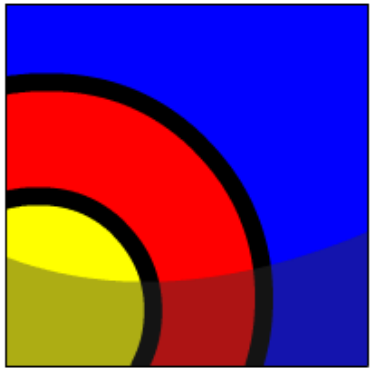
Self-Joins and Hierarchical Queries

What Will I Learn?

In this lesson, you will learn to:

- Construct and execute a SELECT statement to join a table to itself using a self-join
- Interpret the concept of a hierarchical query
- Create a tree-structured report
- Format hierarchical data
- Exclude branches from the tree structure



Why Learn It?

In data modeling, it was sometimes necessary to show an entity with a relationship to itself. For example, an employee can also be a manager. We showed this using the "pig's ear" relationship. Once we have a real employees table, a special kind of join called a self-join is required to access this data. You probably realize by now the importance of a data model once it becomes a database. It's no coincidence that the data model looks similar to the tables we now have in the database.

EMPLOYEE
id
first name
last name
phone number
hire date
salary

```
SELECT worker.last_name || 'works for' || manager.last_name
FROM employees worker, employees manager
WHERE worker.manager_id = manager.employee_id;
```

EMPLOYEES TABLE

employee_id	first_name	last_name	email	phone_number	hire_date	job_id	salary	commission_pct	manager_id	department_id
100	Steven	King	SKING	515.123.4567	17-JUN-87	AD_PRES	24000	(null)	(null)	90
101	Neena	Kochhar	NKOCHHAR	515.123.4568	21-SEP-89	AD_VP	17000	(null)	100	90

(This EMPLOYEES table output shows columns resulting from a join)

Tell Me / Show Me

SELF-JOIN

To join a table to itself, the table is given two names or aliases. This will make the database “think” that there are two tables. Choose alias names that relate to the data's association with that table.

EMPLOYEES (worker)

employee_id	last_name	manager_id
100	King	
101	Kochar	100
102	De Haan	100
103	Hunold	102
104	Ernst	103
107	Lorentz	103
124	Mourgos	100

EMPLOYEES (manager)

employee_id	last_name
100	King
101	Kochar
102	De Haan
103	Hunold
104	Ernst
107	Lorentz
124	Mourgos

Manager_id in the worker table is equal to employee_id in the manager table.

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SELF-JOIN

Here is another example of a self-join. In this example of a band, we have members of the band who play an instrument and members of the band who play an instrument and are their section's lead player or chair. A readable way to show this self-join is:

```
SELECT chair.last_name || ' is the section chair of ' ||
player.last_name
FROM band_members chair, band_members player
WHERE  player.chair_id =  chair.member_id;
```

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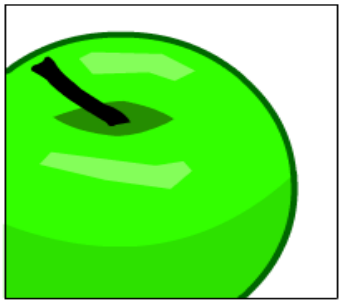
HIERARCHICAL QUERIES



Closely related to self-joins are hierarchical queries. On the previous pages you saw how you can use self-joins to see who is someone's direct manager. With hierarchical queries we can also see who that manager works for and so on.

We can basically build an Organization Chart showing the structure of a company or a department. Imagine a family tree with the eldest members of the family found close to the base or trunk of the tree and the youngest members representing branches of the tree. Branches can have their own branches, and so on.

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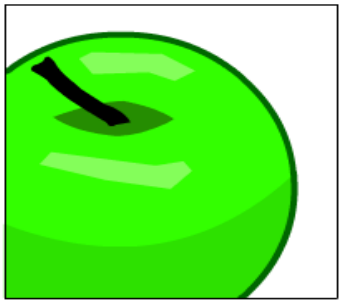
HIERARCHICAL QUERIES



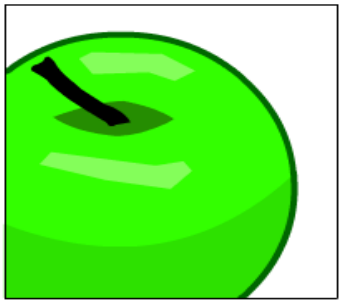
Using hierarchical queries, you can retrieve data based on a natural hierarchical relationship between rows in a table.

