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Database Programming with SQL 2 / 2

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Section 11 – Ensuring Quality Queries Part I

11-1 Ensuring Quality Query Results

Solve a series of problems:

- Solve a series of problems Create a query to produce specified data
- Modify a query to produce specified data

Select * from user_tables	PURGE RECYCLEBIN;
select * from tab;	

Section 12 – DML

12-1 INSERT Statements

USER	Someone doing “real work” with the computer, using it as a means rather than an end
Transaction	Consists of a collection of DML statements that form a logical unit of work.
Explicit	Fully and clearly expressed; leaving nothing implied
INSERT INTO	Adds a new row to a table

The table copies will not inherit the associated primary-to-foreign-key integrity rules (relationship constraints) of the original tables.

Copy structure and data	Copy only structure
CREATE TABLE copy_departments as SELECT * FROM departments;	CREATE TABLE copy_departments as (SELECT * FROM departments where 1=2);

Describe employees	SALARY NUMBER(6,2) Precision 6, Scale 2 [-9999.99, 9999.99]
user	select user from dual;
sysdate	select sysdate from dual; -- default DD-Mon-YYYY
	select to_char(sysdate, 'Month fmdd, yyyy') from dual;

select columns	all columns
INSERT INTO copy_departments (department_id, department_name, location_id) VALUES (200,'Human Resources', 1500);	INSERT INTO copy_departments VALUES (210,'Estate Management', 102, 1700);

INSERT INTO copy_employees (employee_id, first_name, last_name, email, hire_date, salary) VALUES (302,'Grigorz','Polanski', 'GPolanski', TO_DATE('2017-07-20', 'yyyy-mm-dd'), 4200);

Insert multiple records at the same time
INSERT INTO sales_reps(id, name, salary, commission_pct) SELECT employee_id, last_name, salary, commission_pct FROM employees WHERE job_id LIKE '%REP%';

12-2 Updating Column Values and Deleting Rows

UPDATE	Modifies existing rows in a table
Correlated subquery UPDATE	retrieves information from one table & uses the information to update another table
Integrity Constraint	Ensures that the data adheres to a predefined set of rules
Correlated subquery DELETE	deletes information on a linked table based on what was deleted on the other table
Delete	Removes existing rows from a table

Not Correlated	Correlated
<pre>UPDATE copy_employees SET hire_date = sysdate WHERE employee_id = 206;</pre>	<pre>UPDATE copy_employees SET hire_date = sysdate, salary = (SELECT salary FROM copy_employees WHERE employee_id= 205), job_id = (SELECT job_id FROM copy_employees WHERE employee_id= 205) WHERE employee_id = 206;</pre>

Correlated
<pre>ALTER TABLE copy_employees ADD (department_name varchar2(30)); select e.department_id, d.department_id, d.department_name from employees e, departments d where e.department_id = d.department_id; UPDATE copy_employees e SET e.department_name= (SELECT d.department_name FROM departments d WHERE e.department_id= d.department_id);</pre>

Not Correlated	Correlated
<pre>DELETE FROM departments WHERE department_id = 50; DELETE FROM copy_employees WHERE department_id = 50;</pre>	<pre>DELETE FROM copy_employees WHERE department_id = (SELECT department_id FROM departments WHERE department_name= 'Shipping');</pre>

Be carefully	
<pre>SELECT * FROM copy_employees e WHERE e.manager_id IN (SELECT d.manager_id FROM employees d GROUP BY d.manager_id HAVING count(d.department_id) < 2);</pre>	<pre>DELETE FROM copy_employees e WHERE e.manager_id IN (SELECT d.manager_id FROM employees d GROUP BY d.manager_id HAVING count(d.department_id) < 2);</pre>

row-level locks, until you issue a COMMIT or ROLLBACK
<pre> SELECT e.employee_id, e.salary, d.department_name FROM employees e JOIN departments d USING (department_id) WHERE location_id = 1500 AND job_id= 'ST_CLERK' FOR UPDATE ORDER BY e.employee_id; GRANT update, select ON employees TO schemas User: SCHEMAS update ESQUEMAS.employees e set salary = salary where e.employee_id = 141; </pre>

12-3 DEFAULT Values, MERGE, and Multi-Table Inserts

A **data warehouse** is a collection of data designed to support business-management decision making. Data warehouses contain a wide variety of data, such as sales data, customer data, payroll, accounting, and personnel data, which presents a coherent picture of business conditions at a single point in time.

