Database Management

BU.330.770

Session 5 (Part I)

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Announcement

- We have Quiz #3 next week
  - Includes class contents from week 4 and week 5
- The logistics are the same
  - Check your network, Respondus LockDown Browser
  - After submission, you may leave the classroom and come back to join the class within the given amount of time
- Similar to Quiz #2: multiple choice questions + SQL statement

Restricting Rows & Sorting Data

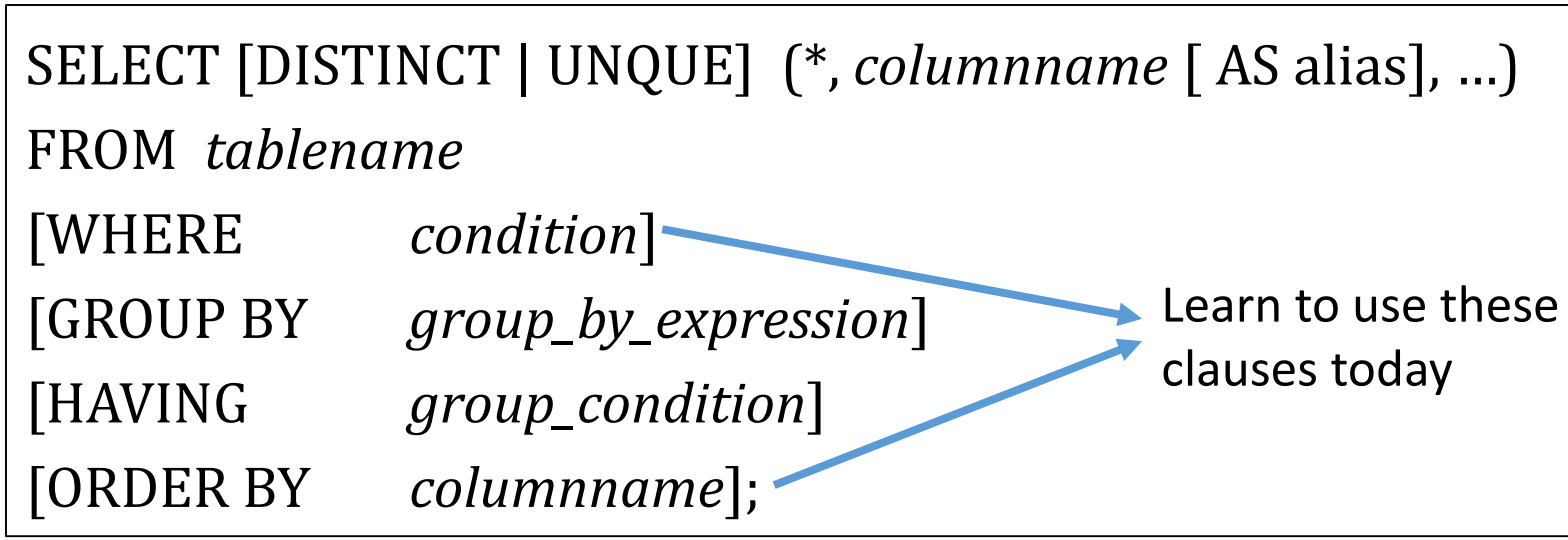
Session Objectives (1/2)

- Use a WHERE clause to restrict the rows returned by a query
- Create a search condition using mathematical comparison operators
- Use the BETWEEN…AND comparison operator to identify records within a range of values
- Specify a list of values for a search condition using the IN comparison operator

Session Objectives (2/2)

- Search for patterns using the LIKE comparison operator
- Identify the purpose of the % and _ wildcard characters
- Combine multiple search conditions using the appropriate logical operator
- Perform searches for NULL values
- Specify the order for the presentation of query results using an ORDER BY clause

Review SELECT Statement Syntax



WHERE Clause Syntax

- A WHERE clause is used to retrieve rows based on a stated condition

- Requires:
  - Column name
  - Comparison operator
  - Value or column for comparison

WHERE clause format:

<column name> <comparison operator> <another named column or value>

- Values are case sensitive

```
SELECT *
FROM acctmanager
WHERE amlast = 'Jones';
```

WHERE Clause Example

- List WHERE clause after FROM clause
- Enclose nonnumeric data in single quotes

Worksheet | Query Builder

```
SELECT lastname, state
FROM customers
WHERE state = 'FL';
```

