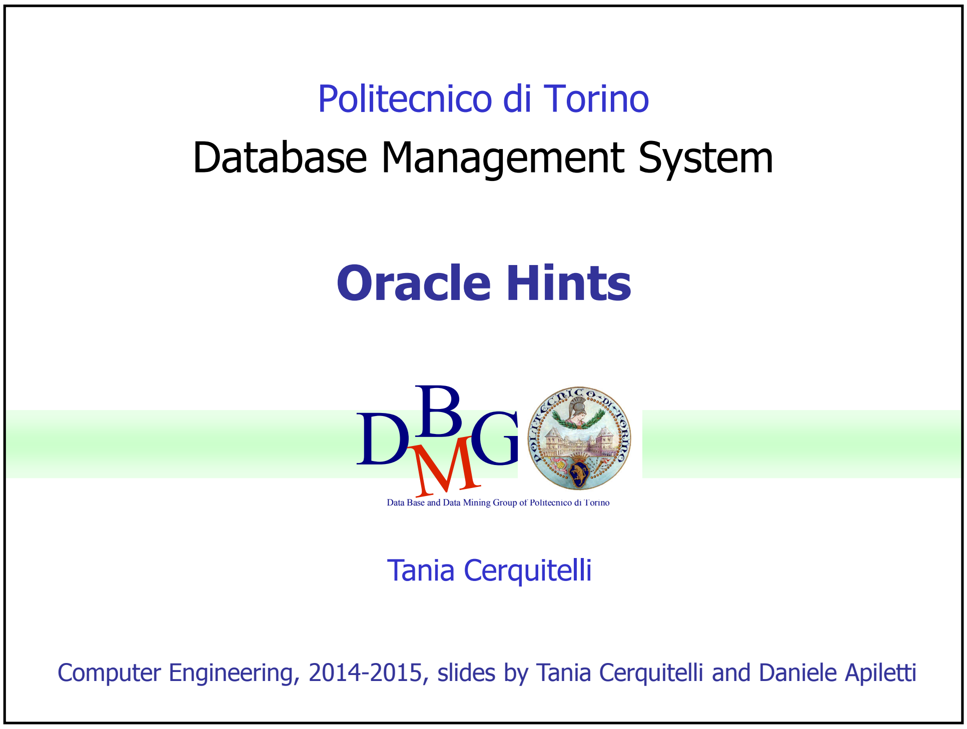

Politecnico di Torino

Database Management System

Oracle Hints

Data Base and Data Mining Group of Politecnico di Torino

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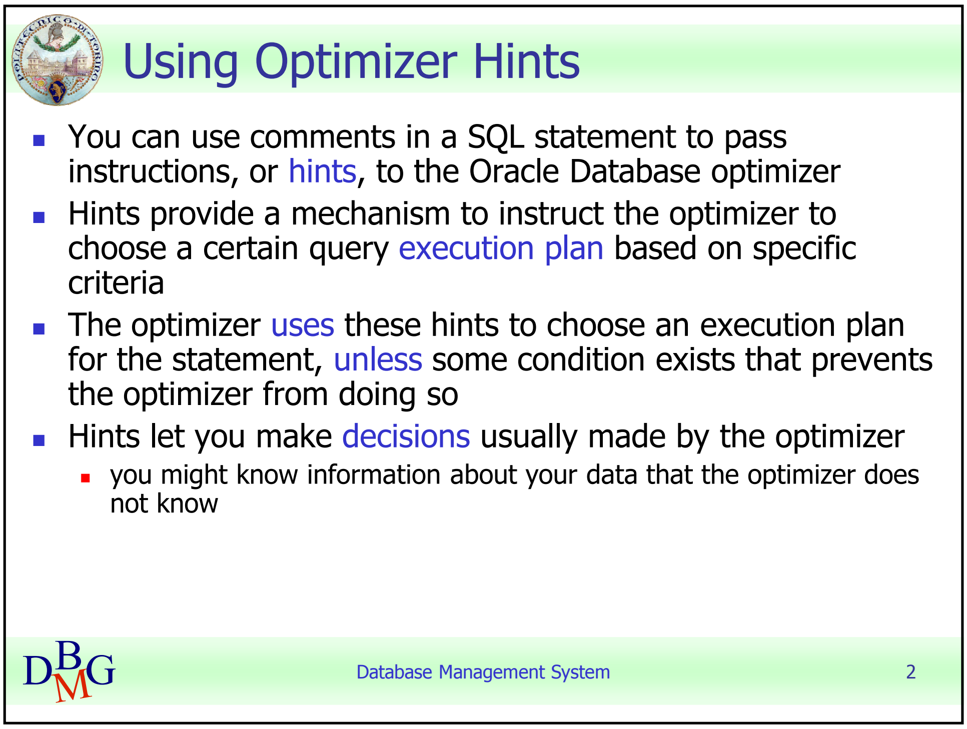
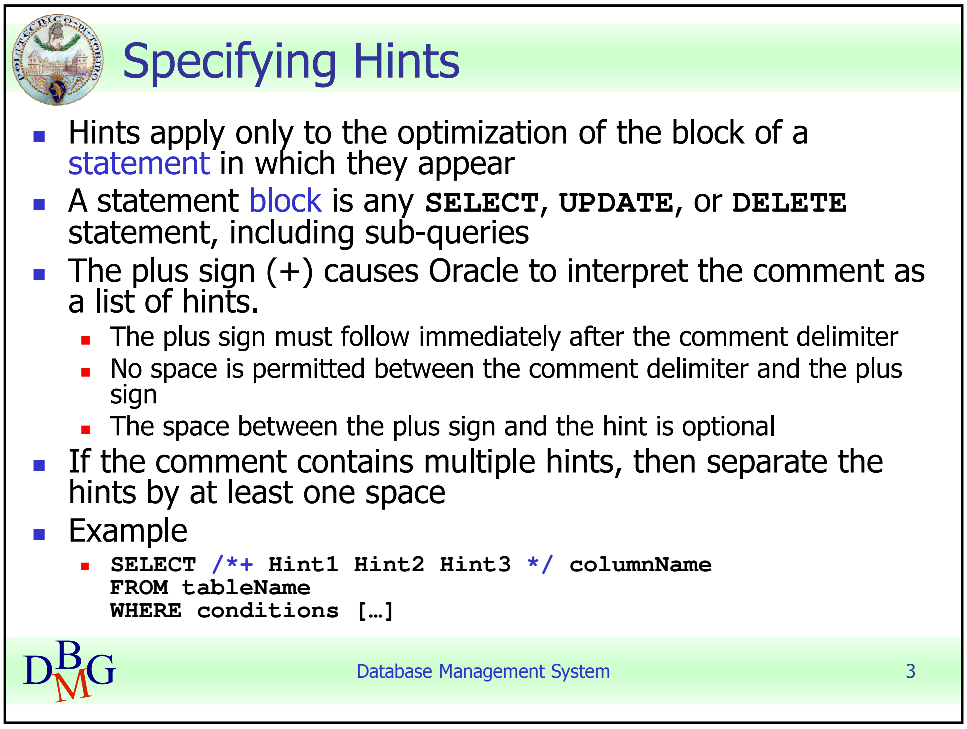
Computer Engineering, 2014-2015, slides by Tania Cerquitelli and Daniele Apiletti



Using Optimizer Hints

- You can use comments in a SQL statement to pass instructions, or hints, to the Oracle Database optimizer
- Hints provide a mechanism to instruct the optimizer to choose a certain query execution plan based on specific criteria
- The optimizer uses these hints to choose an execution plan for the statement, unless some condition exists that prevents the optimizer from doing so
- Hints let you make decisions usually made by the optimizer
  - you might know information about your data that the optimizer does not know

