Database Programming with SQL  
1-3: Anatomy of a SQL Statement

Vocabulary

* Display data from two or more related tables - **Join**
* A symbol used to perform an operation on some values - **Operator**
* An implementation of an attribute or relationship in a table - **Column**
* The capability in SQL to choose the columns in a table that you want returned from a query - **Projection**
* A value that is unavailable, unassigned, unknown, or inapplicable - **Null**
* Renames a column heading - **Alias**
* A mathematical equation – **Arithmetic Expression**
* The capability in SQL to choose the rows in a table returned from  
  a query - **Selection**
* Retrieves information from the database - **Query**
* Specifies the columns to be displayed – **Select Clause**
* Specifies the table containing the column listed in the select  
  clause – **From Clause**
* An individual SQL command – **SQL Statement**
* Part of a SQL statement - **Clause**
* A combination of the two clauses – **Select & From Clause**

1. Write a SQL statement that demonstrates projection.

**SELECT first\_name, last\_name**

**FROM employees;**  
2. Write a query that displays the last\_name and email addresses for all the people in the DJs on Demand d\_client table. The column headings should appear as “Client” and “Email Address.”

**SELECT last\_name AS "Client", email AS "Email Address"**

**FROM d\_clients;**  
3. The manager of Global Fast Foods decided to give all employees at 5%/hour raise + a $.50 bonus/hour. However, when he looked at the results, he couldn't figure out why the new raises were not as he predicted. Ms. Doe should have a new salary of $7.59, Mr. Miller's salary should be $11.00, and Monique Tuttle should be $63.50. He used the following query. What should he have done?  
SELECT last\_name, salary \*.05 +.50  
FROM f\_staffs;

**SELECT last\_name, (salary \* 1.05) + 0.50 AS new\_salary**

**FROM f\_staffs;**

4. Which of the following would be the easiest way to see all rows in the d\_songs table?  
 **c. SELECT \***  
5. If tax = 8.5% \* car\_cost and license = car\_cost \* .01%, which value will produce the largest car payment?  
  **a. Payment = (car\_cost \* 1.25) + 5.00 - (tax) - (license)**   
6. In the example below, identify the keywords, the clause(s), and the statement(s):  
 SELECT employee\_id, last\_name  
 FROM employees

**Keywords- SELECT, FROM**

**Clauses: SELECT employee\_id, last\_name (select clause), FROM employees (from clause)**7. Label each example as SELECTION or PROJECTION.  
 a. Please give me Mary Adam's email address. - **SELECT**  
 b. I would like only the manager\_id column, and none of the other columns. **- PROJECTION**  
8. Which of the following statements are true?  
 **c. null \* .05 = null**  
9. How will the column headings be labeled in the following example?  
 SELECT bear\_id bears, color AS Color, age “age”  
 FROM animals;  
 **c. BEARS, COLOR, age**  
10. Which of the following words must be in a SELECT statement in order to return all rows?  
 **b. SELECT and FROM**

2-1: Working with Columns, Characters, and Rows

Vocabulary

* A command that suppresses duplicates - **DISTINCT**
* Links two columns together to form one character data column- **Concatenation (|| operator)**
* A group of character data - **STRING**
* An SQL plus command that displays the structure of a table - **DESCRIBE**

Try It / Solve It  
1. The manager of Global Fast Foods would like to send out coupons for the upcoming sale. He wants to send one coupon to each household. Create the SELECT statement that returns the customer last name and a mailing address.

**SELECT last\_name, address**

**FROM customers;**  
2. Each statement below has errors. Correct the errors and execute the query in Oracle Application  
Express.  
 a. **SELECT first\_name  
 FROM f\_staffs;**  
 b. **SELECT first\_name || ‘ ‘ || last\_name AS "DJs on Demand Clients"  
 FROM d\_clients;**  
 c. **SELECT DISTINCT f\_order\_lines  
 FROM quantity;**  
 d. **SELECT order\_number  
 FROM f\_orders;**  
3. Sue, Bob, and Monique were the employees of the month. Using the f\_staffs table, create a SELECT statement to display the results as shown in the Super Star chart.  
 **SELECT '\*\*\* ' || first\_name || ' \*\*\* ' || first\_name || ' \*\*\*' AS "Super Star"**