<pre> CREATE TABLE my_employees (hire_date DATE DEFAULT SYSDATE, first_name VARCHAR2(15), last_name VARCHAR2(15)); </pre>	<pre> -- Explicit INSERT INTO my_employees (hire_date, first_name, last_name) VALUES (DEFAULT, 'Angelina','Wright'); </pre>	<pre> -- Implicit INSERT INTO my_employees (first_name, last_name) VALUES('Angelina','Wright'); </pre>
--	---	--

<pre> UPDATE my_employees SET hire_date = DEFAULT WHERE last_name = 'Wright'; </pre>	<pre> UPDATE my_employees SET hire_date = '21-SEP-89' WHERE last_name = 'Wright'; </pre>	<pre> UPDATE copy_employees SET hire_date = to_date('1989-09-21', 'yyyy-mm-dd') WHERE employee_id = 100; </pre>
--	--	--

<pre> MERGE will INSERT and UPDATE simultaneously. MERGE INTO destination-table USING source-table ON matching-condition WHEN MATCHED THEN UPDATE SET WHEN NOT MATCHED THEN INSERT VALUES (.....); </pre>	<pre> MERGE INTO copy_emp c USING employees e ON (c.employee_id = e.employee_id) WHEN MATCHED THEN UPDATE SET c.last_name = e.last_name, c.department_id = e.department_id WHEN NOT MATCHED THEN INSERT VALUES (e.employee_id, e.last_name, e.department_id); </pre>
--	--

MERGE Example

EMPLOYEES (source table)

EMPLOYEE_ID	LAST_NAME	DEPARTMENT_ID
100	King	90
103	Hunold	60
142	Davies	50

COPY_EMP before the MERGE is executed

EMPLOYEE_ID	LAST_NAME	DEPARTMENT_ID
100	Smith	40
103	Chang	30

COPY_EMP after the MERGE has executed

EMPLOYEE_ID	LAST_NAME	DEPARTMENT_ID
100	King	90
103	Hunold	60
142	Davies	50

Multi-Table Inserts Conditional

```

INSERT ALL
  WHEN call_format IN ('tlk','txt','pic') THEN
    INTO all_calls
      VALUES (caller_id, call_timestamp, call_duration, call_format)
  WHEN call_format IN ('tlk','txt') THEN
    INTO police_record_calls
      VALUES (caller_id, call_timestamp, recipient_caller)
  WHEN call_duration < 50 AND call_type = 'tlk' THEN
    INTO short_calls
      VALUES (caller_id, call_timestamp, call_duration)
  WHEN call_duration >= 50 AND call_type = 'tlk' THEN
    INTO long_calls
      VALUES (caller_id, call_timestamp, call_duration)
SELECT caller_id, call_timestamp, call_duration, call_format,
       recipient_caller
FROM calls
WHERE TRUNC(call_timestamp) = TRUNC(SYSDATE);

```

Section 13 – DDL

13-1 Creating Tables

Data dictionary	Created and maintained by the Oracle Server and contains information about the database
Schema	A collection of objects that are the logical structures that directly refer to the data in the database
DEFAULT	Specifies a preset value if a value is omitted in the INSERT statement
Table	Stores data; basic unit of storage composed of rows and columns
CREATE TABLE	Command used to make a new table

Table names are not case sensitive.

Table names should be plural, for example STUDENTS, not student

The main database object types are:

Table	Index	Constraint	View	Sequence	Synonym
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```
CREATE TABLE my_cd_collection (  
  cd_number NUMBER(3),  
  title VARCHAR2(20) not null,  
  artist VARCHAR2(20) check(regex_like(artist, '[a-zA-Z .]')),  
  purchase DATE DEFAULT SYSDATE);
```

-- External Tables Example