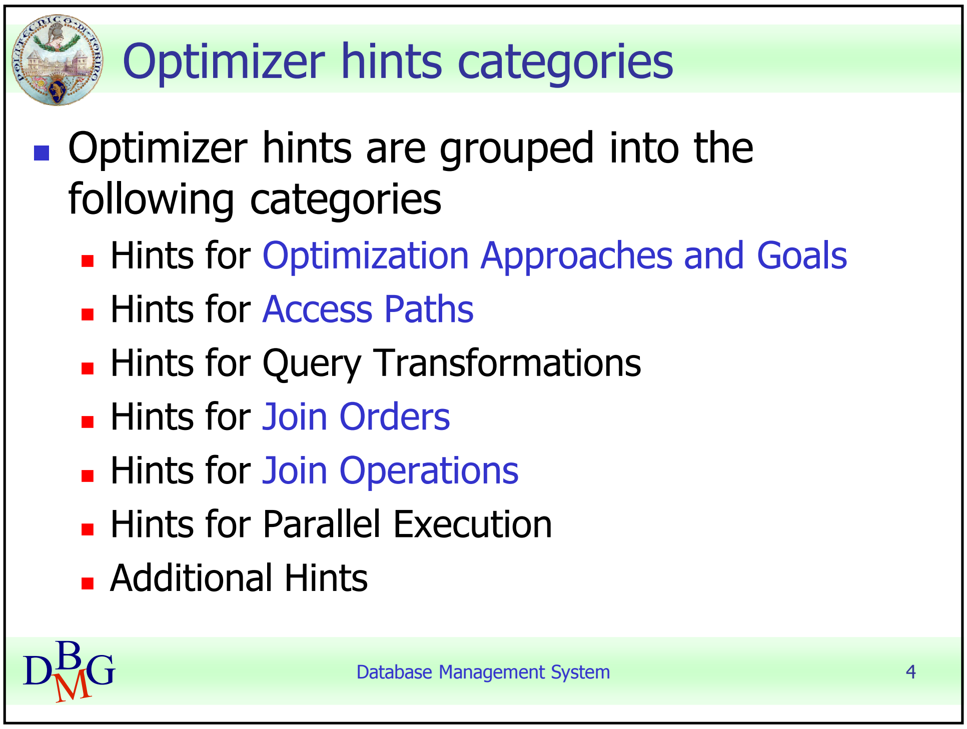


Specifying Hints

- Hints apply only to the optimization of the block of a statement in which they appear
- A statement block is any **SELECT**, **UPDATE**, or **DELETE** statement, including sub-queries
- The plus sign (+) causes Oracle to interpret the comment as a list of hints.
  - The plus sign must follow immediately after the comment delimiter
  - No space is permitted between the comment delimiter and the plus sign
  - The space between the plus sign and the hint is optional
- If the comment contains multiple hints, then separate the hints by at least one space
- Example

  -
    ```
    SELECT /*+ Hint1 Hint2 Hint3 */ columnName
    FROM tableName
    WHERE conditions […]
    ```

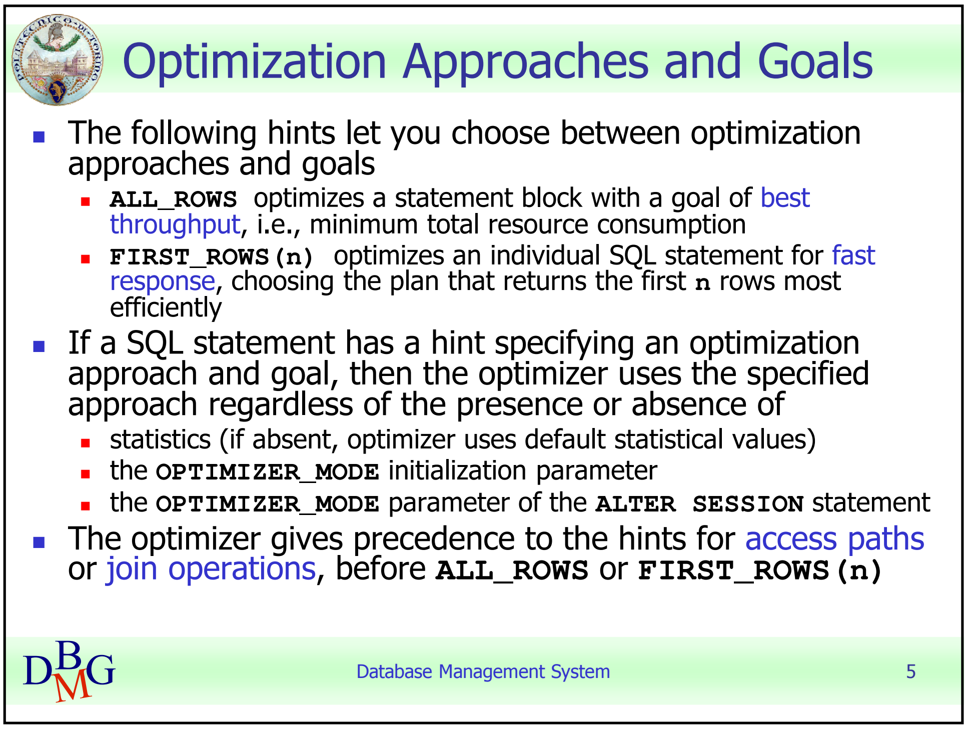
Database Management System 3



Optimizer hints categories

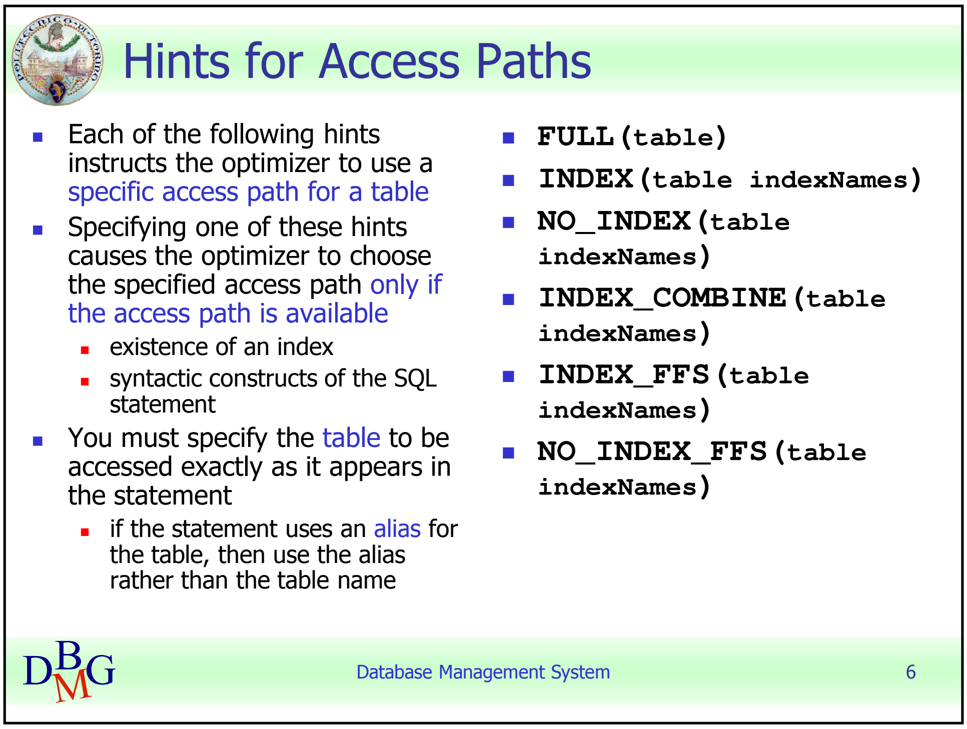
- Optimizer hints are grouped into the following categories