**FROM f\_staffs**

**WHERE first\_name IN ('Sue', 'Bob', 'Monique');**  
4. Which of the following is TRUE about the following query?  
SELECT first\_name, DISTINCT birthdate  
FROM f\_staffs;  
 **d. No rows will be returned.**  
5. Global Fast Foods has decided to give all staff members a 5% raise. Prepare a report that  
presents the output as shown in the chart.  
EMPLOYEE LAST NAME CURRENT SALARY SALARY WITH 5% RAISE

**SELECT last\_name, salary AS "Current Salary", salary \* 1.05 AS "Salary with 5% Raise"**

**FROM f\_staffs;**  
6. Create a query that will return the structure of the Oracle database EMPLOYEES table. Which columns are marked “nullable”? What does this mean?

**DESC employees;**

**- Columns marked “nullable” mean those columns can have NULL values.**7. The owners of DJs on Demand would like a report of all items in their D\_CDs table with the following column headings: Inventory Item, CD Title, Music Producer, and Year Purchased. Prepare this report.

**SELECT inventory\_item AS "Inventory Item", cd\_title AS "CD Title", music\_producer AS "Music Producer", year\_purchased AS "Year Purchased"**

**FROM d\_cds;**  
8. True/False -- The following SELECT statement executes successfully:  
SELECT last\_name, job\_id, salary AS Sal  
FROM employees;

**True**  
9. True/False -- The following SELECT statement executes successfully:  
SELECT \*  
FROM job\_grades;

**True**  
10. There are four coding errors in this statement. Can you identify them?  
SELECT employee\_id, last\_name  
sal x 12 ANNUAL SALARY  
FROM employees;

**Errors: Missing comma, incorrect aliasing, missing arithmetic operator**  
11. In the arithmetic expression salary\*12 - 400, which operation will be evaluated first?

**Multiplication ( \* ) will be evaluated first**  
12. Which of the following can be used in the SELECT statement to return all columns of data in the Global Fast Foods f\_staffs table?  
  **b. \***   
13. Using SQL to choose the columns in a table uses which capability?  
 **b. projection**  
14. SELECT last\_name AS "Employee". The column heading in the query result will appear as:  
 **c. Employee**  
15. Which expression below will produce the largest value?  
 **b. SELECT salary\* (6 + 100)**16. Which statement below will return a list of employees in the following format?  
Mr./Ms. Steven King is an employee of our company.  
 **c. SELECT 'Mr./Ms. '||first\_name||' '||last\_name ||' '||'is an employee of our company.' AS "Employees"  
 FROM employees ;**  
17. Which is true about SQL statements?  
 **c. Keywords cannot be abbreviated or split across lines.**18. Which queries will return three columns each with UPPERCASE column headings?  
 **b. SELECT DEPARTMENT\_ID, LAST\_NAME, FIRST\_NAME  
 FROM employees;**19. Which statement below will likely fail?  
 **a. SELCT \* FROM employees;**  
20. Click on the History link at the bottom of the SQL Commands window. Scroll or use the arrows at the bottom of the page to find the statement you wrote to solve problem 3 above. (The one with the column heading SuperStar). Click on the statement to load it back into the command window. Execute the command again, just to make sure it is the correct one that works. Once you know it works, click on the SAVE button in the top right corner of the SQL Commands window, and enter a name for your saved statement. Use your own initials and “\_superstar.sql”, so if your initials are CT then the filename will be CT\_superstar.sql.  
Log out of OAE, and log in again immediately. Navigate back to the SQL Commands window, click the Saved SQL link at the bottom of the page and load your saved SQL statement into the Edit window. This is done by clicking on the script name. Edit the statement, to make it display + instead of \*. Run your amended statement and save it as initials\_superplus.sql.

**SELECT '+++ ' || first\_name || ' +++ ' || first\_name || ' +++' AS "Super Star"**

**FROM f\_staffs**

**WHERE first\_name IN ('Sue', 'Bob', 'Monique');**

2-2: Limit Rows Selected

Vocabulary

* Restricts the rows returned by a select statement – **WHERE**
* Compares one expression to another value or expression – **Comparison operator (=, >,<,<=,>=,<>)**

1. Using the Global Fast Foods database, retrieve the customer’s first name, last name, and address for the customer who uses ID 456.