```
CREATE TABLE emp_load (  
  employee_number CHAR(5),  
  employee_dob CHAR(20),  
  employee_last_name CHAR(20),  
  employee_first_name CHAR(15),  
  employee_middle_name CHAR(15),  
  employee_hire_date DATE )  
ORGANIZATION EXTERNAL (  
  TYPE ORACLE_LOADER  
  DEFAULT DIRECTORY def_dir1  
  ACCESS PARAMETERS  
    (RECORDS DELIMITED BY NEWLINE  
    FIELDS (employee_number CHAR(2),  
            employee_dob CHAR(20),  
            employee_last_name CHAR(18),  
            employee_first_name CHAR(11),  
            employee_middle_name CHAR(11),  
            employee_hire_date CHAR(10) date_format DATE mask "mm/dd/yyyy"))  
  LOCATION ('info.dat') );
```

User tables:	Data Dictionary tables (Only Select):
Employees Departments	SELECT * FROM DICTIONARY; SELECT * FROM USER_TABLES; SELECT * FROM USER_INDEXES; SELECT * FROM user_objects WHERE object_type= 'SEQUENCE'; SELECT * FROM USER_SEGMENTS; SELECT * FROM ALL_TABLES;

13-2 Using Data Types

BLOB	Binary large object data up to 4 gigabytes
CLOB	Character data up to 4 gigabytes
INTERVAL YEAR TO MONTH	Allows time to be stored as an interval of years and months
INTERVAL DAY TO SECOND	Allows time to be stored as an interval of days to hours, minutes, and seconds
TIMESTAMP	Allows the time to be stored as a date with fractional seconds
TIMESTAMP WITH TIMEZONE	stores a time zone value as a displacement from Universal Coordinated Time or UCT
TIMESTAMP WITH LOCAL TIMEZONE	when a column is selected in a SQL statement the time is automatically converted to the user's timezone

- CHAR (fixed size, maximum 2000 characters)
- VARCHAR2 (variable size, maximum 4000 characters)
- NUMBER (variable size, maximum precision 38 digits)
- DATE range yyyy-mm-dd hh24:mi:ss
- TIMESTAMP range yyyy-mm-dd hh12:mi:ss and fractions of a second
- INTERVAL DAY [(day_precision)] TO SECOND The default precision value is 2

select current_timestamp, SYSTIMESTAMP from dual

current_timestamp	03-OCT-22 05.22.33.598000000 PM AMERICA/MEXICO_CITY
SYSTIMESTAMP UCT	03-OCT-22 05.22.33.598000000 PM -05:00

MySQL Date yyyy-mm-dd	ORACLE Date yyyy-mm-dd hh:mi:ss
create table tmp_Formatos(Fecha date, FechaTiempo datetime, TiempoMarca timestamp);	create table tmp_Formatos(Fecha date, TiempoMarca timestamp);
select now(), sysdate(), current_timestamp();	select sysdate, current_date, current_timestamp, SYSTIMESTAMP from dual;
insert into tmp_Formatos values(sysdate(), sysdate(), sysdate());	insert into tmp_Formatos values(sysdate, sysdate);
Select * from tmp_formatos;	select * from tmp_formatos;
select second(fechaTiempo), extract(second from TiempoMarca) from tmp_formatos;	select to_char(fecha, 'ss'), extract(second from TiempoMarca) from tmp_formatos;

create table tmp_Horarios (Fecha date, TS TIMESTAMP, TS_TZ TIMESTAMP WITH TIME ZONE, TS_LTZ TIMESTAMP WITH LOCAL TIME ZONE);	create table tmp_Intervalos (loan1 INTERVAL YEAR TO MONTH, loan2 INTERVAL YEAR TO MONTH);
insert into tmp_horarios values (sysdate, sysdate, SYSTIMESTAMP, sysdate);	INSERT INTO tmp_Intervalos (loan1, loan2) VALUES (INTERVAL '121' MONTH(3), INTERVAL '3-6' YEAR TO MONTH);
	select sysdate+loan1 from tmp_intervalos;

13-3 Modifying a Table

You can add or modify a column in a table, but you cannot specify where the column appears

```
ALTER TABLE tablename  
ADD (column_name data_type [DEFAULT expression],  
     column_name data_type [DEFAULT expression], ...);
```

