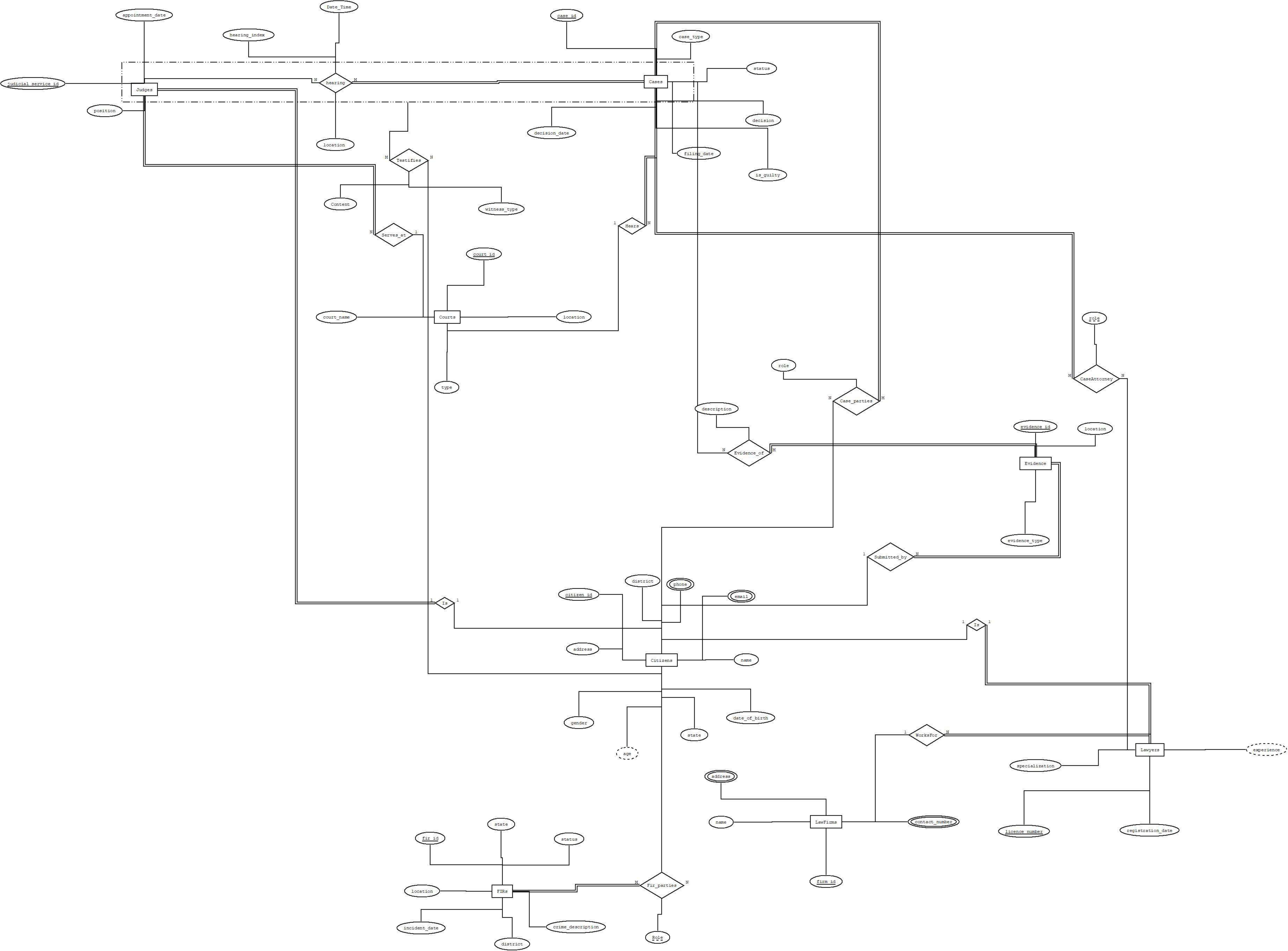


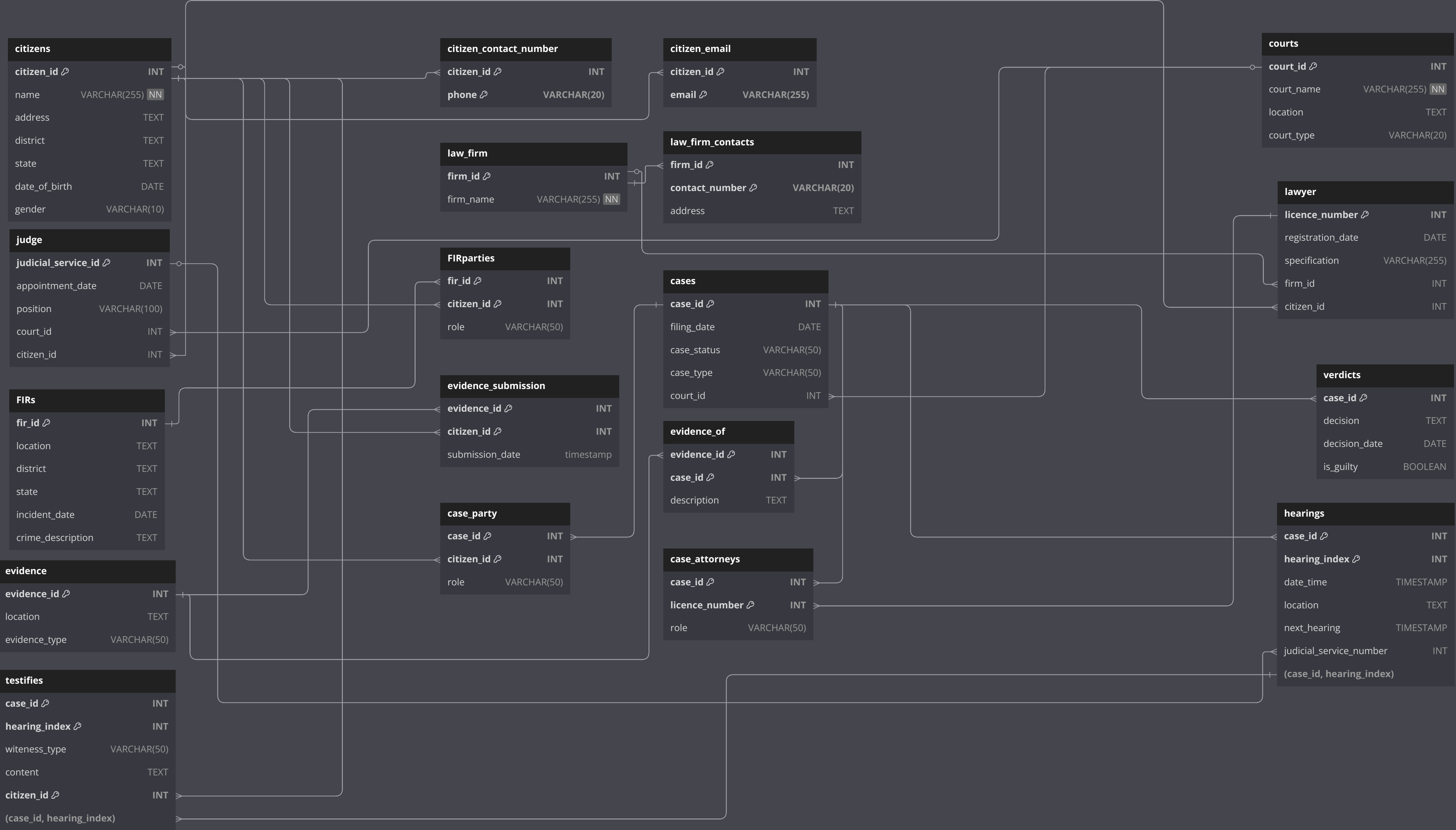
Group 2

Judicial Database Management System

Members

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Minimal (Canonical) Functional Dependency Set

Introduction

In this document, we have listed the minimal functional dependency set for our database.

Theoretical Background

A functional dependency $X \rightarrow Y$ states that the values of attribute set X uniquely determine the values of attribute set Y .

In a canonical (minimal) set of functional dependencies:

1. Every determinant (left-hand side) is minimal
2. No functional dependency in the set can be derived from other FDs in the set
3. The right-hand side of each FD contains a single attribute or is irreducible

Schema Analysis

1. citizens

Minimal FD Set:

`citizen_id` \rightarrow `name`, `address`, `date_of_birth`, `gender`, `district`, `state`

The `citizen_id` is the minimal determinant that uniquely identifies all other attributes in the relation.