  - Hints for Optimization Approaches and Goals
  - Hints for Access Paths
  - Hints for Query Transformations
  - Hints for Join Orders
  - Hints for Join Operations
  - Hints for Parallel Execution
  - Additional Hints

Database Management System 4



Optimization Approaches and Goals

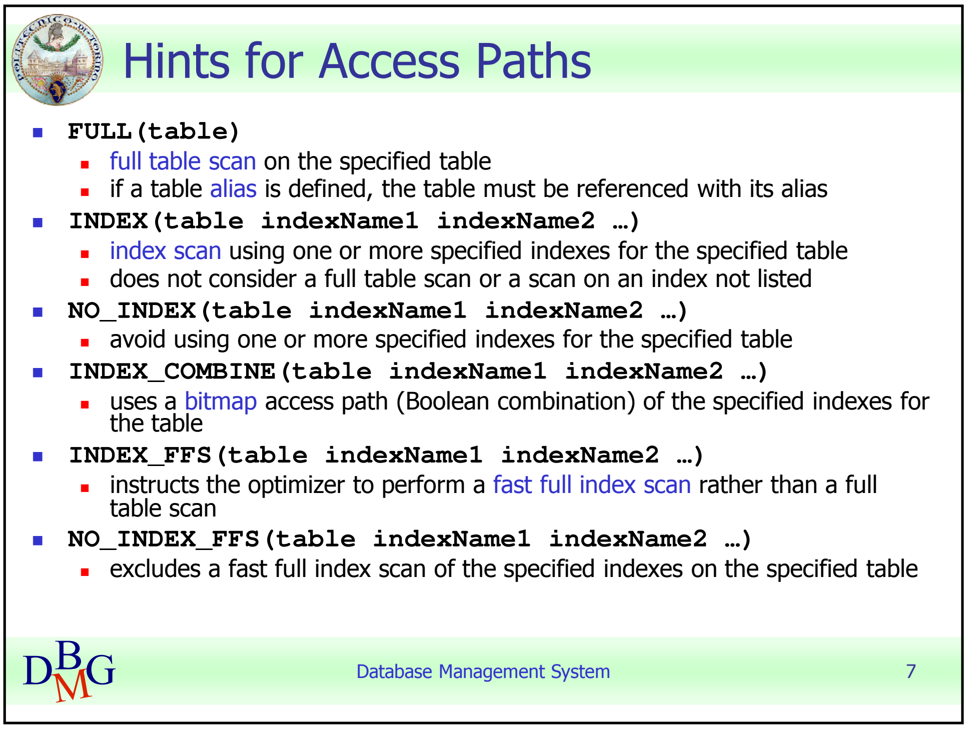
- The following hints let you choose between optimization approaches and goals
  - **ALL_ROWS** optimizes a statement block with a goal of best throughput, i.e., minimum total resource consumption
  - **FIRST_ROWS(n)** optimizes an individual SQL statement for fast response, choosing the plan that returns the first **n** rows most efficiently
- If a SQL statement has a hint specifying an optimization approach and goal, then the optimizer uses the specified approach regardless of the presence or absence of
  - statistics (if absent, optimizer uses default statistical values)
  - the **OPTIMIZER_MODE** initialization parameter