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 a method of reporting the branches of a tree in a specific order.

Tell Me / Show Me

HIERARCHICAL QUERIES



Examine the sample data from the EMPLOYEES table below, and look at how you can manually make the connections to see who works for whom starting with Steven King and going down the tree from there.

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	EMAIL	PHONE_NUMBER	HIRE_DATE	JOB_ID	SALARY	COMM_PCT	MGR_ID	DEPT_ID
100	Steven	King	SKING	515.123.4567	17-JUN-87	AD_PRES	24000	(null)	(null)	90
101	Neena	Kochhar	NKOCHHAR	515.123.4568	21-SEP-89	AD_VP	17000	(null)	100	90
102	Lex	De Haan	LDEHAAN	515.123.4569	13-JAN-93	AD_VP	17000	(null)	100	90
103	Alexander	Hunold	AHUNOLD	590.423.4567	03-JAN-90	IT_PROG	9000	(null)	102	60
104	Bruce	Ernst	BERNST	590.423.4568	21-MAY-91	IT_PROG	6000	(null)	103	60
124	Kevin	Mourgos	KMOURGOS	650.123.5234	16-NOV-99	ST_MAN	5800	(null)	100	50
141	Trenna	Rajs	TRAJS	650.121.8009	17-OCT-95	ST_CLERK	3500	(null)	124	50

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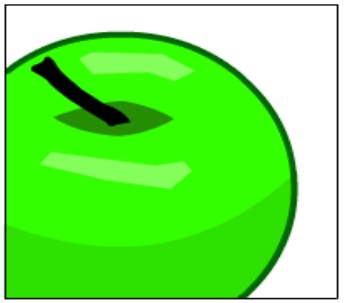
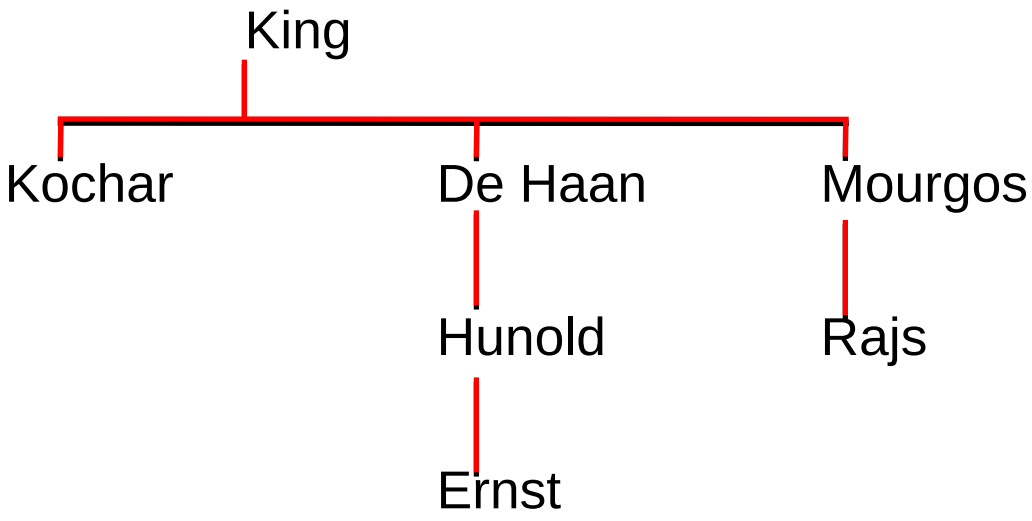
HIERARCHICAL QUERIES



So the organization chart we can draw from the data in the EMPLOYEES table will look like this:



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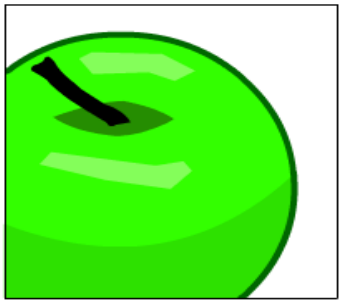
HIERARCHICAL QUERIES



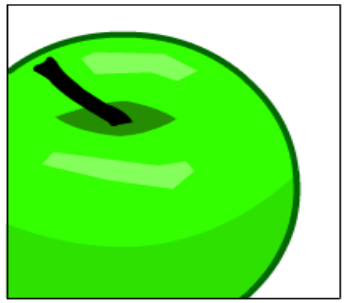
Hierarchical queries have their own new keywords: START WITH, CONNECT BY PRIOR and LEVEL.

