# Hierarchical Retrieval

# Objectives

- After completing this lesson, you should be able to do the following:
  - Interpret the concept of a hierarchical query
  - Create a tree-structured report
  - Format hierarchical data
  - Exclude branches from the tree structure

# Sample Data from the EMPLOYEES Table

| EMPLOYEE_ID | LAST_NAME | JOB_ID | MANAGER_ID |
|---|---|---|---|
| 100 | King | AD_PRES | |
| 101 | Kochhar | AD_VP | 100 |
| 102 | De Haan | AD_VP | 100 |
| 103 | Hunold | IT_PROG | 102 |
| 104 | Ernst | IT_PROG | 103 |
| 105 | Austin | IT_PROG | 103 |
| 106 | Pataballa | IT_PROG | 103 |
| 107 | Lorentz | IT_PROG | 103 |
| 108 | Greenberg | FI_MGR | 101 |

...

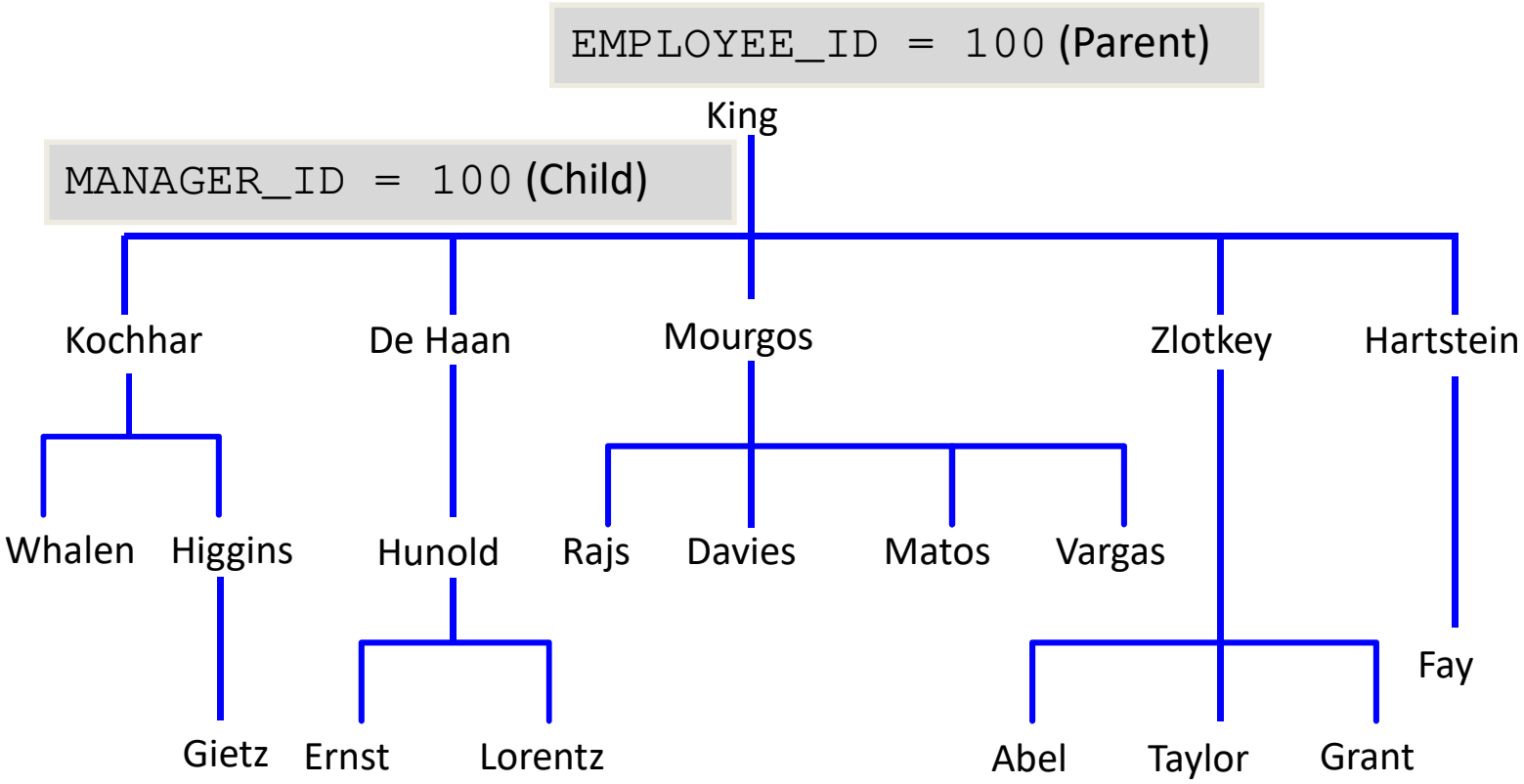
| EMPLOYEE_ID | LAST_NAME | JOB_ID | MANAGER_ID |
|---|---|---|---|
| 196 | Walsh | SH_CLERK | 124 |
| 197 | Feeney | SH_CLERK | 124 |
| 198 | OConnell | SH_CLERK | 124 |
| 199 | Grant | SH_CLERK | 124 |
| 200 | Whalen | AD_ASST | 101 |
| 201 | Hartstein | MK_MAN | 100 |
| 202 | Fay | MK_REP | 201 |
| 203 | Mavris | HR_REP | 101 |
| 204 | Baer | PR_REP | 101 |
| 205 | Higgins | AC_MGR | 101 |
| 206 | Gietz | AC_ACCOUNT | 205 |

107 rows selected.