  - the **OPTIMIZER_MODE** parameter of the **ALTER SESSION** statement
- The optimizer gives precedence to the hints for access paths or join operations, before **ALL_ROWS** or **FIRST_ROWS(n)**



Hints for Access Paths

- Each of the following hints instructs the optimizer to use a specific access path for a table
- Specifying one of these hints causes the optimizer to choose the specified access path only if the access path is available
  - existence of an index
  - syntactic constructs of the SQL statement
- You must specify the table to be accessed exactly as it appears in the statement
  - if the statement uses an alias for the table, then use the alias rather than the table name

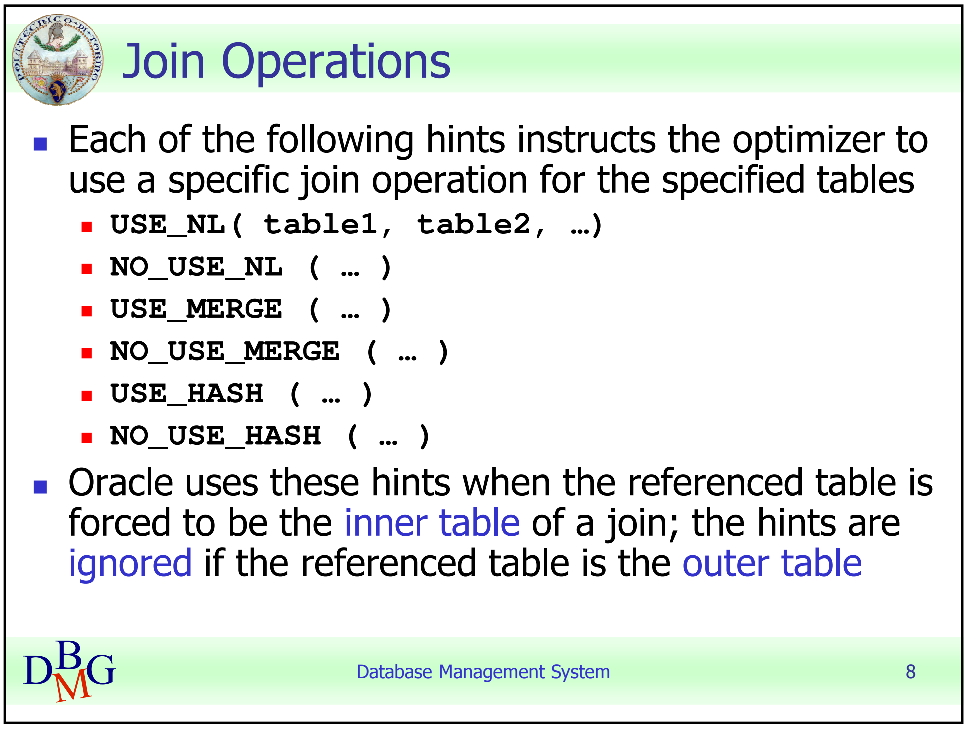
- **FULL(table)**
- **INDEX(table indexNames)**
- **NO_INDEX(table indexNames)**
- **INDEX_COMBINE(table indexNames)**
- **INDEX_FFS(table indexNames)**
- **NO_INDEX_FFS(table indexNames)**



Hints for Access Paths

- `FULL(table)`