START WITH is used to tell Oracle which row to use as its Root of the tree it is constructing, CONNECT BY PRIOR tells Oracle how to do the inter-row joins and LEVEL is how many steps down from the top of the tree we have taken.

Tell Me / Show Me

HIERARCHICAL QUERIES

```
SELECT employee_id, last_name, job_id, manager_id
FROM   employees
START  WITH  employee_id = 100
CONNECT BY PRIOR employee_id = manager_id
```

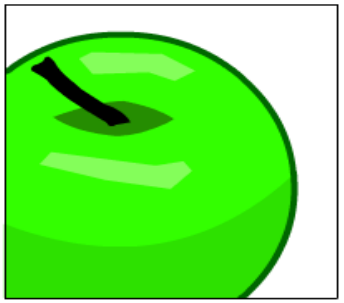


employee_id	last_name	job_id	manager_id
100	King	AD_PRES	(null)
101	Kochhar	AD_VP	100
200	Whalen	AD_ASST	101
205	Higgins	AC_MGR	101
206	Gietz	AC_ACCOUNT	205
102	De Haan	AD_VP	100
103	Hunould	IT_PROG	102
141	Rajs	ST_CLERK	124

Tell Me / Show Me

HIERARCHICAL QUERIES

```
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
```

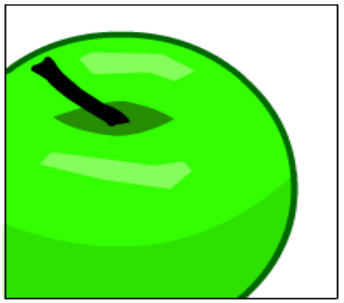


Walk Top Down
King reports to
Kochhar reports to King
Whalen reports to Kochhar
Higgins reports to Kochhar
Gietz reports to Higgins
De Haan reports to King
Hunold reports to De Haan
Ernst reports to Hunold

Tell Me / Show Me

HIERARCHICAL QUERIES

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

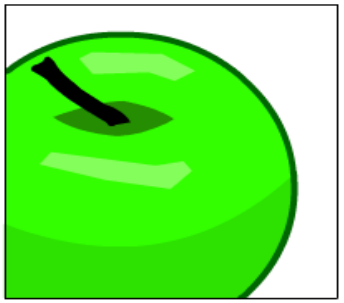


LEVEL is a pseudo-column used with hierarchical queries, and it counts the number of steps it has taken from the root of the tree.

LEVEL	Walk Top Down
1	King reports to
2	Kochhar reports to King
3	Whalen reports to Kochhar
3	Higgins reports to Kochhar
4	Gietz reports to Higgins
2	De Haan reports to King
3	Hunold reports to De Haan
4	Ernst reports to Hunold

Tell Me / Show Me

HIERARCHICAL QUERIES



If you wanted to create a report displaying company management levels, beginning with the highest level and indenting each of the following levels, then this would be easy to do using the LEVEL pseudo column and the LPAD function to indent employees based on their level.

```
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
```

Tell Me / Show Me

HIERARCHICAL QUERIES

```
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
```

As you can see in the result on the left, each row is indented by two underscores per level.

ORG_CHART
King
__Kochhar
____Whalen
____Higgins
______Gietz
__De Haan
____Hunold
______Ernst
______Lorentz
__Mourgos
____Rajs
____Davies
____Matos
____Vargas
__Zlotkey
____Abel
____Taylor
____Grant
__Hartstein
____Fay

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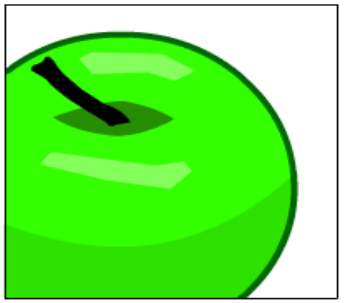
HIERARCHICAL QUERIES



Pruning branches from the tree can be done using either the WHERE clause or the CONNECT BY PRIOR clause.

If the WHERE clause is used then only the row named in the statement is excluded and if the CONNECT BY PRIOR is used that entire branch is excluded.

