

A thick black L-shaped frame surrounds the text. The top-left corner is a horizontal bar extending to the right, then a vertical bar extending downwards. The bottom-right corner is a horizontal bar extending to the left, then a vertical bar extending upwards.

DATABASE DESIGN & IMPLEMENTATION

ICT Skills

Objectives

- Define and give an example of a PRIMARY KEY, FOREIGN KEY and CHECK constraints.
- Explain the purpose of defining PRIMARY KEY, FOREIGN KEY AND CHECK constraints.
- Demonstrate the creation of these constraints at column or table level.

PRIMARY KEY Constraints

- A PRIMARY KEY constraint is a rule that the values in one column or combination of columns must uniquely identify each row in a table.
- No primary key value can appear in more than one row in a table.
- To satisfy the PRIMARY KEY constraint both of the following must be true:
 - *No column that is part of the primary key can contain a null.*
 - *A table can only have one primary key.*
- A PRIMARY KEY constraints can be defined at the column or table level.
- If it is a composite key it must be defined at the table level.
- It is common practice to use `_pk` for the name

PRIMARY KEY Constraints

```
CREATE TABLE clients
(client_number NUMBER(4) CONSTRAINT clients_client_num_pk PRIMARY KEY,
first_name VARCHAR2(14),
last_name VARCHAR2(13));
```

```
CREATE TABLE clients
(client_number NUMBER(4),
first_name VARCHAR2(14),
last_name VARCHAR2(13),
CONSTRAINT clients_client_num_pk PRIMARY KEY (client_number));
```

PRIMARY KEY Constraints

- A composite key is defined at the table level and all column names are included in the parenthesis separated by commas.

```
CREATE TABLE copy_job_history
(employee_id NUMBER(6,0),
 start_date DATE,
 job_id VARCHAR2(10),
 department_id NUMBER(4,0),
CONSTRAINT copy_jhist_id_st_date_pk PRIMARY KEY(employee_id, start_date));
```

- When defining any constraint at the table level the column name must exist upon which the constraint is to be applied.

FOREIGN KEY (Referential Integrity) Constraints

- FOREIGN KEY constraints are also called 'Referential Integrity' constraints.
- They designate a column or combination of columns as a foreign key.
- They link back to the primary key in another table.
- The table containing the foreign key is called the 'child' table and the table it references is called the 'parent' table.

FOREIGN KEY (Referential Integrity) Constraints

DEPARTMENTS - Parent

DEPARTMENT_ID	DEPT_NAME	MANAGER_ID	LOCATION_ID
90	Executive	100	1700
110	Accounting	205	1700
190	Contracting	-	1700

EMPLOYEE - Child

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	DEPARTMENT_ID
100	Steven	King	90
101	Neena	Kochhar	90
102	Lex	De Haan	90
205	Shelley	Higgins	110
206	William	Gietz	110

- To satisfy a referential integrity constraint a foreign key value must match an existing value in the parent table or be NULL
- A primary key value can exist without a corresponding foreign key but not visa versa.

FOREIGN KEY (Referential Integrity) Constraints

- Before you define a referential integrity constraint in the child table, the referenced PRIMARY KEY constraint in the parent table must already exist.
- It is good practice to use `_fk` for the naming of a foreign key constraint.

```
CREATE TABLE copy_employees
(employee_id NUMBER(6,0) CONSTRAINT copy_emp_pk PRIMARY KEY,
 first_name VARCHAR2(20),
 last_name VARCHAR2(25),
 department_id NUMBER(4,0) CONSTRAINT c_emps_dept_id_fk
                                REFERENCES departments(department_id),
 email VARCHAR2(25));
```


FOREIGN KEY (Referential Integrity) Constraints

```
CREATE TABLE copy_employees
(employee_id NUMBER(6,0) CONSTRAINT copy_emp_pk PRIMARY KEY,
first_name VARCHAR2(20),
last_name VARCHAR2(25),
department_id NUMBER(4,0),
email VARCHAR2(25),
CONSTRAINT c_emps_dept_id_fk FOREIGN KEY (department_id)
REFERENCES departments(department_id));
```

Maintaining Referential Integrity

- ON DELETE CASCADE enables the dependent rows in the child table to be deleted when a row in the parent table is deleted.
- If the foreign key does not have an ON DELETE CASCADE option (default), referenced rows in the parent table cannot be deleted.

```
CREATE TABLE copy_employees
(employee_id NUMBER(6,0) CONSTRAINT copy_emp_pk PRIMARY KEY,
first_name VARCHAR2(20),
last_name VARCHAR2(25),
department_id NUMBER(4,0),
email VARCHAR2(25),
CONSTRAINT cdept_dept_id_fk FOREIGN KEY (department_id)
REFERENCES copy_departments(department_id) ON DELETE CASCADE);
```

FOREIGN KEY (Referential Integrity) Constraints

- Rather than having the rows in the child table deleted when using the ON DELETE CASCADE option, the child rows can be filled with null values
- ON DELETE SET NULL

```
CREATE TABLE copy_employees
(employee_id NUMBER(6,0) CONSTRAINT copy_emp_pk PRIMARY KEY,
first_name VARCHAR2(20),
last_name VARCHAR2(25),
department_id NUMBER(4,0),
email VARCHAR2(25),
CONSTRAINT cdept_dept_id_fk FOREIGN KEY (department_id)
REFERENCES copy_departments(department_id) ON DELETE SET NULL);
```

CHECK Constraints

- The CHECK constraint explicitly defines a condition that must be met.
- To satisfy the constraint, each row in the table must make the condition either True or unknown (due to a null).
- The condition of a CHECK constraint can refer to any column in the specified table but not to columns of other tables.
- If a CHECK constraint references more than one column it must be defined at the table level.

CHECK Constraints

```
CREATE TABLE copy_job_history
(employee_id NUMBER(6,0),
 start_date DATE,
 end_date DATE,
 job_id VARCHAR2(10),
 department_id NUMBER(4,0),
 CONSTRAINT cjhist_emp_id_st_date_pk
          PRIMARY KEY(employee_id, start_date),
 CONSTRAINT cjhist_end_ck CHECK (end_date > start_date));
```

CHECK Constraints

- A CHECK constraint must only be on the row where the constraint is defined.
- A CHECK constraint cannot be used in queries that refer to values in other rows.
- A CHECK constraint cannot contain calls to the functions SYSDATE, UID, USER, or USERENV.
- A CHECK constraint cannot use the pseudocolumns CURRVAL, NEXTVAL, LEVEL, or ROWNUM.
- A single column can have multiple CHECK constraints.
- They can be defined at the column or table level.

CHECK Constraints

– Column-level syntax:

```
salary NUMBER(8,2) CONSTRAINT employees_min_sal_ck CHECK (salary > 0)
```

– Table-level syntax:

```
CONSTRAINT employees_min_sal_ck CHECK (salary > 0)
```