```
ALTER TABLE mod_emp  
MODIFY (salary NUMBER(8,2) DEFAULT 50);
```

```
ALTER TABLE tablename  
DROP COLUMN columnname;
```

```
-- Dropping a column from a large table can take a long time  
ALTER TABLE tablename SET UNUSED (column_name);
```

```
-- when you want to reclaim the extra disk space  
ALTER TABLE copy_employees  
DROP UNUSED COLUMNS;
```

```
ALTER SESSION SET RECYCLEBIN = ON;  
DROP TABLE table_name;
```

```
-- Recovery a Table  
FLASHBACK TABLE table_name TO BEFORE DROP;
```

```
-- Show deleted tables  
select * from USER_RECYCLEBIN;
```

```
-- Drop a table definitely  
DROP TABLE Table_Name PURGE;
```

```
-- Rename a table  
RENAME old_name to new_name;
```

it does not release storage space	Free up storage space
Delete from Table_Name;	Truncate Table Table_Name;

```
COMMENT ON TABLE Employees is 'Tabla de empleados';  
comment on column Employees.last_name is 'Apellido Paterno';
```

```
select * from user_tab_comments;  
SELECT * FROM USER_COL_COMMENTS;
```

	Review the changes made (UNDO tablespace) SCN (System Change Number)
UPDATE EMPLOYEES SET LAST_NAME = 'King Kong' where employee_id = 100;	select * from Employees VERSIONS BETWEEN SCN MINVALUE AND MAXVALUE WHERE employee_id= 100;

Section 14 – Constraints

14-1 Intro to Constraints; NOT NULL and UNIQUE Constraints

Constraint	Database rule.
PRIMARY KEY	Constraint ensures that the column contains no null values and uniquely identifies each row of the table
UNIQUE KEY	An integrity constraint that requires every value in a column or set of columns be unique
UNIQUE constraint	Every value in a column or set of columns (a composite key) must be unique
FOREIGN KEY	Designates a column (child table) that establishes a relationship between a primary key in the same table and a different table (parent table)
REFERENCES	Identifies that table and column in the parent table
NOT NULL constraint	For every row entered into the table, there must be a value for that column
CHECK constraint	Specifies a condition for a column that must be true for each row of data
Table level constraint	References one or more columns and is defined separately from the definitions of the columns in the table
Column-level constraint	Database rule that references a single column

5 Types of constraints: All the constraints have a name

NOT NULL	PRIMARY KEY	FOREIGN KEY	UNIQUE	CHECK
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There are two different places in the CREATE TABLE statement that you can specify the constraint details:

- At the **column level** next to the name and data type
- At the **table level** after all the column names are listed

Constraints at the Column Level	Constraints at the Table Level
<pre>CREATE TABLE clients (IDnumber NUMBER(4) primary KEY, LastName VARCHAR2(20) constraint nn_LN not null, Email VARCHAR2(20) UNIQUE, HireDate date default sysdate, Salary number(6,2) check(salary > 0));</pre> <p>system gives the constraint a name, such as SYS_C00585417</p> <p>The NOT NULL constraint can be specified only at the column level, not the table level</p>	<pre>CREATE TABLE clients (IDNumber NUMBER(4), LastName VARCHAR2(20), Email VARCHAR2(20), HireDate date default sysdate, Salary number(6,2), CONSTRAINT Clients_IDNumber_pk primary key (IDNumber), CONSTRAINT uk_Email UNIQUE(Email),--unique(email,phone) CONSTRAINT check_Salary check(Salary>0));</pre> <pre>ALTER TABLE clients MODIFY (LastName NOT NULL);</pre>

14-2 PRIMARY KEY, FOREIGN KEY, and CHECK Constraints

PRIMARY KEY constraint	A column or set of columns that uniquely identifies each row in a table
FOREIGN KEY constraint	Establishes a relationship between the foreign key column and a primary key or unique key in the same table or a different table
NOT NULL	Constraint ensures that the column contains no null values
CHECK constraint	Explicitly defines a condition that must be met
ON DELETE SET NULL	Allows a child row to remain in a table with null values when a parent record has been deleted
ON DELETE CASCADE	Allows a foreign key row that is reference to a primary key row to be deleted

Column-level syntax example:

```
CREATE TABLE employees(
employee_id NUMBER(6,0) CONSTRAINT emp_pk PRIMARY KEY,
first_name VARCHAR2(20),
last_name VARCHAR2(25),
department_id NUMBER(4,0) CONSTRAINT emp_department_id_fk
REFERENCES departments(department_id) ON DELETE SET NULL,
email VARCHAR2(25));
```

Table-level syntax example:

```
CREATE TABLE employees(
employee_id NUMBER(6,0) CONSTRAINT emp_pk PRIMARY KEY,
first_name VARCHAR2(20),
last_name VARCHAR2(25),
department_id NUMBER(4,0),
email VARCHAR2(25),
CONSTRAINT emp_dept_id_fk FOREIGN KEY (department_id)
REFERENCES departments(department_id) ON DELETE CASCADE);
```

Composite primary key

<pre>CREATE TABLE job_history (employee_id NUMBER(6,0), start_date DATE, end_date DATE, job_id VARCHAR2(10), department_id NUMBER(4,0), CONSTRAINT jh_pk PRIMARY KEY(employee_id, start_date), CONSTRAINT jh_endDate_ck CHECK (end_date > start_date));</pre>	<p>CHECK constraint cannot contain functions: SYSDATE, UID, USER, or USERENV Example: SYSDATE > '05-May-1999'</p> <p>CHECK constraint cannot use: CURRVAL, NEXTVAL, LEVEL, or ROWNUM</p>
---	---

14-3 Managing Constraints

DISABLE CONSTRAINT	To deactivate an integrity constraint
CASCADE clause	Disables dependent integrity constraints
ALTER TABLE	To add, modify, or drop columns from a table
ENABLE CONSTRAINT	To activate an integrity constraint currently disabled
DROP CONSTRAINT	Removes a constraint from a table
DROP COLUMN	Allows user to delete a column from a table
CASCADE CONSTRAINT clause	Defines the actions the database server takes when a user attempts to delete or update a key to which existing foreign keys point

Write ALTER TABLE statements to add, drop, disable, and enable constraints

select * from USER_CONSTRAINTS WHERE TABLE_NAME='EMPLOYEES'; select * from USER_CONS_COLUMNS where table_name = 'EMPLOYEES';	* constraint_name, table_name, constraint_type, status constraint_type: P PRIMARY KEY R REFERENCES (foreign key); C CHECK constraint (including NOT NULL); U UNIQUE
--	---

Sintaxis	Example
ALTER TABLE table_name ADD [CONSTRAINT constraint_name] type of constraint (column_name);	ALTER TABLE employees ADD CONSTRAINT emp_id_pk PRIMARY KEY (employee_id);
ALTER TABLE tablename ADD [CONSTRAINT constraint_name] FOREIGN KEY(column_name) REFERENCES tablename(column_name);	ALTER TABLE employees ADD CONSTRAINT emp_dept_fk FOREIGN KEY (department_id) REFERENCES departments (department_id);
ALTER TABLE table_name MODIFY (column_name CONSTRAINT constraint_name NOT NULL);	ALTER TABLE employees MODIFY (email CONSTRAINT emp_email_nn NOT NULL);
ALTER TABLE table_name DROP CONSTRAINT name [CASCADE]	ALTER TABLE departments DROP CONSTRAINT dept_dept_id_pk;

Sintaxis	Example
ALTER TABLE table_name DISABLE CONSTRAINT constraint_name [CASCADE]	ALTER TABLE departments DISABLE CONSTRAINT dept_dept_id_pk;
ALTER TABLE table_name ENABLE CONSTRAINT constraint_name;	ALTER TABLE departments ENABLE CONSTRAINT dept_dept_id_pk;

Section 15 – Views

15-1 Creating Views

View	A subset of data from one or more tables that is generated from a query and stored as a virtual table
VIEW_NAME	Name of view
CREATE VIEW	Statement used to create a new view
REPLACE	Re-creates the view if it already exists
NOFORCE (default)	Creates the view only if the base table exists
FORCE	Creates a view regardless of whether or not the base tables exist
Alias	Specifies a name for each expression selected by the view's query
Subquery	A complete SELECT statement
Simple view	Derives data from one table, no functions or groups, performs DML operations through the view
Complex view	Derives data from one or more tables, contains functions or groups of data, and does not always allow DML operations through the view