  - full table scan on the specified table
  - if a table alias is defined, the table must be referenced with its alias
- `INDEX(table indexName1 indexName2 …)`
  - index scan using one or more specified indexes for the specified table
  - does not consider a full table scan or a scan on an index not listed
- `NO_INDEX(table indexName1 indexName2 …)`
  - avoid using one or more specified indexes for the specified table
- `INDEX_COMBINE(table indexName1 indexName2 …)`
  - uses a bitmap access path (Boolean combination) of the specified indexes for the table
- `INDEX_FFS(table indexName1 indexName2 …)`
  - instructs the optimizer to perform a fast full index scan rather than a full table scan
- `NO_INDEX_FFS(table indexName1 indexName2 …)`
  - excludes a fast full index scan of the specified indexes on the specified table

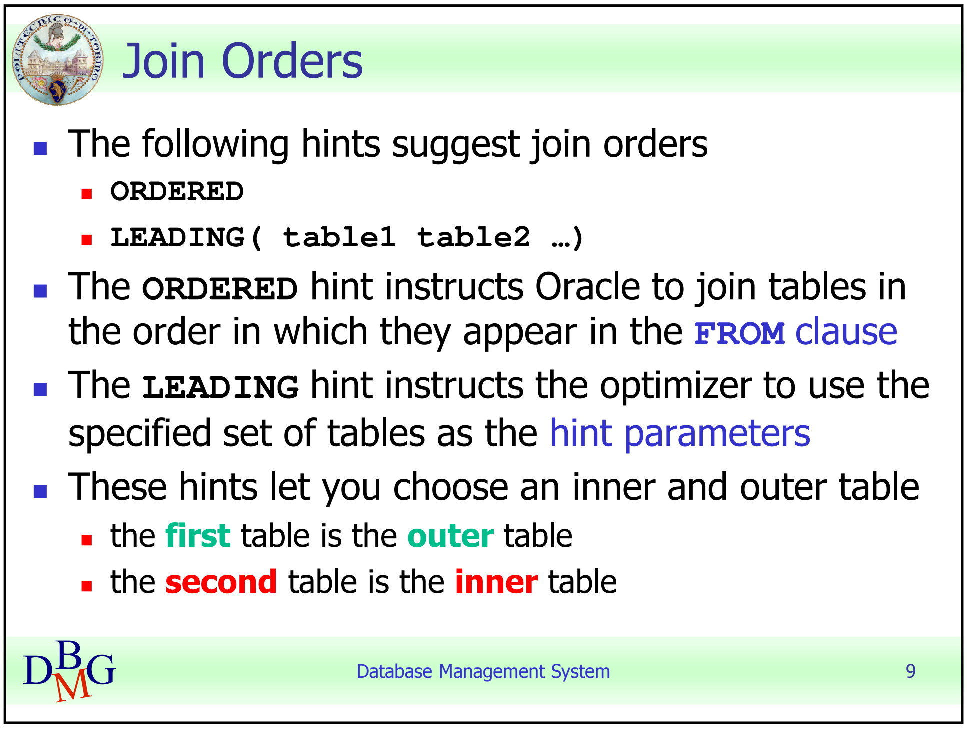
Database Management System 7



Join Operations

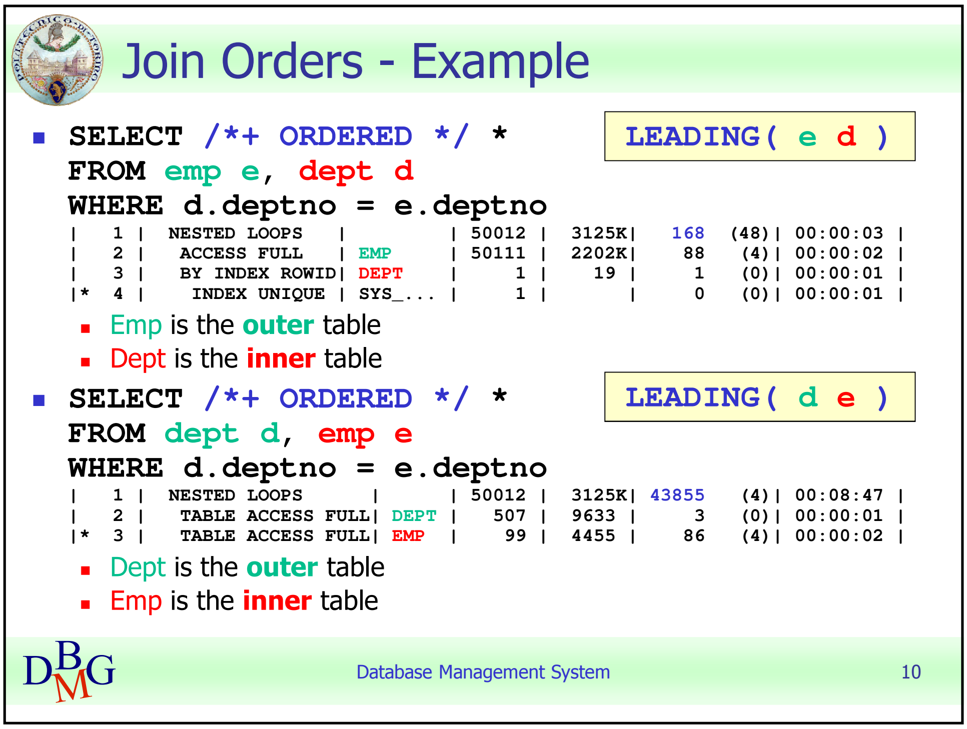
- Each of the following hints instructs the optimizer to use a specific join operation for the specified tables
  - `USE_NL( table1, table2, …)`
  - `NO_USE_NL ( … )`
  - `USE_MERGE ( … )`
  - `NO_USE_MERGE ( … )`
  - `USE_HASH ( … )`
  - `NO_USE_HASH ( … )`
- Oracle uses these hints when the referenced table is forced to be the inner table of a join; the hints are ignored if the referenced table is the outer table

Database Management System 8



Join Orders

- The following hints suggest join orders
  - **ORDERED**
  - **LEADING(table1 table2 …)**
- The **ORDERED** hint instructs Oracle to join tables in the order in which they appear in the **FROM** clause
- The **LEADING** hint instructs the optimizer to use the specified set of tables as the hint parameters
- These hints let you choose an inner and outer table
  - the **first** table is the **outer** table
  - the **second** table is the **inner** table



Join Orders - Example