# Natural Tree Structure

Using hierarchical queries, you can retrieve data based on a natural hierarchical relationship between rows in a table.
A relational database does not store records in a hierarchical way.
However, where a hierarchical relationship exists between the rows of a single table, a process called *tree walking* enables the hierarchy to be constructed.
A hierarchical query is possible when a relationship exists between rows in a table

# Natural Tree Structure



# Natural Tree Structure

The EMPLOYEES table has a tree structure representing the management reporting line. The hierarchy can be created by looking at the relationship between equivalent values in the EMPLOYEE_ID and MANAGER_ID columns. This relationship can be exploited by joining the table to itself.
The MANAGER_ID column contains the employee number of the employee's manager.
The parent-child relationship of a tree structure enables you to control:
The direction in which the hierarchy is walked.
The starting point inside the hierarchy.

# Hierarchical Queries

```
SELECT [LEVEL], column, expr...
FROM   table
[WHERE condition(s)]
[START WITH condition(s)]
[CONNECT BY PRIOR condition(s)] ;
```

WHERE *condition*:

```
expr comparison_operator expr
```

# Keywords and Clauses

**SELECT** Is the standard SELECT clause.
**LEVEL** For each row returned by a hierarchical query, the LEVEL pseudocolumn returns 1 for a root row, 2 for a child of a root, and so on.
**FROM** *table* Specifies the table, view, or snapshot containing the columns. You can select from only one table.
**WHERE** Restricts the rows returned by the query without affecting other rows of the hierarchy.
**START WITH** Specifies the root rows of the hierarchy (where to start). This clause is required for a true hierarchical query.
**CONNECT BY** Specifies the columns in which the relationship between parent and child rows exist.
**PRIOR** This clause is required for a hierarchical query.
The SELECT statement cannot contain a join or query from a view that contains a join.

# Walking the Tree

**Starting Point**

- Specifies the condition that must be met
- Accepts any valid condition

```
START WITH column1 = value
```

- Using the EMPLOYEES table, start with the employee whose last name is Kochhar.

```
...START WITH last_name = 'Kochhar'
```

# Starting Point(s)

The row or rows to be used as the root of the tree are determined by the `START WITH` clause.

A **`START WITH`** condition **can contain a subquery**.

```
START WITH employee_id =
  (SELECT employee_id FROM employees
   WHERE last_name = 'Kochhar')
```

If the `START WITH` clause is omitted, the tree walk is started with all of the rows in the table as root rows.

# Walking the Tree

```
CONNECT BY PRIOR column1 = column2
```

Walk from the top down, using the `EMPLOYEES` table.

```
... CONNECT BY PRIOR employee_id = manager_id
```

**Direction**

Top down → Column1 = Parent Key
Column2 = Child Key

Bottom up → Column1 = Child Key
Column2 = Parent Key

# Parent-Child relationship

The **PRIOR** operator refers to the parent row. To find the child rows of a parent row, the Oracle server evaluates the PRIOR expression for the parent row and the other expressions for each row in the table. Rows for which the condition is true are the child rows of the parent.

The Oracle server always selects child rows by evaluating the CONNECT BY condition with respect to a current parent row.

The **CONNECT BY** clause **cannot contain a subquery**.

# Walking the Tree: From the Bottom Up

```
SELECT employee_id, last_name, job_id, manager_id
FROM   employees
START  WITH  employee_id = 101
CONNECT BY PRIOR manager_id = employee_id ;
```

| EMPLOYEE_ID | LAST_NAME | JOB_ID | MANAGER_ID |
|---|---|---|---|
| 101 | Kochhar | AD_VP | 100 |
| 100 | King | AD_PRES | |