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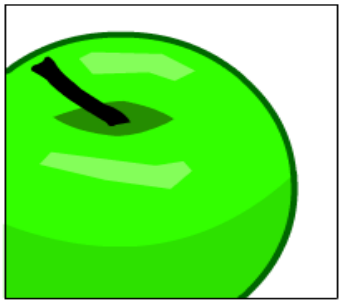
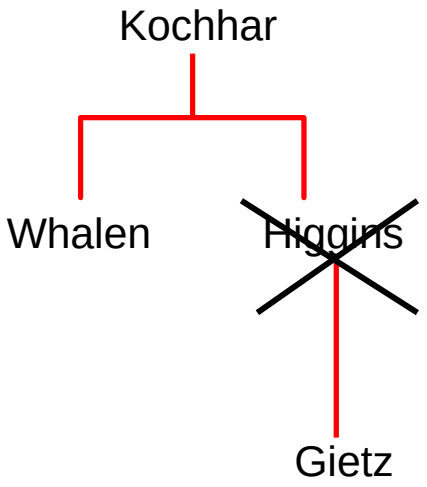
HIERARCHICAL QUERIES



So if you wanted to just not include a single row in your result you would use the WHERE clause to exclude that row, but in the result it would then look like Gietz worked directly for Kochhar, which he does not.

```
SELECT last_name
FROM employees
WHERE last_name != 'Higgins‘
START WITH last_name = ‘Kochhar’
CONNECT BY PRIOR  employee_id = manager_id
```



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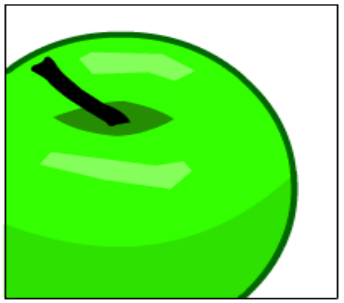
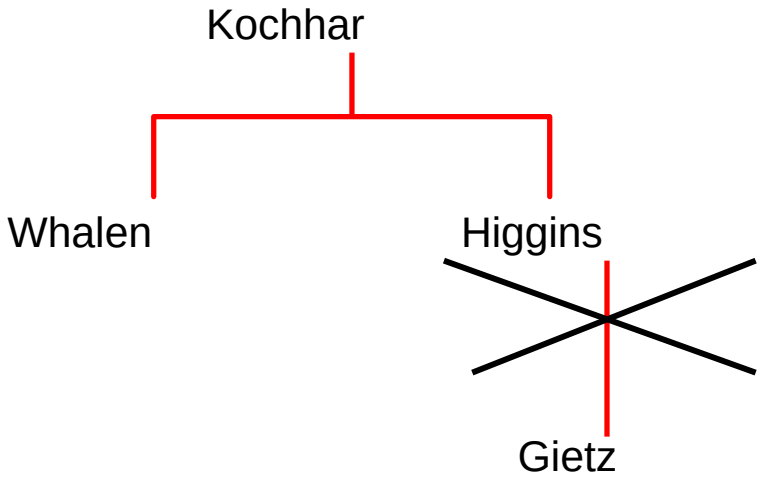
HIERARCHICAL QUERIES



If, however, you wanted to exclude one row and all the rows below that one you should make the exclusion part of the CONNECT BY statement. In this example by excluding Higgins, we are also excluding Gietz in the result.

```
SELECT last_name
FROM employees
START  WITH last_name = ‘Kochhar’
CONNECT BY PRIOR  employee_id = manager_id
AND last_name != 'Higgins
```



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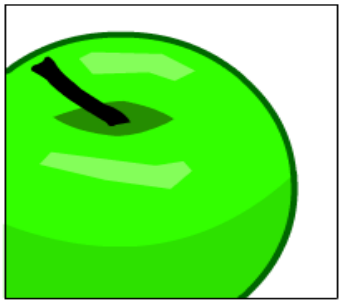
Terminology

Key terms used in this lesson include:



Self join

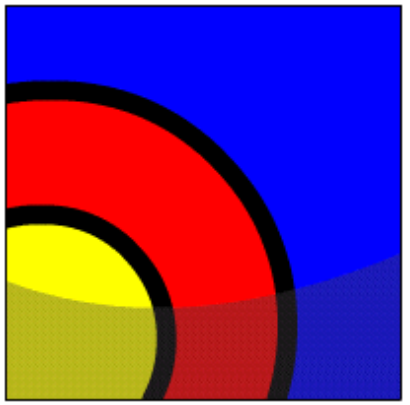
Hierarchical Queries

Level

Start with

Connect By prior

Summary



In this lesson you have learned to:

- Construct and execute a SELECT statement to join a table to itself using a self-join
- Interpret the concept of a hierarchical query
- Create a tree-structured report
- Format hierarchical data
- Exclude branches from the tree structure

Summary

Practice Guide

The link for the lesson practice guide can be found in the course resources in Section 0.