Query Result | SQL | All Rows Fetched: 4 in 0.13 seconds

	LASTNAME	STATE
1	MORALES	FL
2	SMITH	FL
3	NGUYEN	FL
4	SCHELL	FL

Any value entered in a string literal (inside single quotation marks) is evaluated exactly as entered both in spacing and letter case

Worksheet | Query Builder

```
SELECT lastname, firstname
FROM customers
WHERE customer# = 1010;
```

Script Output | Query Result | SQL | All Rows Fetched: 1 in 0.019 seconds

	LASTNAME	FIRSTNAME
1	LUCAS	JAKE

Numeric values don't need to be enclosed in ' '

Condition on Dates

- A date value must be enclosed in single quotation marks

Worksheet | Query Builder

```
SELECT *
FROM books
WHERE pubdate = '21-JAN-15';
```

Query Result

SQL | All Rows Fetched: 2 in 0.022 seconds

	ISBN	TITLE	PUBDATE	PUBID	COST	RETAIL	DISCOUNT	CATEGORY
1	1059831198	BODYBUILD IN 10 MINUTES A DAY	21-JAN-15	4	18.75	30.95	(null)	FITNESS
2	1915762492	HANDCRANKED COMPUTERS	21-JAN-15	3	21.8	25	(null)	COMPUTER

Comparison Operators

- Indicate how the data should relate to the given search value

Worksheet | Query Builder

```
SELECT title, retail
FROM books
WHERE retail > 55;
```

Script Output | Query Result

SQL | All Rows Fetched: 4 in 0.019 seconds

	TITLE	RETAIL
1	BUILDING A CAR WITH TOOTHPICKS	59.95
2	DATABASE IMPLEMENTATION	55.95
3	HOLY GRAIL OF ORACLE	75.95
4	PAINLESS CHILD-REARING	89.95

Suppose JustLee's marketing team wants to include a gift with the purchase of any book that has a retail price of more than $55.

Comparison Operators used with Text

- The greater than '>' operator can be used with a text field, too

Worksheet | Query Builder

```
SELECT title
FROM books
WHERE title > 'HOO';
```

Script Output | Query Result

SQL | All Rows Fetched: 6 in 0.017 seconds

	TITLE
1	HOW TO GET FASTER PIZZA
2	HOW TO MANAGE THE MANAGER
3	PAINLESS CHILD-REARING
4	REVENGE OF MICKEY
5	SHORTEST POEMS
6	THE WOK WAY TO COOK

'HOL' < 'HOO'

'HOW' > 'HOO'

'PAI' > 'HOO'

All titles start with either 'HOO+' or alphabetically greater letters

Then, how about 'HOOT HOOT POKEMON'?

Comparison Operators used with Date

- The greater than > operator can be used with date field too

Worksheet | Query Builder

```
SELECT order#, orderdate
FROM orders
WHERE orderdate < '01-APR-19';
```

Query Result

SQL | All Rows Fetched: 3 in 0.019 seconds

	ORDER#	ORDERDATE
1	1000	31-MAR-19
2	1001	31-MAR-19
3	1002	31-MAR-19

Orders placed before Apr. 1, 2019, are listed

Comparison with Calculated Value

Worksheet | Query Builder

```
SELECT title, retail - cost profit
FROM books
WHERE retail - cost < cost * 0.2
```

Script Output x | Query Result x

SQL | All Rows Fetched: 1 in 0.027 seconds

	TITLE	PROFIT
1	HANDCRANKED COMPUTERS	3.2

JustLee Books wants to see a list of books having less than 20% markup percentage (a profit of less than 20% of the book's cost).

Notes.

We can't use a column alias in WHERE clause. Important

Arithmetic Comparison Operators

Mathematical Comparison Operators	
=	Equality or “equal to” (ex. cost = 55.95)
>	Greater than (ex. cost > 20)
<	Less than (ex. cost < 20)
<>, !=, or ^=	Not equal to (ex. cost <> 55.95 or cost != 55.95 or cost ^= 55.95)
<=	Less than or equal to (ex. cost <= 20)
>=	Greater than or equal to (ex. cost >= 20)

Other Comparison Operators

Other Comparison Operators	
[NOT] BETWEEN *x* and *y*	Used to express a range. For example, searching for numbers BETWEEN 5 and 10. The optional NOT is used when searching for numbers that are NOT BETWEEN 5 AND 10.
[NOT] IN (*x*, *y*, …)	Similar to the OR logical operator. Can search for records which meet at least one condition contained within the parentheses. For example, *Pubid* IN (1, 4, 5) will return only books with a publisher id of 1, 4, or 5. The optional NOT keyword instructs Oracle to return books not published by publisher 1, 4, or 5.
[NOT] LIKE	Used when searching for patterns if you are not certain how something is spelled. For example, *title* LIKE 'TH%'. Using the optional NOT indicates that records that do contain the specified pattern should not be included in the results.
IS [NOT] NULL	Used to search for records that do not have an entry in the specified field. For example, *shipdate* IS NULL. Include the optional NOT to find records that do have an entry in the field. For example, *shipdate* IS NOT NULL.

