Database Management System

EXPERIMENT 3 INCLUDING CONSTRAINTS

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1.First, let's recreate the DEPT and EMP tables with basic structure:

```
-- Create DEPT table
CREATE TABLE dept (
    id NUMBER(7),
    name VARCHAR2(25)
);

-- Create EMP table
CREATE TABLE emp (
    id NUMBER(7),
    last_name VARCHAR2(25),
    first_name VARCHAR2(25),
    dept_id NUMBER(7)
);
```

Expected Output:

```
Table created.
Table created.
```

Verify table structures:

```
DESC dept;
DESC emp;
```

Expected Output:

```
Name Null?    Type
---- -------- -----------
ID            NUMBER(7)
NAME          VARCHAR2(25)

Name       Null? Type
---------- -------- -----------
ID                  NUMBER(7)
LAST_NAME           VARCHAR2(25)
FIRST_NAME          VARCHAR2(25)
DEPT_ID             NUMBER(7)
```

Adding Constraints:

1. Add PRIMARY KEY constraint to EMP table

```
ALTER TABLE emp
ADD CONSTRAINT my_emp_id_pk PRIMARY KEY (id);
```

Expected Output:

```
Table altered.
```

2. Add PRIMARY KEY constraint to DEPT table

```
ALTER TABLE dept
ADD CONSTRAINT my_dept_id_pk PRIMARY KEY (id);
```

Expected Output:

```
Table altered.
```

3. Add DEPT_ID column and FOREIGN KEY constraint to EMP table

```
-- First add the column
ALTER TABLE emp ADD (dept_id_new NUMBER(7));

-- Then add the foreign key constraint
ALTER TABLE emp
ADD CONSTRAINT my_emp_dept_id_fk
FOREIGN KEY (dept_id_new)
REFERENCES dept(id);
```

Expected Output:

```
Table altered.
Table altered.
```

4. Add COMMISSION column with CHECK constraint

```
ALTER TABLE emp ADD commission NUMBER(2,2);

ALTER TABLE emp
ADD CONSTRAINT emp_commission_check
CHECK (commission > 0);
```

Expected Output:

```
Table altered.
Table altered.
```

Inserting Data with Constraints:

Insert data into DEPT table first:

```
INSERT INTO dept VALUES (10, 'Administration');
INSERT INTO dept VALUES (20, 'Marketing');
INSERT INTO dept VALUES (30, 'Purchasing');
INSERT INTO dept VALUES (40, 'Human Resources');
INSERT INTO dept VALUES (50, 'Shipping');
COMMIT;
```

Expected Output:

```
1 row created.
1 row created.
1 row created.
1 row created.
1 row created.
Commit complete.
```

Insert valid data into EMP table:

```
INSERT INTO emp (id, last_name, first_name, dept_id_new,
commission)
VALUES (1, 'Smith', 'John', 10, 0.15);

INSERT INTO emp (id, last_name, first_name, dept_id_new,
commission)
VALUES (2, 'Johnson', 'Lisa', 20, 0.20);
```

Expected Output:

```
1 row created.
1 row created.
```

Testing Constraints:

Test PRIMARY KEY constraint (duplicate ID):

```
INSERT INTO emp (id, last_name, first_name, dept_id_new,
commission)
VALUES (1, 'Brown', 'Mike', 30, 0.10);
```

Expected Output:

```
ERROR at line 1:
ORA-00001: unique constraint (SYSTEM.MY_EMP_ID_PK) violated
```

Test FOREIGN KEY constraint (non-existent department):

```
INSERT INTO emp (id, last_name, first_name, dept_id_new,
commission)
VALUES (3, 'Davis', 'Sarah', 99, 0.15);
```

Expected Output:

```
ERROR at line 1:
ORA-02291: integrity constraint (SYSTEM.MY_EMP_DEPT_ID_FK)
violated - parent key not found
```

Test CHECK constraint (commission <= 0):

```
INSERT INTO emp (id, last_name, first_name, dept_id_new,
commission)
```

```
VALUES (3, 'Davis', 'Sarah', 30, 0);
```

Expected Output:

```
ERROR at line 1:
ORA-02290: check constraint (SYSTEM.EMP_COMMISSION_CHECK)
violated
```

Test NOT NULL constraint (let's add one):

```
ALTER TABLE emp MODIFY last_name NOT NULL;
```

Expected Output:

```
Table altered.
```

Test NOT NULL constraint:

```
INSERT INTO emp (id, first_name, dept_id_new, commission)
VALUES (4, 'Robert', 40, 0.25);
```

Expected Output:

```
ERROR at line 1:
ORA-01400: cannot insert NULL into
("SYSTEM"."EMP"."LAST_NAME")
```

Viewing Constraints:

5. Confirm constraints by querying USER_CONSTRAINTS

```
SELECT constraint_name, constraint_type, table_name, status
FROM user_constraints
```

```
WHERE table_name IN ('EMP', 'DEPT')
ORDER BY table_name, constraint_type;
```

Expected Output:

```
CONSTRAINT_NAME                C TABLE_NAME STATUS
------------------------------ - ---------- --------
MY_DEPT_ID_PK                  P DEPT       ENABLED
MY_EMP_ID_PK                   P EMP        ENABLED
EMP_COMMISSION_CHECK           C EMP        ENABLED
MY_EMP_DEPT_ID_FK              R EMP        ENABLED
SYS_C0012345                   C EMP        ENABLED  -- This
is the NOT NULL constraint
```

View constraint details:

```
SELECT uc.constraint_name, uc.constraint_type,
uc.table_name,
       ucc.column_name, uc.search_condition
FROM user_constraints uc
JOIN user_cons_columns ucc ON uc.constraint_name =
ucc.constraint_name
WHERE uc.table_name IN ('EMP', 'DEPT')
ORDER BY uc.table_name, uc.constraint_type;
```

Expected Output:

```
CONSTRAINT_NAME                C TABLE_NAME COLUMN_NAME
SEARCH_CONDITION
------------------------------ - ---------- ---------------
---- --------------------
MY_DEPT_ID_PK                  P DEPT       ID
MY_EMP_ID_PK                   P EMP        ID
```

```
EMP_COMMISSION_CHECK            C EMP        COMMISSION
commission > 0
MY_EMP_DEPT_ID_FK               R EMP        DEPT_ID_NEW
SYS_C0012345                    C EMP        LAST_NAME
"LAST_NAME" IS NOT NULL
```

Additional Constraint Examples:

6. Add UNIQUE constraint on email (let's add email column first)

```
ALTER TABLE emp ADD email VARCHAR2(50);

ALTER TABLE emp
ADD CONSTRAINT emp_email_uk UNIQUE (email);
```

Expected Output:

```
Table altered.
Table altered.
```

Test UNIQUE constraint:

```
INSERT INTO emp (id, last_name, first_name, dept_id_new,
commission, email)
VALUES (3, 'Wilson', 'David', 30, 0.15,
'david.wilson@company.com');

INSERT INTO emp (id, last_name, first_name, dept_id_new,
commission, email)
VALUES (4, 'Miller', 'Karen', 40, 0.18,
'david.wilson@company.com');
```

Expected Output:

```
1 row created.

ERROR at line 1:
ORA-00001: unique constraint (SYSTEM.EMP_EMAIL_UK) violated
```

7. Create table with all constraints at once

```
CREATE TABLE employee_demo (
    employee_id NUMBER(6)
        CONSTRAINT emp_demo_id_pk PRIMARY KEY,
    first_name VARCHAR2(20),
    last_name VARCHAR2(25)
        CONSTRAINT emp_demo_last_name_nn NOT NULL,
    email VARCHAR2(25)
        CONSTRAINT emp_demo_email_uk UNIQUE
        CONSTRAINT emp_demo_email_nn NOT NULL,
    phone_number VARCHAR2(20),
    hire_date DATE
        CONSTRAINT emp_demo_hire_date_nn NOT NULL,
    job_id VARCHAR2(10)
        CONSTRAINT emp_demo_job_nn NOT NULL,
    salary NUMBER(8,2)
        CONSTRAINT emp_demo_salary_ck CHECK (salary > 0),
    commission_pct NUMBER(2,2),
    manager_id NUMBER(6),
    department_id NUMBER(4),
    CONSTRAINT emp_demo_manager_fk FOREIGN KEY (manager_id)
        REFERENCES employee_demo(employee_id)
);
```

Expected Output:

```
Table created.
```

Verify the constraints:

```
SELECT constraint_name, constraint_type, table_name, status
FROM user_constraints
WHERE table_name = 'EMPLOYEE_DEMO'
ORDER BY constraint_type;
```

Expected Output:

```
CONSTRAINT_NAME                C TABLE_NAME   STATUS
------------------------------ - ------------ --------
EMP_DEMO_ID_PK                 P EMPLOYEE_DEMO ENABLED
EMP_DEMO_EMAIL_UK              U EMPLOYEE_DEMO ENABLED
EMP_DEMO_MANAGER_FK            R EMPLOYEE_DEMO ENABLED
EMP_DEMO_SALARY_CK             C EMPLOYEE_DEMO ENABLED
EMP_DEMO_LAST_NAME_NN          C EMPLOYEE_DEMO ENABLED
EMP_DEMO_EMAIL_NN              C EMPLOYEE_DEMO ENABLED
EMP_DEMO_HIRE_DATE_NN          C EMPLOYEE_DEMO ENABLED
EMP_DEMO_JOB_NN                C EMPLOYEE_DEMO ENABLED
```

Modifying and Dropping Constraints:

8. Disable and enable constraints

```
-- Disable a constraint
ALTER TABLE emp DISABLE CONSTRAINT emp_commission_check;

-- Try to insert invalid data (should work now)
INSERT INTO emp (id, last_name, first_name, dept_id_new,
commission)
VALUES (5, 'Taylor', 'James', 50, 0);
```

```
-- Enable the constraint back
ALTER TABLE emp ENABLE CONSTRAINT emp_commission_check;
```

Expected Output:

```
Table altered.

1 row created.

ERROR at line 1:
ORA-02293: cannot validate (SYSTEM.EMP_COMMISSION_CHECK) -
check constraint violated
```

We need to fix the invalid data first:

```
UPDATE emp SET commission = 0.10 WHERE id = 5;

ALTER TABLE emp ENABLE CONSTRAINT emp_commission_check;
```

Expected Output:

```
1 row updated.

Table altered.
```

9. Drop constraints

```
-- Drop a constraint
ALTER TABLE emp DROP CONSTRAINT emp_commission_check;

-- Verify it's gone
SELECT constraint_name FROM user_constraints
WHERE table_name = 'EMP' AND constraint_name =
```

```
'EMP_COMMISSION_CHECK';
```

Expected Output:

```
Table altered.

no rows selected
```

Final Data Verification:

Check current data in tables:

```
SELECT * FROM dept;
```

Expected Output:

```
        ID NAME
---------- -------------------------
         10 Administration
         20 Marketing
         30 Purchasing
         40 Human Resources
         50 Shipping
 SELECT id, last_name, first_name, dept_id_new, commission,
email FROM emp;
```

Expected Output:

```
        ID LAST_NAME                 FIRST_NAME
DEPT_ID_NEW COMMISSION EMAIL
---------- ------------------------- ----------------------
-- ---------- ---------- -------------------------
          1 Smith                     John
```

```
10          .15
          2 Johnson                   Lisa
20          .2
          3 Wilson                    David
30          .15 david.wilson@company.com
          5 Taylor                    James
50          .1
```

Summary of Constraint Types Demonstrated:

1. **PRIMARY KEY** - Uniquely identifies each row, implies NOT NULL
2. **FOREIGN KEY** - Maintains referential integrity between tables
3. **CHECK** - Validates data against specific conditions
4. **NOT NULL** - Ensures column cannot contain NULL values
5. **UNIQUE** - Ensures all values in column are distinct
6. **Constraint Naming** - Best practice to name constraints explicitly
7. **Constraint States** - ENABLED/DISABLED and VALIDATE/NOVALIDATE
8. **Constraint Management** - Adding, modifying, and dropping constraints