-
  ```
  SELECT /*+ ORDERED */ *
  FROM emp e, dept d
  WHERE d.deptno = e.deptno
  ```

  LEADING(e d)

  ```
  |   1 |  NESTED LOOPS     |           | 50012 |  3125K|   168  (48)| 00:00:03 |
  |   2 |   ACCESS FULL     | EMP       | 50111 |  2202K|    88   (4)| 00:00:02 |
  |   3 |   BY INDEX ROWID| DEPT      |     1 |    19 |     1   (0)| 00:00:01 |
  |*  4 |    INDEX UNIQUE | SYS_... |     1 |       |     0   (0)| 00:00:01 |
  ```

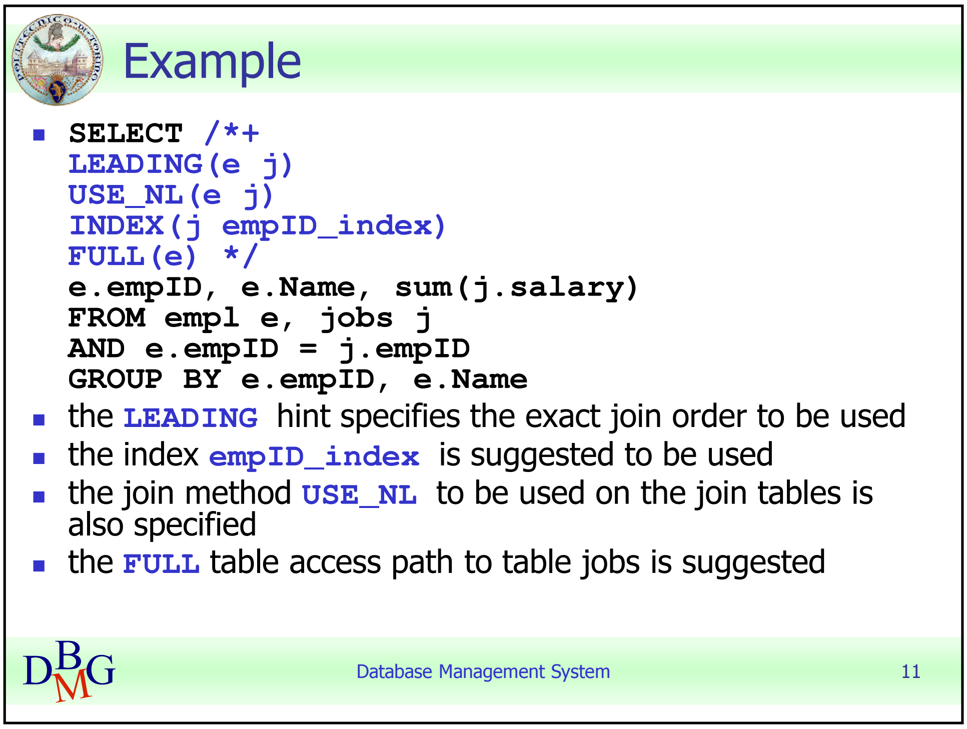
  - Emp is the **outer** table
  - Dept is the **inner** table

-
  ```
  SELECT /*+ ORDERED */ *
  FROM dept d, emp e
  WHERE d.deptno = e.deptno
  ```

  LEADING(d e)

  ```
  |   1 |  NESTED LOOPS        |        | 50012 |  3125K| 43855   (4)| 00:08:47 |
  |   2 |   TABLE ACCESS FULL| DEPT   |   507 |  9633 |     3   (0)| 00:00:01 |
  |*  3 |   TABLE ACCESS FULL| EMP    |    99 |  4455 |    86   (4)| 00:00:02 |
  ```

  - Dept is the **outer** table
  - Emp is the **inner** table



Example

-
  ```
  SELECT /*+
  LEADING(e j)
  USE_NL(e j)
  INDEX(j empID_index)
  FULL(e) */
  e.empID, e.Name, sum(j.salary)
  FROM empl e, jobs j
  AND e.empID = j.empID
  GROUP BY e.empID, e.Name
  ```
- the `LEADING` hint specifies the exact join order to be used
- the index `empID_index` is suggested to be used
- the join method `USE_NL` to be used on the join tables is also specified
- the `FULL` table access path to table jobs is suggested