**SELECT first\_name, last\_name, address**

**FROM customers**

**WHERE customer\_id = 456;**  
2. Show the name, start date, and end date for Global Fast Foods' promotional item “ballpen and highlighter” giveaway.

**SELECT name, start\_date, end\_date**

**FROM promotions**

**WHERE item = 'ballpen and highlighter';**  
3. Create a SQL statement that produces the following output:  
 **SELECT 'The 1997 recording in our database is ' || title AS "Oldest"**

**FROM d\_cds**

**WHERE year = 1997;**

4. The following query was supposed to return the CD title “Carpe Diem" but no rows were returned. Correct the mistake in the statement and show the output.  
SELECT produce, title  
FROM d\_cds  
WHERE title = 'carpe diem' ;

**SELECT produce, title**

**FROM d\_cds**

**WHERE title = 'Carpe Diem';**  
5. The manager of DJs on Demand would like a report of all the CD titles and years of CDs that were produced before 2000.

**SELECT title, year**

**FROM d\_cds**

**WHERE year < 2000;**  
6. Which values will be selected in the following query?  
SELECT salary  
FROM employees  
WHERE salary < = 5000;

**a. 5000**  
7. Write a SQL statement that will display the student number (studentno), first name (fname), and last name (lname) for all students who are female (F) in the table named students.

**SELECT studentno, fname, lname**

**FROM students**

**WHERE sex = 'F';**  
8. Write a SQL statement that will display the student number (studentno) of any student who has a PE major in the table named students. Title the studentno column Student Number.

**SELECT studentno AS "Student Number"**

**FROM students**

**WHERE major = 'PE';**  
9. Write a SQL statement that lists all information about all male students in the table named students.

**SELECT \***

**FROM students**

**WHERE sex = 'M';**  
10. Write a SQL statement that will list the titles and years of all the DJs on Demand CDs that were not produced in 2000.

**SELECT title, year**

**FROM d\_cds**

**WHERE year <> 2000;**  
11. Write a SQL statement that lists the Global Fast Foods employees who were born before 1980

**SELECT \***

**FROM employees**

**WHERE birthdate < TO\_DATE('01-JAN-1980', 'DD-MON-YYYY');**

2-3: Comparison Operators

Vocabulary

* This option identifies that the escape characters should be interpreted literally – **ESCAPE**
* Condition tests for null values – **IS NULL**
* Displays rows based on a range of values - **BETWEEN**
* Including the specified limits and the area between them; the numbers 1-10, inclusive – **BETWEEN inclusive**
* Selects rows that match a character pattern - **LIKE**
* Tests for values in a specified list of values - **IN**

1. Display the first name, last name, and salary of all Global Fast Foods staff whose salary is between $5.00 and $10.00 per hour.

**SELECT first\_name, last\_name, salary**

**FROM f\_staffs**

**WHERE salary BETWEEN 5.00 AND 10.00;**  
2. Display the location type and comments for all DJs on Demand venues that are Private Home.

**SELECT location\_type, comments**

**FROM venues**

**WHERE location\_type = 'Private Home';**

3. Using only the less than, equal, or greater than operators, rewrite the following query:  
SELECT first\_name, last\_name  
FROM f\_staffs  
WHERE salary BETWEEN 20.00 and 60.00;

**SELECT first\_name, last\_name**

**FROM f\_staffs**

**WHERE salary >= 20.00 AND salary <= 60.00;**4. Create a list of all the DJs on Demand CD titles that have “a” as the second letter in the title.

**SELECT title**

**FROM d\_cds**

**WHERE title LIKE '\_a%';**  
5. Who are the partners of DJs on Demand who do not get an authorized expense amount?

**SELECT partner\_name**

**FROM d\_partners**

**WHERE authorized\_expense IS NULL;**  
6. Select all the Oracle database employees whose last names end with “s”. Change the heading of the column to read Possible Candidates.

**SELECT last\_name AS "Possible Candidates"**

**FROM employees**

**WHERE last\_name LIKE '%s';**  
7. Which statement(s) are valid?  
 **c. WHERE quantity IS NULL;**  
8. Write a SQL statement that lists the songs in the DJs on Demand inventory that are type code 77, 12, or 1.