CONSTRAINT	Is the name assigned to the CHECK OPTION constraint.
WITH READ ONLY	Ensures that no DML operations can be performed on this view.
WITH CHECK OPTION	Specifies that rows remain accessible to the view after insert or update operations.

Views restrict access to base table data because the view can display selective columns from the table

Views can be used to reduce the complexity of executing queries based on more complicated SELECT statements

<pre>CREATE [OR REPLACE] [FORCE NOFORCE] VIEW view [(alias [,alias]...)] AS subquery [WITH CHECK OPTION [CONSTRAINT constraint]] [WITH READ ONLY [CONSTRAINT constraint]];</pre>

Feature	Simple Views	Complex Views
Number of tables used to derive data	One	One or more
Can contain functions	No	Yes
Can contain groups of data	No	Yes
Can perform DML operations (INSERT, UPDATE, DELETE) through a view	Yes	Not always

Simple View	
<pre>CREATE OR REPLACE VIEW view_euro_countries AS SELECT country_id ID, country_name "Country" FROM wf_countries WHERE location LIKE '%Europe';</pre>	<pre>CREATE OR REPLACE VIEW view_euro_countries(ID, "Country") AS SELECT country_id, country_name FROM wf_countries WHERE location LIKE '%Europe';</pre>

Complex View	
<pre>CREATE OR REPLACE VIEW view_euro_countries ("ID", "Country", "Region") AS SELECT c.country_id, c.country_name, r.region_name FROM wf_countries c JOIN wf_world_regions r USING (region_id) WHERE location LIKE '%Europe';</pre>	<pre>CREATE OR REPLACE VIEW view_high_pop ("Region ID", "Highest population") AS SELECT region_id, MAX(population) FROM wf_countries GROUP BY region_id;</pre>

SELECT * FROM view_high_pop;

15-2 DML Operations and Views

ROWNUM	A pseudo-column which assigns a sequential value starting with 1 to each of the rows returned from the subquery
WITH READ ONLY	Ensures that no DML operations can be performed on this view
WITH CHECK OPTION	Specifies that INSERTS and UPDATES performed through the view can't create rows which the view cannot select

<pre>CREATE OR REPLACE VIEW view_dept50 AS SELECT department_id, employee_id, salary FROM employees WHERE department_id = 50 WITH CHECK OPTION CONSTRAINT view_dept50_check;</pre>	<pre>UPDATE view_dept50 SET salary = 5800, BONUS = 0.5 WHERE employee_id= 124;</pre>
---	---

<pre>CREATE OR REPLACE VIEW view_dept50 AS SELECT department_id, employee_id, salary FROM employees WHERE department_id = 50 WITH READ ONLY;</pre>	<pre>UPDATE view_dept50 SET salary = 5800 WHERE employee_id= 124;</pre>
---	---

15-3 Managing Views

DROP VIEW	Removes a view
INLINE VIEW	Subquery with an alias that can be used within a SQL statement
TOP- N-ANALYSIS	Asks for the N largest or smallest values in a column

Only the creator or users with the DROP ANY VIEW privilege can remove a view:

DROP VIEW viewname

INLINE VIEW	TOP_N, LIMIT
<pre>SELECT e.department_id, e.employee_id, d.maxsal FROM employees e, (SELECT department_id, max(salary) maxsal FROM employees GROUP BY department_id) d WHERE e.department_id = d.department_id AND e.salary= d.maxsal;</pre>	<pre>SELECT ROWNUM AS "Top_N", employee_id, last_name FROM (SELECT employee_id, last_name FROM employees ORDER BY last_name) WHERE ROWNUM <=5;</pre>

Section 16 – Sequences and Synonyms

16-1 Working With Sequences

16-2 Indexes and Synonyms

```
CREATE INDEX index_name_idx ON table_name( column...,column)
```

```
DROP INDEX upper_last_name_idx;
```

Section 17 – Privileges and Regular Expressions

17-1 Controlling User Access

17-2 Creating and Revoking Object Privileges

17-3 Regular Expressions

Section 18 – TCL

18-1 Database Transactions