BETWEEN…AND Operator

- Finds values in a specified range

Worksheet | Query Builder

```
SELECT title, pubid
FROM books
WHERE pubid BETWEEN 1 AND 3;
```

Script Output | Query Result

SQL | All Rows Fetched: 7 in 0.066 seconds

	TITLE	PUBID
1	REVENGE OF MICKEY	1
2	BUILDING A CAR WITH TOOTHPICKS	2
3	DATABASE IMPLEMENTATION	3
4	HOLY GRAIL OF ORACLE	3
5	HANDCRANKED COMPUTERS	3
6	E-BUSINESS THE EASY WAY	2
7	HOW TO MANAGE THE MANAGER	1

NOT BETWEEN command

Worksheet | Query Builder

```
SELECT title, pubid
FROM books
WHERE pubid NOT BETWEEN 1 AND 3;
```

Script Output | Query Result

SQL | All Rows Fetched: 7 in 0.025 seconds

	TITLE	PUBID
1	BODYBUILD IN 10 MINUTES A DAY	4
2	COOKING WITH MUSHROOMS	4
3	PAINLESS CHILD-REARING	5
4	THE WOK WAY TO COOK	4
5	BIG BEAR AND LITTLE DOVE	5
6	HOW TO GET FASTER PIZZA	4
7	SHORTEST POEMS	5

- Works for character strings and date

IN Operator

- Returns records that match a value in a specified list
- List must be in parentheses
- Values are separated by commas

Worksheet | Query Builder

```
SELECT title, pubid
FROM books
WHERE pubid IN (1, 2, 5);
```

Script Output | Query Result

SQL | All Rows Fetched: 7 in 0.023 seconds

	TITLE	PUBID
1	REVENGE OF MICKEY	1
2	BUILDING A CAR WITH TOOTHPICKS	2
3	E-BUSINESS THE EASY WAY	2
4	PAINLESS CHILD-REARING	5
5	BIG BEAR AND LITTLE DOVE	5
6	HOW TO MANAGE THE MANAGER	1
7	SHORTEST POEMS	5

Worksheet | Query Builder

```
SELECT title, pubid
FROM books
WHERE pubid NOT IN (1, 2, 5);
```

Script Output | Query Result

SQL | All Rows Fetched: 7 in 0.016 seconds

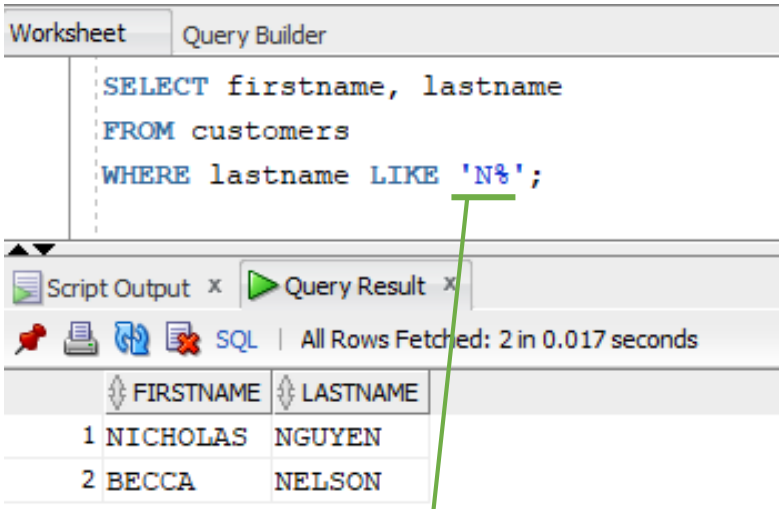
	TITLE	PUBID
1	BODYBUILD IN 10 MINUTES A DAY	4
2	DATABASE IMPLEMENTATION	3
3	COOKING WITH MUSHROOMS	4
4	HOLY GRAIL OF ORACLE	3
5	HANDCRANKED COMPUTERS	3
6	THE WOK WAY TO COOK	4
7	HOW TO GET FASTER PIZZA	4