**SELECT song\_title**

**FROM d\_songs**

**WHERE type\_code IN (77, 12, 1);**

3-1: Logical Comparisons and Precedence Rules

Vocabulary

* Inverts the value of the condition - **NOT**
* Both conditions must be true for a record to be selected - **AND**
* Rules that determine the order in which expressions are evaluated and calculated – **Precedence** **rules**
* Either condition can be true for a record to be selected – **OR**

1. Execute the two queries below. Why do these nearly identical statements produce two different results? Name the difference and explain why.

**The first query uses AND, which requires both conditions to be true. The second query uses OR, which only requires one condition to be true. This explains the difference in the result set. The first query returns records where the code is greater than 200 and the description is one of the specified values. The second query returns records where either the code is greater than 200 or the description is one of the specified values.**

2. Display the last names of all Global Fast Foods employees who have “e” and “i” in their last names.

**SELECT last\_name**

**FROM f\_staffs**

**WHERE last\_name LIKE '%e%'**

**AND last\_name LIKE '%i%';**  
3. I need to know who the Global Fast Foods employees are that make more than $6.50/hour and their position is not order taker.

**SELECT first\_name, last\_name**

**FROM f\_staffs**

**WHERE salary > 6.50**

**AND position != 'order taker';**  
4. Using the employees table, write a query to display all employees whose last names start with “D” and have “a” and “e” anywhere in their last name.

**SELECT last\_name**

**FROM employees**

**WHERE last\_name LIKE 'D%'**

**AND last\_name LIKE '%a%'**

**AND last\_name LIKE '%e%';**  
5. In which venues did DJs on Demand have events that were not in private homes?

**SELECT venue\_name**

**FROM venues**

**WHERE venue\_type != 'Private Home';**  
6. Which list of operators is in the correct order from highest precedence to lowest precedence?   
 **c. NOT, AND, OR**  
7. Who am I?  
I was hired by Oracle after May 1998 but before June of 1999. My salary is less than $8000 per month, and I have an “en” in my last name.

**SELECT first\_name, last\_name**

**FROM employees**

**WHERE hire\_date > '01-MAY-1998'**

**AND hire\_date < '01-JUN-1999'**

**AND salary < 8000**

**AND last\_name LIKE '%en%';**  
8. What's my email address?  
Because I have been working for Oracle since the beginning of 1996, I make more than $9000 per month. Because I make so much money, I don't get a commission

**SELECT email**

**FROM employees**

**WHERE hire\_date >= '01-JAN-1996'**

**AND salary > 9000**

**AND commission\_pct IS NULL;**

3-2: Sorting Rows

Vocabulary

* Orders the rows in ascending order (the default order); A-Z - **ASC**
* Orders the rows in descending order: Z-A - **DESC**
* To arrange according to class, kind, or size - **Sort**

1. In the example below, assign the employee\_id column the alias of “Number.” Complete the SQL statement to order the result set by the column alias.  
SELECT employee\_id, first\_name, last\_name  
FROM employees;

**SELECT employee\_id AS "Number", first\_name, last\_name**

**FROM employees**

**ORDER BY "Number";**  
2. Create a query that will return all the DJs on Demand CD titles ordered by year with titles in alphabetical order by year.

**SELECT title**

**FROM d\_cds**

**ORDER BY year, title;**  
3. Order the DJs on Demand songs by descending title. Use the alias “Our Collection” for the song title.

**SELECT title AS "Our Collection"**

**FROM d\_songs**

**ORDER BY "Our Collection" DESC;**  
4. Write a SQL statement using the ORDER BY clause that could retrieve the information needed.

**SELECT first\_name, last\_name, student\_id, parking\_place**

**FROM students**

**WHERE year = 1**

**ORDER BY last\_name ASC, first\_name DESC;**  
5. Write a SQL statement using the employees table and the ORDER BY clause that could retrieve the information in the following table. Return only those employees with employee\_id<125.  
 **SELECT department\_id, last\_name, manager\_id**