2. citizen_contact_number

Minimal FD Set:

Composite key (`citizen_id`, `phone`) forms the primary key

No non-trivial FDs beyond the key itself

This is a simple entity-attribute relation where the composite key is the only meaningful FD.

3. citizen_email

Minimal FD Set:

Composite key (`citizen_id`, `email`) forms the primary key

No non-trivial FDs beyond the key itself

Similar to `citizen_contact_number`, this is an entity-attribute relation with no additional dependencies.

4. courts

Minimal FD Set:

`court_id` \rightarrow `court_name`, `location`, `court_type`

The `court_id` uniquely determines all court information.

5. judge

Minimal FD Set:

`judicial_service_id` \rightarrow `appointment_date`, `position`, `court_id`,
`citizen_id`

The `judicial_service_id` uniquely identifies a judge's appointment and associated information.

6. law_firm

Minimal FD Set:

`firm_id` \rightarrow `firm_name`

A simple relationship where the `firm_id` uniquely determines the firm's name.

7. law_firm_contacts

Minimal FD Set:

`(firm_id, contact_number)` \rightarrow `address`

The key `(firm_id, contact_number)` uniquely determines the address for a law firm.

8. lawyer

Minimal FD Set:

`licence_number` \rightarrow `registration_date`, `specification`, `firm_id`,
`citizen_id`

The `licence_number` uniquely identifies all attributes associated with a lawyer.

9. FIRs

Minimal FD Set:

`fir_id` \rightarrow `location`, `incident_date`, `crime_description`, `district`,
`state`

The `fir_id` uniquely determines all information related to a specific FIR report.

10. FIRparties

Minimal FD Set:

$(fir_id, citizen_id) \rightarrow role$

The above key uniquely determines the role of a citizen in a specific FIR.

11. cases**Minimal FD Set:**

$case_id \rightarrow filing_date, case_status, court_id$

The $case_id$ uniquely identifies all relevant case information.

12. verdicts**Minimal FD Set:**

$case_id \rightarrow decision, decision_date, is_guilty$

The $case_id$ uniquely determines the verdict's information for a case.

13. evidence**Minimal FD Set:**

$evidence_id \rightarrow location, evidence_type$

The $evidence_id$ uniquely determines all attributes of evidence.

14. evidence_submission**Minimal FD Set:**

$(evidence_id, citizen_id) \rightarrow submission_date$

The composite key uniquely determines when a piece of evidence was submitted by a specific citizen.

15. evidence_of**Minimal FD Set:**

$(evidence_id, case_id) \rightarrow description$

The composite key uniquely determines the description of how a piece of evidence is related to a specific case.

16. hearings**Minimal FD Set:**

$(case_id, hearing_index) \rightarrow date_time, location, next_hearing, judicial_service_number$

The composite key uniquely identifies all information about a specific hearing for a case.

17. testifies

Minimal FD Set:

$(\text{case_id}, \text{hearing_index}, \text{citizen_id}) \rightarrow \text{witness_type}, \text{content}$

The composite key uniquely determines the testimony details of a citizen in a specific hearing.

18. case_party**Minimal FD Set:**

$(\text{case_id}, \text{citizen_id}) \rightarrow \text{role}$

The composite key uniquely determines the role a citizen plays in a specific case.

19. case_attorneys**Minimal FD Set:**

$(\text{case_id}, \text{licence_number}) \rightarrow \text{role}$

The composite key uniquely determines the role an attorney plays in a specific case.

Boyce-Codd Normal Form (BCNF) Analysis of Database Schema

1. citizens

The primary key here is **citizen_id**.

Functional dependencies are:

$\text{citizen_id} \rightarrow \text{name, address, date_of_birth, gender, district, state}$

The only determinant here is **citizen_id**, which is the primary key, so our BCNF is justified.

2. citizen_contact_number

The primary key here is **(citizen_id, phone)**

Functional dependency:

Here (citizen_id, phone) combined uniquely determines each record.

Since the only non-trivial functional dependency has the primary key as its determinant, it satisfies all BCNF requirements.

3. citizen_email

The primary key is **(citizen_id, email)**

Functional Dependencies:

(citizen_id, email) uniquely determines each record.

Again, since the only non-trivial dependency uses the composite primary key as its determinant, thus it meets BCNF criteria.

4. courts

The primary key is **court_id**

The functional dependencies are:

$\text{court_id} \rightarrow \text{court_name, location, court_type}$

The determinant **court_id** is the primary key, hence BCNF is justified.

5. judge

The primary key is **judicial_service_id**.

FDs are:

$\text{judicial_service_id} \rightarrow \text{appointment_date, position, court_id, citizen_id}$

The only determinant is **judicial_service_id**, which is the primary key, thus satisfying BCNF.

6. law_firm

The primary key here is **firm_id**

FDs:

$\text{firm_id} \rightarrow \text{firm_name}$

The determinant **firm_id** is the primary key, ensuring BCNF compliance.

7. law_firm_contacts

The primary key here is **(firm_id, contact_number)**

FDs are:

$(\text{firm_id, contact_number}) \rightarrow \text{address}$

Since the composite key is the only determinant in any non-trivial dependency, it satisfies BCNF.

8. lawyer

The primary key in this is **licence_number**

FDs are:

$\text{licence_number} \rightarrow \text{registration_date}, \text{specification}, \text{firm_id}, \text{citizen_id}$

The determinant **licence_number** is the primary key, ensuring BCNF.

9. FIRs

The primary key is **fir_id**

FDs are:

$\text{fir_id} \rightarrow \text{location}, \text{incident_date}, \text{crime_description}, \text{district}, \text{state}$

The determinant **fir_id** is the primary key, thus satisfying BCNF.

10. FIRparties

The primary key taken here is **(fir_id, citizen_id)**

FDs are:

$(\text{fir_id}, \text{citizen_id}) \rightarrow \text{role}$

The composite key is the only determinant in any non-trivial dependency, meeting BCNF requirements.

11. cases

Primary key is **case_id**

FDs are:

$\text{case_id} \rightarrow \text{filing_date}, \text{case_status}, \text{court_id}$

The determinant **case_id** is the primary key, ensuring BCNF.

12. verdicts

The primary key here is **case_id**

FDs are:

$\text{case_id} \rightarrow \text{decision}, \text{decision_date}, \text{is_guilty}$

The determinant **case_id** is the primary key, thus satisfying BCNF.

13. evidence

Primary Key is **evidence_id**

FDs are:

$\text{evidence_id} \rightarrow \text{location}, \text{evidence_type}$

The determinant **evidence_id** is the primary key, ensuring BCNF.

14. evidence_submission

Primary key here is **(evidence_id, citizen_id)**

FD is:

$(\text{evidence_id}, \text{citizen_id}) \rightarrow \text{submission_date}$

The composite key is the only determinant in any non-trivial dependency, satisfying BCNF.

15. evidence_of

The primary key is **(evidence_id, case_id)**

FDs are:

$(\text{evidence_id}, \text{case_id}) \rightarrow \text{description}$

The composite key is the only determinant in any non-trivial dependency, meeting BCNF requirements.

16. hearings

Primary key: **(case_id, hearing_index)**

FDs are:

$(\text{case_id}, \text{hearing_index}) \rightarrow \text{date_time}, \text{location}, \text{next_hearing}, \text{judicial_service_number}$

The composite key is the only determinant in any non-trivial dependency, ensuring BCNF compliance.

17. testifies

Primary key is Composite key **(case_id, hearing_index, citizen_id)**

FDs are:

$(\text{case_id}, \text{hearing_index}, \text{citizen_id}) \rightarrow \text{witness_type}, \text{content}$

The composite key is the only determinant in any non-trivial dependency, satisfying BCNF.

18. case_party

Primary Key is **(case_id, citizen_id)**

FDs are:

$(\text{case_id}, \text{citizen_id}) \rightarrow \text{role}$

The composite key is the only determinant in any non-trivial dependency, meeting BCNF requirements.

19. case_attorneys

Primary key is **(case_id, licence_number)**

FDs are:

$(\text{case_id}, \text{licence_number}) \rightarrow \text{role}$

The composite key is the only determinant in any non-trivial dependency, ensuring BCNF compliance.