Group 11

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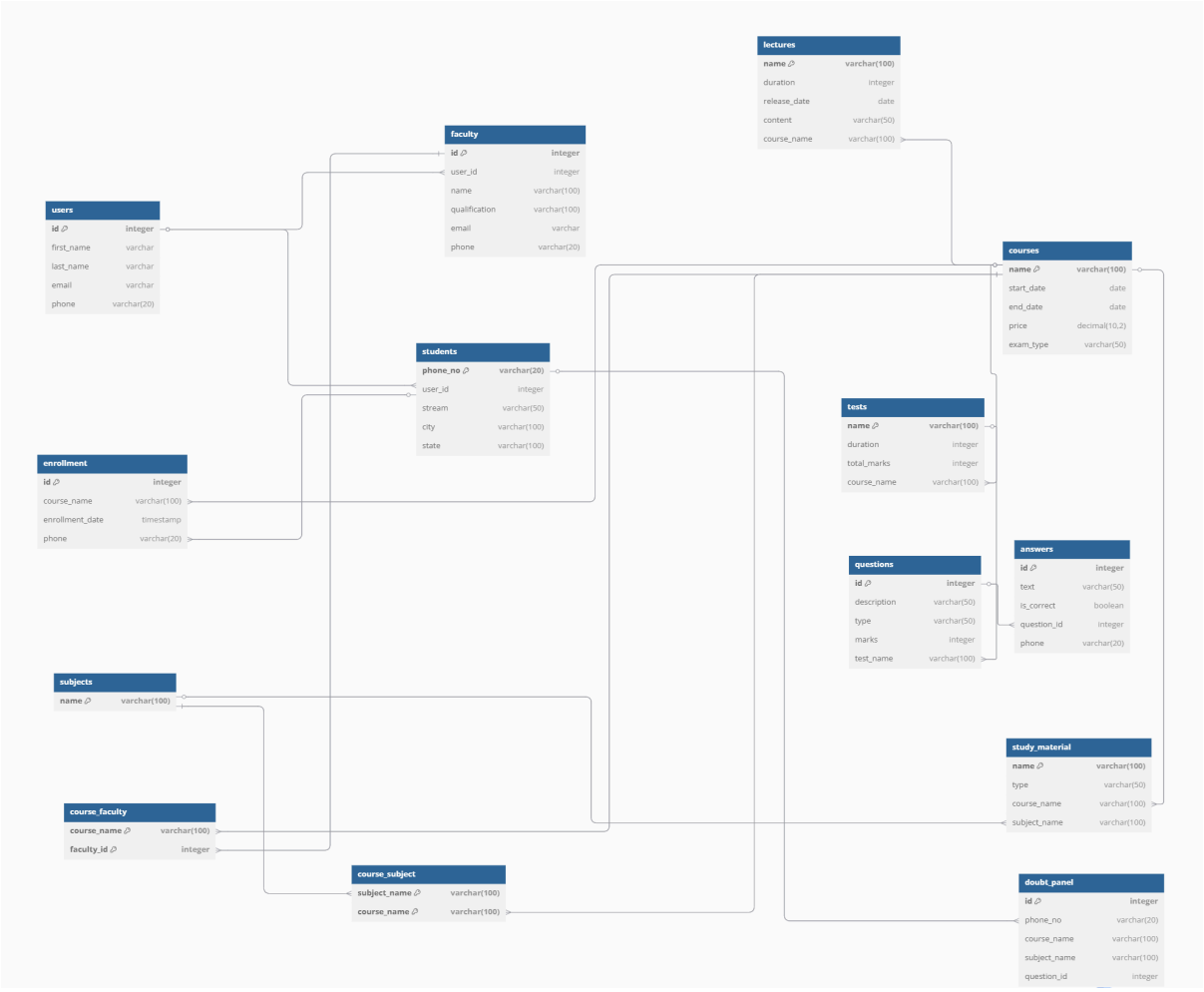
RELATIONAL SCHEMA -



Minimal FD Set and BCNF Analysis

1. Overview of the Database schema

The Online Education System schema includes tables for users, students, faculty, courses, enrollment, tests, questions, answers, subjects, lectures, study_material, doubt_panel, course_faculty, and course_subject. Each table is defined with a primary key (or a composite key) that uniquely identifies each record. In this report, we focus on the internal functional dependencies that arise from these key definitions, and we ignore foreign key constraints for the purpose of normalization analysis.

2. Derivation of Minimal Functional Dependencies

Table: users

Attributes: id, first_name, last_name, email, phone

Primary Key: id

Minimal FD:

id → first_name, last_name, email, phone

Key: id

About BCNF:

Here, id is the superkey and determines all other attributes. So, this relation satisfies BCNF.