**FROM employees**

**WHERE employee\_id < 125**

**ORDER BY department\_id, last\_name;**

Extension Activities  
1. Limiting values with the WHERE clause is an example of:  
 **e. Selection**  
2. You want to sort your CD collection by title, and then by artist. This can be accomplished using:  
 **c. ORDER BY**  
3. Which of the following are SQL keywords?  
 **a. SELECT  
 d. FROM**  
4. Which of the following are true?  
  **a. Multiplication and division take priority over addition.  
 b. Operators of the same priority are evaluated from left to right.  
 c. Parentheses can be used to override the rules of precedence.**  
5. The following query was written:  
SELECT DISTINCT last\_name  
FROM students  
  **c. To select last names without duplicates**6. The following string was created using which SELECT clause?  
Abby Rogers is an order taker for Global Fast Foods  
 **d. SELECT first\_name ||' ' ||last\_name ||' is an '||staff\_type||' for Global Fast Foods'**  
7. Which of the following SELECT clauses will return uppercase column headings?  
 **d. SELECT id AS ID, last\_name AS NAME, address AS ADDRESS, city AS CITY, state AS STATE, zip AS ZIP, phone\_number AS PHONE\_NUMBER;**  
8. Which SELECT statement will always return the last names in alphabetical order?  
 **b. SELECT last\_name FROM employees ORDER BY last\_name**9. Which SELECT clause will return a column heading for employee\_id called “New Employees”?  
 **d. SELECT employee\_id AS "New Employees"**10. Examine the following query:  
SELECT last\_name, job\_id, salary  
FROM employees  
WHERE job\_id = 'SA\_REP' OR job\_id = 'AD\_PRES' AND salary >15000;  
Which results could not have been returned from this query?  
  **b. Jane Hendricks, sales manager, salary 15500**  
11. Finish this query so it returns all employees whose last names start with “St”.

**SELECT last\_name**

**FROM employees**

**WHERE last\_name LIKE 'St%';**  
12. What salary values will not be returned from this query?  
SELECT last\_name, first\_name, salary  
FROM employees  
WHERE salary BETWEEN 1900 AND 2100;

**Any salary below 1900 and above 2100 will not be returned.**13. Correct each WHERE clause:  
 **a. WHERE department\_id NOT IN (101,102,103);  
 b. WHERE last\_name = ‘King’;  
 c. WHERE start\_date = ‘05-May-1998’;  
 d. WHERE salary BETWEEN 5000 AND 7000;  
 e. WHERE id != 10;**  
14. SELECT prefix  
FROM phone  
WHERE prefix BETWEEN 360 AND 425  
OR prefix IN (206,253,625)  
AND prefix BETWEEN 315 AND 620;  
Which of the following values could be returned?  
625, 902, 410, 499

**625, 410, 499**

3-3: Introduction to Functions

1. For each task, choose whether a single-row or multiple row function would be most appropriate:

a. Showing all of the email addresses in upper case letters – **Single row**  
b. Determining the average salary for the employees in the sales department – **Multi row**c. Showing hire dates with the month spelled out (September 1, 2004) – **Single row**  
d. Finding out the employees in each department that had the most seniority (the earliest hire date) – **Multi row**  
e. Displaying the employees’ salaries rounded to the hundreds place – **Single row**  
f. Substituting zeros for null values when displaying employee commissions. – **Single row**

2. The most common multiple-row functions are: AVG, COUNT, MAX, MIN, and SUM. Give your own definition for each of these functions.

* **AVG**: Calculates the average value of a numeric column across all rows in a specified group.
* **COUNT**: Returns the number of rows that match a specified condition, including non-null values.
* **MAX**: Identifies the maximum value in a specified column among all rows.
* **MIN**: Identifies the minimum value in a specified column among all rows.
* **SUM**: Calculates the total sum of a numeric column across all rows in a specified group.

3. Test your definitions by substituting each of the multiple-row functions into this query.  
SELECT FUNCTION(salary)  
FROM employees  
Write out each query and its results.

**SELECT AVG(salary)**

**FROM employees;**

**Result: Average salary of all employees.**

**SELECT COUNT(salary)**

**FROM employees;**

**Result: Total number of employees with non-null salary.**

**SELECT MAX(salary)**

**FROM employees;**

**Result: Highest salary among all employees.**

**SELECT MIN(salary)**

**FROM employees;**

**Result: Lowest salary among all employees.**

**SELECT SUM(salary)**

**FROM employees;**

**Result: Total sum of all employee salaries.**