LIKE Operator

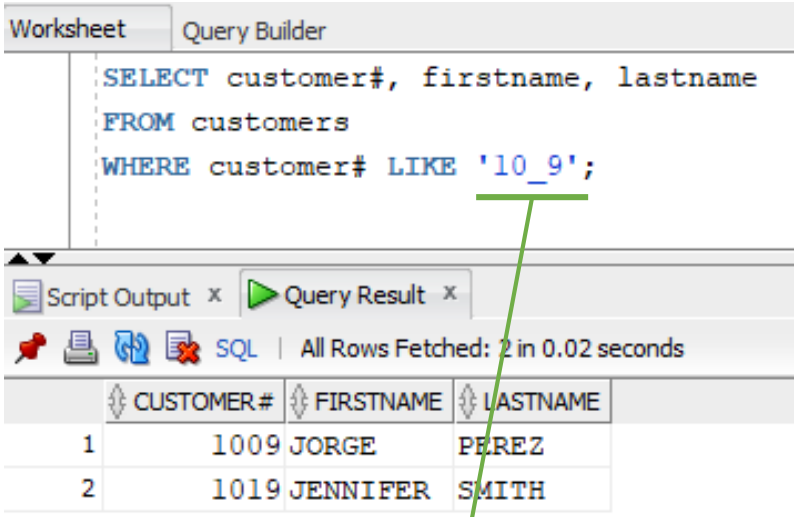
- Performs pattern searches
- Used with wildcard characters
  - Percent sign (%) represents any number of characters → 'P%' represents any length of character starting with P
  - Underscore (_) for exactly one character in the indicated position → 'P_' represents exactly two alphanumeric characters starting with P

Then, how to use wildcards to search for names with the letter P in any position?

LIKE Operator Examples



Pattern starting with letter 'N'



Pattern starting with 10 followed by any character/number and ends with 9

Let's Practice

- Suppose you need to identify books from the BOOKS table using their ISBNs, where the second numeral is 4 and the ISBN ends with 0. Use a single search condition (in WHERE clause) that combines both wildcard characters (% and _).

Logical Operators

- Used to combine search conditions

  How to list books that are in Children's category and retail price higher than $30?

- Evaluated in order of AND, OR
  - NOT – reverses the meaning
  - AND – both conditions must be TRUE
  - OR – at least one condition must be TRUE

  Use parenthesis to override the order

AND Logical Operator Example

- AND: needs to satisfy both conditions

Worksheet | Query Builder

```
SELECT title, pubid, category
FROM books
WHERE pubid = 3
AND category = 'COMPUTER';
```

Script Output | Query Result

SQL | All Rows Fetched: 3 in 0.038 seconds

	TITLE	PUBID	CATEGORY
1	DATABASE IMPLEMENTATION	3	COMPUTER
2	HOLY GRAIL OF ORACLE	3	COMPUTER
3	HANDCRANKED COMPUTERS	3	COMPUTER

Retrieves records if the books are published by publisher 3 and the books' category is Computer.

OR Logical Operator Example

- OR: needs to satisfy one of the conditions

Worksheet | Query Builder

```
SELECT title, pubid, category
FROM books
WHERE pubid = 3
OR category = 'COMPUTER';
```

Script Output | Query Result

SQL | All Rows Fetched: 4 in 0.016 seconds

	TITLE	PUBID	CATEGORY
1	DATABASE IMPLEMENTATION	3	COMPUTER
2	HOLY GRAIL OF ORACLE	3	COMPUTER
3	HANDCRANKED COMPUTERS	3	COMPUTER
4	E-BUSINESS THE EASY WAY	2	COMPUTER

Retrieves records if the books are published by publisher 3 or if the books' category is Computer

This book is not published by publisher 3, but its category is Computer.

Multiple Logical Operators (1/3)

- Resolved in order of NOT, AND, OR

Worksheet | Query Builder

```
SELECT title, pubid, retail, cost, category
FROM books
WHERE category = 'FAMILY LIFE'
OR pubid = 4
AND cost > 15;
```

Condition 1

Condition 2

Script Output | Query Result

SQL | All Rows Fetched: 5 in 0.017 seconds

	TITLE	PUBID	RETAIL	COST	CATEGORY
1	BODYBUILD IN 10 MINUTES A DAY	4	30.95	18.75	FITNESS
2	REVENGE OF MICKEY	1	22	14.2	FAMILY LIFE
3	PAINLESS CHILD-REARING	5	89.95	48	FAMILY LIFE
4	THE WOK WAY TO COOK	4	28.75	19	COOKING
5	HOW TO GET FASTER PIZZA	4	29.95	17.85	SELF HELP

AND considered first, then OR

Fetch if the books are in the 'Family Life' category (condition 1)
OR
Fetch if the books are from publisher 4 and cost more than $15 (condition 2)

Multiple Logical Operators (2/3)

- Resolved in order of NOT, AND, OR

Worksheet | Query Builder

```
SELECT title, pubid, retail, cost, category
FROM books
WHERE NOT category = 'FAMILY LIFE'
OR pubid = 4
AND cost > 15;
```

Script Output | Query Result

SQL | All Rows Fetched: 12 in 0.016 seconds

	TITLE	PUBID	RETAIL	COST	CATEGORY
1	BODYBUILD IN 10 MINUTES A DAY	4	30.95	18.75	FITNESS
2	BUILDING A CAR WITH TOOTHPICKS	2	59.95	37.8	CHILDREN
3	DATABASE IMPLEMENTATION	3	55.95	31.4	COMPUTER
4	COOKING WITH MUSHROOMS	4	19.95	12.5	COOKING
5	HOLY GRAIL OF ORACLE	3	75.95	47.25	COMPUTER
6	HANDCRANKED COMPUTERS	3	25	21.8	COMPUTER
7	E-BUSINESS THE EASY WAY	2	54.5	37.9	COMPUTER
8	THE WOK WAY TO COOK	4	28.75	19	COOKING
9	BIG BEAR AND LITTLE DOVE	5	8.95	5.32	CHILDREN
10	HOW TO GET FASTER PIZZA	4	29.95	17.85	SELF HELP
11	HOW TO MANAGE THE MANAGER	1	31.95	15.4	BUSINESS
12	SHORTEST POEMS	5	39.95	21.85	LITERATURE

AND considered first, then OR

Fetch if the books are not in the 'Family Life' category
OR
Fetch if the books are from publisher 4 and cost more than $15

Multiple Logical Operators (3/3)

- Use parentheses to override the order of evaluation

Worksheet | Query Builder

```
SELECT title, pubid, retail, cost, category
FROM books
WHERE (category = 'FAMILY LIFE'
OR pubid = 4)
AND cost > 15;
```

Condition 1

Condition 2

Script Output | Query Result

SQL | All Rows Fetched: 4 in 0.015 seconds

	TITLE	PUBID	RETAIL	COST	CATEGORY
1	BODYBUILD IN 10 MINUTES A DAY	4	30.95	18.75	FITNESS
2	PAINLESS CHILD-REARING	5	89.95	48	FAMILY LIFE
3	THE WOK WAY TO COOK	4	28.75	19	COOKING
4	HOW TO GET FASTER PIZZA	4	29.95	17.85	SELF HELP

( ) resolved first

Among the books in the Family Life category + books from publisher 4, those that cost more than $15, will be fetched.

'Revenge of mickey' is gone (cost 14.2 < $15) – look at the next slide

In Detail…

```
SELECT title, pubid, retail, cost, category
FROM books
WHERE category = 'FAMILY LIFE';
```

Title	PubID	Retail	Cost	Category
REVENGE OF MICKEY	1	22	14.2	FAMILY LIFE
PAINLESS CHILD-REARING	5	89.95	48	FAMILY LIFE

```
SELECT title, pubid, retail, cost, category
FROM books
WHERE pubid = 4;
```

Title	PubID	Retail	Cost	Category
BODYBUILD IN 10 MINUTES A DAY	4	30.95	18.75	FITNESS
COOKING WITH MUSHROOMS	4	19.95	12.5	COOKING
THE WOK WAY TO COOK	4	28.75	19	COOKING
HOW TO GET FASTER PIZZA	4	29.95	17.85	SELF HELP

Cost more than $15

Resolving Order of Operators

1. Arithmetic operators
2. Comparison operators (<, >, =, LIKE, etc.)
3. Logical operators
   - In the order NOT, AND, OR

Jmp

WHERE clause can contain multiple types of operators; we need to understand the order in which they are resolved.