Table: students

Attributes: phone_no, user_id, stream, city, state

Primary Key: phone_no

Minimal FD:

phone_no → user_id, stream, city, state

Key: phone_no

About BCNF:

Since phone_no is the superkey and determines all other attributes, this relation satisfies BCNF.

Table: faculty

Attributes: id, user_id, name, qualification, email, phone

Primary Key: id

Minimal FD:

id → user_id, name, qualification, email, phone

Key: id

About BCNF:

Here, id is the superkey and it determines all other attributes. So, this relation is in BCNF.

Table: courses

Attributes: name, start_date, end_date, price, exam_type

Primary Key: name

Minimal FD:

name → start_date, end_date, price, exam_type

Key: name

About BCNF:

Since name is the superkey and determines all other attributes, this relation satisfies BCNF.

Table: enrollment

Attributes: id, course_name, enrollment_date, phone

Primary Key: id

Minimal FD:

id → course_name, enrollment_date, phone

Key: id

About BCNF:

Here, id is the superkey and it determines all other attributes, hence this relation is in BCNF.

Table: tests

Attributes: name, duration, total_marks, course_name

Primary Key: name

Minimal FD:

name → duration, total_marks, course_name

Key: name

About BCNF:

Since name is the superkey, the functional dependency satisfies BCNF.

Table: questions

Attributes: id, description, type, marks, test_name

Primary Key: id

Minimal FD:

id → description, type, marks, test_name

Key: id

About BCNF:

Here, id is the superkey and determines all other attributes. So, the relation is in BCNF.

Table: answers

Attributes: id, text, is_correct, question_id, phone

Primary Key: id

Minimal FD:

id → text, is_correct, question_id, phone

Key: id

About BCNF:

Since id is the superkey and determines all other attributes, this relation satisfies BCNF.

Table: subjects

Attributes: name

Primary Key: name

Minimal FD:

name → (trivial dependency)

Key: name

About BCNF:

The only dependency is trivial, hence the relation is in BCNF.

Table: lectures

Attributes: name, duration, release_date, content, course_name

Primary Key: name

Minimal FD:

name → duration, release_date, content, course_name

Key: name

About BCNF:

Here, name is the superkey and determines all other attributes, so this relation is in BCNF.

Table: study_material

Attributes: name, type, course_name, subject_name

Primary Key: name

Minimal FD:

name → type, course_name, subject_name

Key: name

About BCNF:

Since name is the superkey and determines all other attributes, this relation satisfies BCNF.

Table: doubt_panel

Attributes: id, phone_no, course_name, subject_name, question_id

Primary Key: id

Minimal FD:

id → phone_no, course_name, subject_name, question_id

Key: id

About BCNF:

Here, id is the superkey and determines all other attributes, so this relation is in BCNF.

Table: course_faculty

Attributes: course_name, faculty_id

Composite Primary Key: (course_name, faculty_id)

Minimal FD:

(course_name, faculty_id) → (trivial dependency)

Key: (course_name, faculty_id)

About BCNF:

The composite key is the superkey, and only trivial dependencies exist. Therefore, this relation satisfies BCNF.

Table: course_subject

Attributes: subject_name, course_name

Composite Primary Key: (subject_name, course_name)

Minimal FD:

(subject_name, course_name) → (trivial dependency)

Key: (subject_name, course_name)

About BCNF:

Since the composite key is the superkey and the only dependencies are trivial, this relation is in BCNF.

Minimal FD Set:

id → first_name	phone_no → user_id
id → last_name	phone_no → stream
id → email	phone_no → city
id → phone	phone_no → state
faculty_id → user_id	course_name → start_date
faculty_id → name	course_name → end_date
faculty_id → qualification	course_name → price
faculty_id → email	course_name → exam_type
faculty_id → phone	enrollment_id → course_name
enrollment_id → enrollment_date	enrollment_id → phone
test_name → duration	test_name → total_marks
test_name → course_name	question_id → description
question_id → type	question_id → marks
question_id → test_name	answer_id → text
answer_id → is_correct	answer_id → question_id
answer_id → phone	subject_name → (trivial)
lecture_name → duration	lecture_name → release_date
lecture_name → content	lecture_name → course_name
study_material_name → type	study_material_name → course_name
study_material_name → subject_name	doubt_panel_id → phone_no
doubt_panel_id → course_name	doubt_panel_id → subject_name

doubt_panel_id → question_id	{course_name, faculty_id} → (trivial)
{subject_name, course_name} → (trivial)	

ER-Diagram: