Database Fundamentals Revision Summary

1. **Domain Concept**

- **Definition**: A domain has both logical meaning and data format

- **Examples**:

  - USA_phone_numbers: 10-digit format (ddd)ddd-dddd

  - Dates: Various formats like yyyy-mm-dd or dd mm,yyyy

- **Purpose**: Attribute names designate the role played by a domain

2. **Database Tables Structure**

- **Columns/Fields**: Define the structure (Patient Id, Name, D.o.B, etc.)

- **Rows/Records**: Actual data entries

- **Flat-file vs Relational**: Single table vs multiple related tables

3. **Key Attributes**

- **Super Key**: All attributes that identify a record

- **Candidate Key**: Potential primary keys

- **Primary Key**: Unique identifier for table records (no duplicates, no nulls)

- **Foreign Key**: Reference to primary key in related table

4. **Data Integrity Types**

- **Entity Integrity**: Primary key constraints (no duplicates/null values)

- **Referential Integrity**: Foreign key must reference existing primary key

- **Domain Integrity**: Data type and value range consistency

- **User-defined Integrity**: Custom rules (e.g., invoice number formatting)

5. **Relationship Cardinality**

- **One-to-One** (1:1)

- **One-to-Many** (1:M)

- **Many-to-One** (M:1)

- **Many-to-Many** (M:N) - requires junction table

6. **Many-to-Many Resolution**

- Use junction/intersection table with foreign keys from both parent tables

- Contains additional attributes about the relationship

7. **DDL (Data Definition Language)**

- **CREATE TABLE**: Define table structure

- **Column constraints**: Primary key, foreign key references, data types

- **Naming rules**: ≤30 chars, start with letter, unique within schema

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💡 Key Points to Remember:

- Primary keys must be unique and not null

- Foreign keys maintain referential integrity between tables

- Many-to-many relationships require junction tables

- Data integrity ensures accuracy and consistency

- DDL commands define database structure

- Proper normalization eliminates data redundancy

1. Differentiate between primary key and foreign key with examples.

- **Answer:**
  - A **Primary Key (PK)** is a unique identifier for a record within its own table. It cannot contain null or duplicate values. (e.g., `Patient Id` in the Patient table).
  - A **Foreign Key (FK)** is a field in one table that references the Primary Key in another table. It creates a link between the two tables and enforces referential integrity. It *can* contain duplicates and nulls, but its values must match an existing PK value in the referenced table. (e.g., `Doctor Id` in the Patient table is a FK referencing the `Doctor Id` PK in the Doctor table).

3. Why can't we implement many-to-many relationships directly between two tables?

Answer: Because it would lead to data redundancy and inconsistency.

4. What are the four types of data integrity constraints?

1. **Entity Integrity:** Ensures each record is uniquely identifiable (via Primary Key constraints).

2. **Referential Integrity:** Ensures relationships between tables are valid (via Foreign Key constraints).

3. **Domain Integrity:** Ensures data values are valid, of the correct type, and within a specified range.

4. **User-Defined Integrity:** Enforces custom business rules that are not covered by the other three (e.g., a specific format for an invoice number).

5. What problem does a junction table solve and how does it work?

Answer: It solves the problem of representing a many-to-many (M:N) relationship. It works by replacing the single M:N relationship with two one-to-many (1:M) relationships.

Identification Questions:

5. In the Patient-Doctor example, which is the primary key and which is the foreign key?

Answer:

Primary Key: Patient Id in the Patient table. Doctor Id in the Doctor table.

Foreign Key: Doctor Id in the Patient table (it references the Doctor Id PK in the Doctor table).

6. Identify the cardinality: "One department has many employees, but each employee belongs to only one department"
Answer: One-to-Many (1:M). The "one" side is Department, the "many" side is Employee.

8. Which data integrity type ensures that foreign key values match existing primary keys?

- **Answer:** Referential Integrity.

Practical Questions:

9. Write SQL to create a Students table with student_id (primary key), name, and email columns

```
CREATE TABLE students (
    student_id NUMBER(9) PRIMARY KEY,
    full_name VARCHAR(150),
    email VARCHAR(30)
);
```

10. Create a junction table to handle the many-to-many relationship between Students and Courses

```
CREATE TABLE registration (
    student_id NUMBER(9),
    course_id VARCHAR(10),
    semester NUMBER(1),
    year DATE,
    PRIMARY KEY (student_id, course_id),
    FOREIGN KEY (student_id) REFERENCES students(student_id),
    FOREIGN KEY (course_id) REFERENCES courses(course_id)
);
```

True/False Questions:

14. A foreign key can contain null values (True/False) **True**

15. A primary key can be changed once assigned (True/False) **False**

16. A junction table requires its own primary key (True/False) **True**

17. Domain integrity only concerns data types, not value ranges (True/False)**False**