# Walking the Tree: From the Top Down

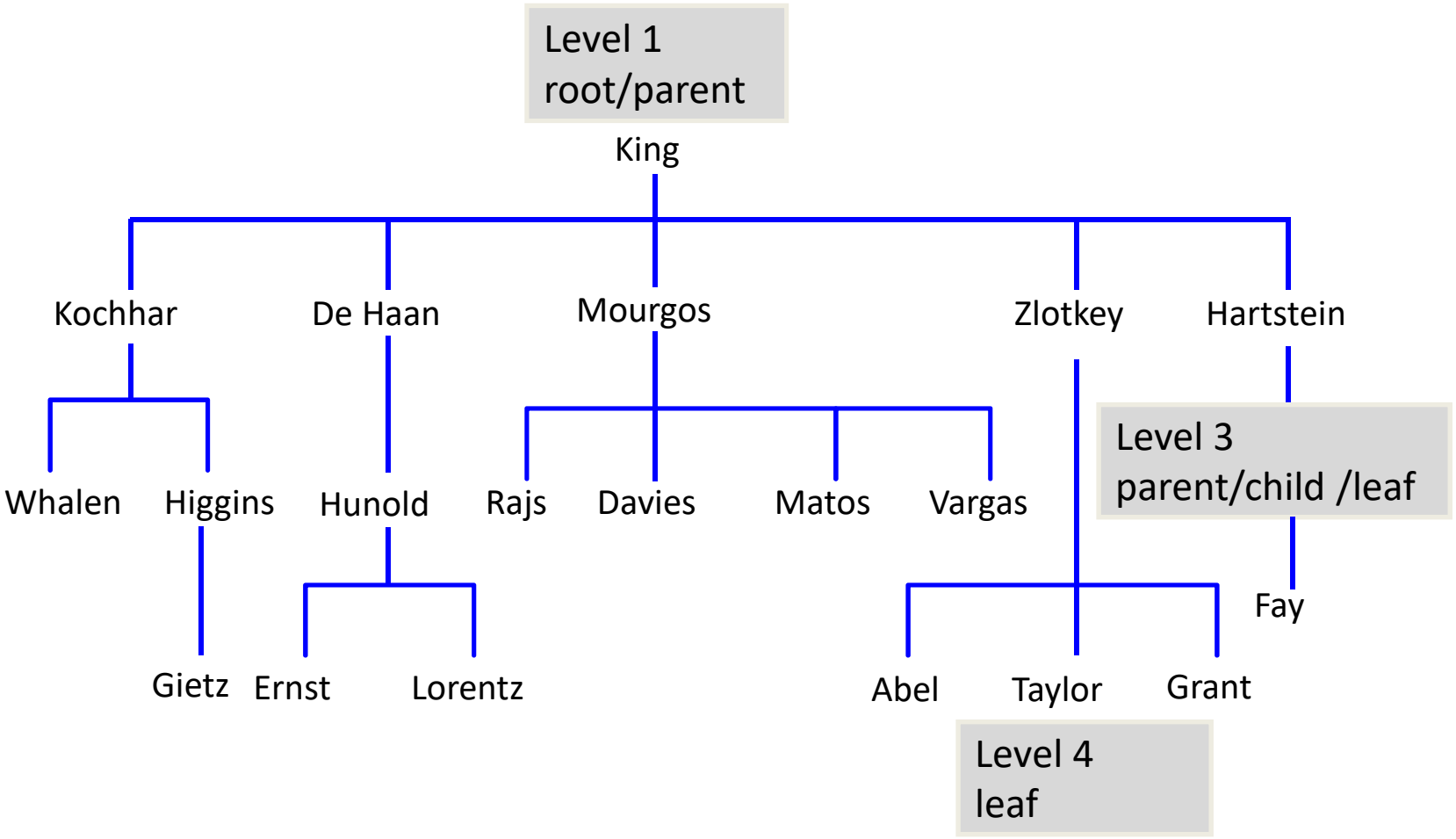
```
SELECT  last_name||' reports to '||
PRIOR   last_name "Walk Top Down"
FROM    employees
START   WITH last_name = 'King'
CONNECT BY PRIOR employee_id = manager_id ;
```

| Walk Top Down |
| --- |
| King reports to |
| King reports to |
| Kochhar reports to King |
| Greenberg reports to Kochhar |
| Faviet reports to Greenberg |
| Chen reports to Greenberg |

...

108 rows selected.

# Ranking Rows with the `LEVEL` Pseudocolumn



# Formatting Hierarchical Reports Using LEVEL and LPAD

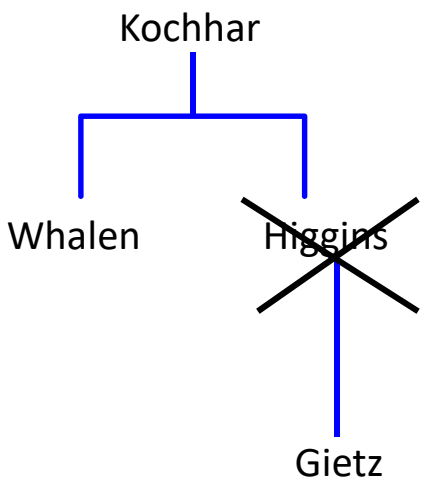
- Create a report displaying company management levels, beginning with the highest level and indenting each of the following levels.

```
COLUMN org_chart FORMAT A12
SELECT LPAD(last_name, LENGTH(last_name)+(LEVEL*2)-2,'_')
       AS org_chart
FROM   employees
START WITH last_name='King'
CONNECT BY PRIOR employee_id=manager_id
```

# Pruning Branches

Use the `WHERE` clause to eliminate a node.

```
WHERE last_name!='Higgins'
```




Use the `CONNECT BY` clause to eliminate a branch.

```
CONNECT BY PRIOR
employee_id = manager_id
AND last_name != 'Higgins'
```