Treatment of NULL Values (1/2)

- Null: Absence of data

can't use the equal (=) sign

- Requires use of IS NULL operator
- Use IS NOT NULL to retrieve rows with any data value

Worksheet | Query Builder

```
SELECT order#, shipdate
FROM orders
WHERE shipdate IS NULL;
```

Script Output | Query Result

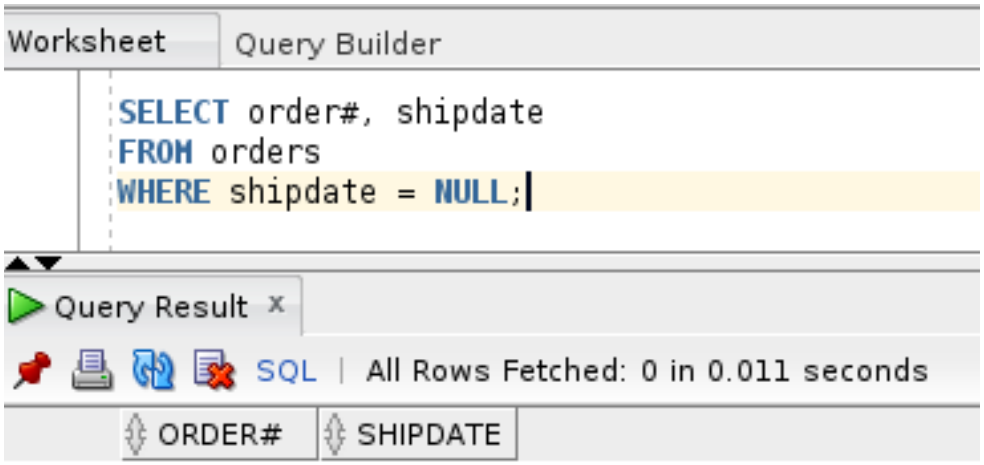
SQL | All Rows Fetched: 6 in 0.033 seconds

	ORDER#	SHIPDATE
1	1012	(null)
2	1015	(null)
3	1016	(null)
4	1018	(null)
5	1019	(null)
6	1020	(null)

These orders are not shipped yet

Treatment of NULL Values (2/2)

- A common error is using = NULL, which does not raise an Oracle error but also does not return any rows



No errors and No rows returned

ORDER BY Clause Syntax

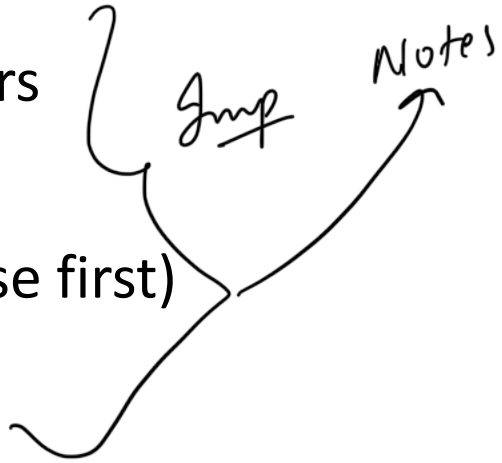
- The ORDER BY clause presents data in sorted order
- Ascending order is default (1, 2, 3…. or A, B, C,…)
- Use the DESC (descending) keyword to override the default order
- 255 columns maximum

```
SELECT [DISTINCT | UNQUE]  (*, columnname [ AS alias], …)
FROM  tablename
[WHERE          condition]
[GROUP BY       group_by_expression]
[HAVING         group_condition]
[ORDER BY       columnname];
```

→ Listed at the end of the SELECT statement

ORDER BY Clause: Sort Sequence

- In ascending order, values will be listed in the following sequence:
  - Blank and special characters
  - Numeric values
  - Character values (uppercase first)
  - NULL values



- In descending order, the sequence is reversed

ORDER BY Example

Worksheet | Query Builder

```
SELECT *
FROM testing
ORDER BY tvalue;
```

Script Output | Query Result

SQL | All Rows Fetched: 7 in 0.026 seconds

	ID	TVALUE	DESCRIP
1	7	ccAccT	Value starts with a blank character
2	1	%ccAccT	Value starts with special character
3	4	1ccAccT	Value starts with a number
4	5	BccAccT	Value starts with an uppercase B
5	6	CccAccT	Value starts with an uppercase C
6	3	bccAccT	Value starts with a lowercase b
7	2	(null)	Value is NULL

- Blank
- %, a special character
- Number
- Uppercase B
- Uppercase C is greater than B
- Lowercase comes after uppercase
- Null is the last in order

ORDER BY Can Reference Column Alias

Worksheet | Query Builder

```
SELECT title, retail, retail-cost profit
FROM books
WHERE retail-cost > cost*0.5
ORDER BY profit;
```

Script Output | Query Result

SQL | All Rows Fetched: 12 in 0.025 seconds

	TITLE	RETAIL	PROFIT
1	BIG BEAR AND LITTLE DOVE	8.95	3.63
2	COOKING WITH MUSHROOMS	19.95	7.45
3	REVENGE OF MICKEY	22	7.8
4	THE WOK WAY TO COOK	28.75	9.75
5	HOW TO GET FASTER PIZZA	29.95	12.1
6	BODYBUILD IN 10 MINUTES A DAY	30.95	12.2
7	HOW TO MANAGE THE MANAGER	31.95	16.55
8	SHORTEST POEMS	39.95	18.1
9	BUILDING A CAR WITH TOOTHPICKS	59.95	22.15
10	DATABASE IMPLEMENTATION	55.95	24.55
11	HOLY GRAIL OF ORACLE	75.95	28.7
12	PAINLESS CHILD-REARING	89.95	41.95

Can use a column alias in ORDER BY clause

Jump

Notes

Can't use a column alias in WHERE clause

Jump

ORDER BY with NULLS FIRST

- Keyword NULLS FIRST or NULLS LAST changes the order for listing NULL values

Worksheet | Query Builder

```
SELECT lastname, firstname, state, referred
FROM customers
WHERE state = 'CA'
ORDER BY referred NULLS FIRST;
```

Script Output | Query Result

SQL | All Rows Fetched: 3 in 0.021 seconds

	LASTNAME	FIRSTNAME	STATE	REFERRED
1	THOMPSON	RYAN	CA	(null)
2	PEREZ	JORGE	CA	1003
3	DAUM	MICHELL	CA	1010

By default, NULL values are listed last in ascending order, but you can list them on top by using NULLS FIRST.

Secondary Sort

A secondary sort, which specifies a second field to sort by, can be included if an exact match occurs between two or more rows in the primary sort.

Primary sort

Secondary sort

Worksheet | Query Builder

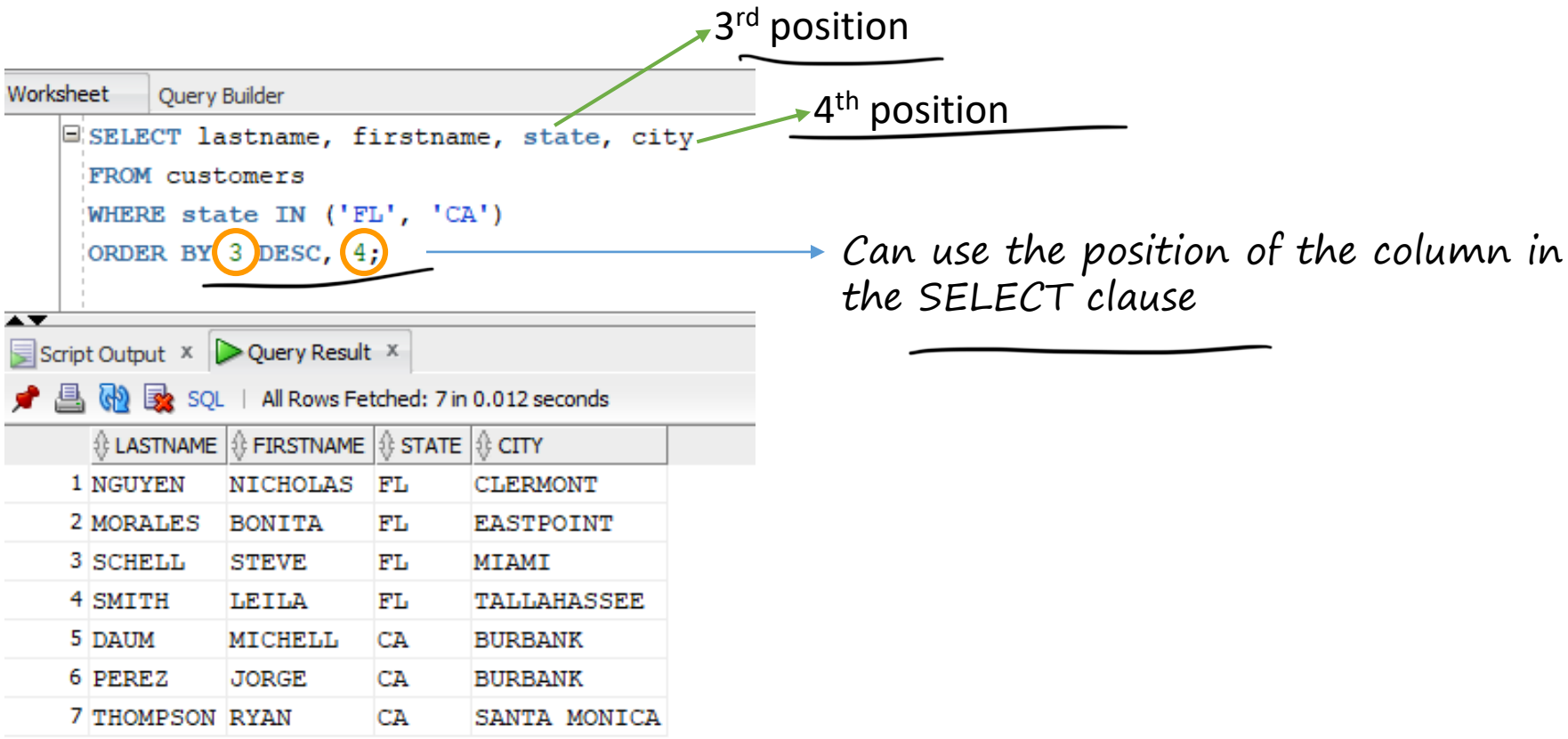
```
SELECT lastname, firstname, state, city
FROM customers
ORDER BY state DESC, city;
```

Script Output | Query Result

SQL | All Rows Fetched: 20 in 0.016 seconds

	LASTNAME	FIRSTNAME	STATE	CITY
1	JONES	KENNETH	WY	CHEYENNE
2	LEE	JASMINE	WY	CODY
3	GIRARD	CINDY	WA	SEATTLE
4	GIANA	TAMMY	TX	AUSTIN
5	CRUZ	MESHIA	NY	ALBANY
6	SMITH	JENNIFER	NJ	MORRISTOWN
7	FALAH	KENNETH	NJ	TRENTON
8	NELSON	BECCA	MI	KALMAZOO
9	MCKENZIE	WILLIAM	MA	BOSTON
10	MCGOVERN	REESE	IL	CHICAGO
11	PIERSON	THOMAS	ID	BOISE
12	LUCAS	JAKE	GA	ATLANTA
13	MONTIASA	GREG	GA	MACON
14	NGUYEN	NICHOLAS	FL	CLERMONT
15	MORALES	BONITA	FL	EASTPOINT
16	SCHELL	STEVE	FL	MIAMI
17	SMITH	LEILA	FL	TALLAHASSEE
18	DAUM	MICHELL	CA	BURBANK
19	PEREZ	JORGE	CA	BURBANK
20	THOMPSON	RYAN	CA	SANTA MONICA

ORDER BY Can Reference Column Position



	LASTNAME	FIRSTNAME	STATE	CITY
1	NGUYEN	NICHOLAS	FL	CLERMONT
2	MORALES	BONITA	FL	EASTPOINT
3	SCHELL	STEVE	FL	MIAMI
4	SMITH	LEILA	FL	TALLAHASSEE
5	DAUM	MICHELL	CA	BURBANK
6	PEREZ	JORGE	CA	BURBANK
7	THOMPSON	RYAN	CA	SANTA MONICA

Summary (1/3)

- The WHERE clause can be included in a SELECT statement to restrict the rows returned by a query to only those meeting a specified condition
- When searching a non-numeric field, the search values must be enclosed in single quotation marks (e.g. ‘FL’)
- Comparison operators are used to indicate how the record should relate to the search value (e.g. >, <>)
- The BETWEEN...AND comparison operator is used to search for records that fall within a certain range of values

Summary (2/3)

- The LIKE comparison operator is used with the percent and underscore symbols (% and _) to establish search patterns
- Logical operators such as AND and OR can be used to combine several search conditions
- When using the AND operator, all conditions must be TRUE for a record to be returned in the results. With the OR operator, only one condition must be TRUE
- A NULL value is the absence of data, not a field with a blank space entered

Summary (3/3)

- Use the IS NULL comparison operator to match NULL values; the IS NOT NULL comparison operator finds records that do not contain NULL values in the indicated column
- You can sort the results of queries by using an ORDER BY clause; when used, the ORDER BY clause should be listed last in the SELECT statement
- By default, records are sorted in ascending order; entering DESC directly after the column name sorts the records in descending order
- A column does not have to be listed in the SELECT clause to serve as a basis for sorting