Database Systems
Fall-2024 Department of Computer Science
The Islamia University Bahawalpur
Class 4th MA

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1. Introduction:

1.1. Background:

The `university_professors` table contains information about professors, their affiliated universities, associated organizations, and the functions they perform. This single table has redundancy and lacks normalization, making it hard to manage and scale. By splitting it into four related tables — `professors`, `universities`, `organizations`, and `affiliations` — we aim to create a normalized structure that enhances data integrity and ensures scalability.

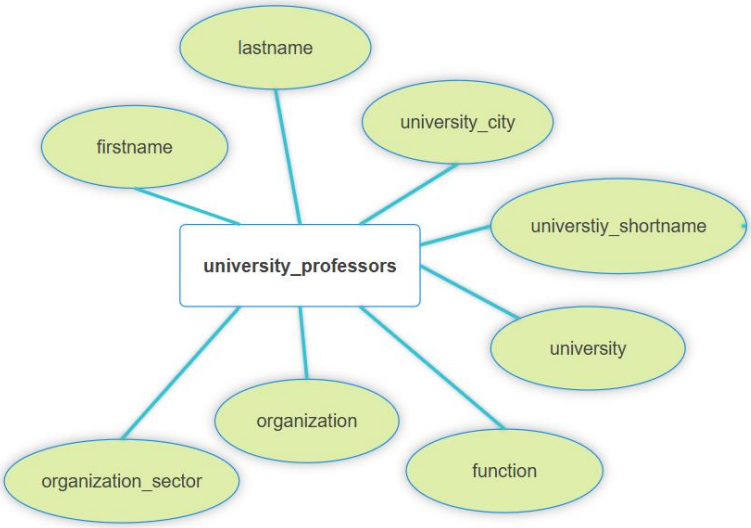


Figure 1 `university_professors` table with redundancy and lack of normalization.

1.2. Goal:

The goal is to create a normalized database structure by splitting the `university_professors` table into multiple tables, ensuring minimal redundancy and easy maintainability. The project aims to implement a robust schema, insert data, and demonstrate various SQL operations like joins, updates, and deletes.

1.3. Requirements:

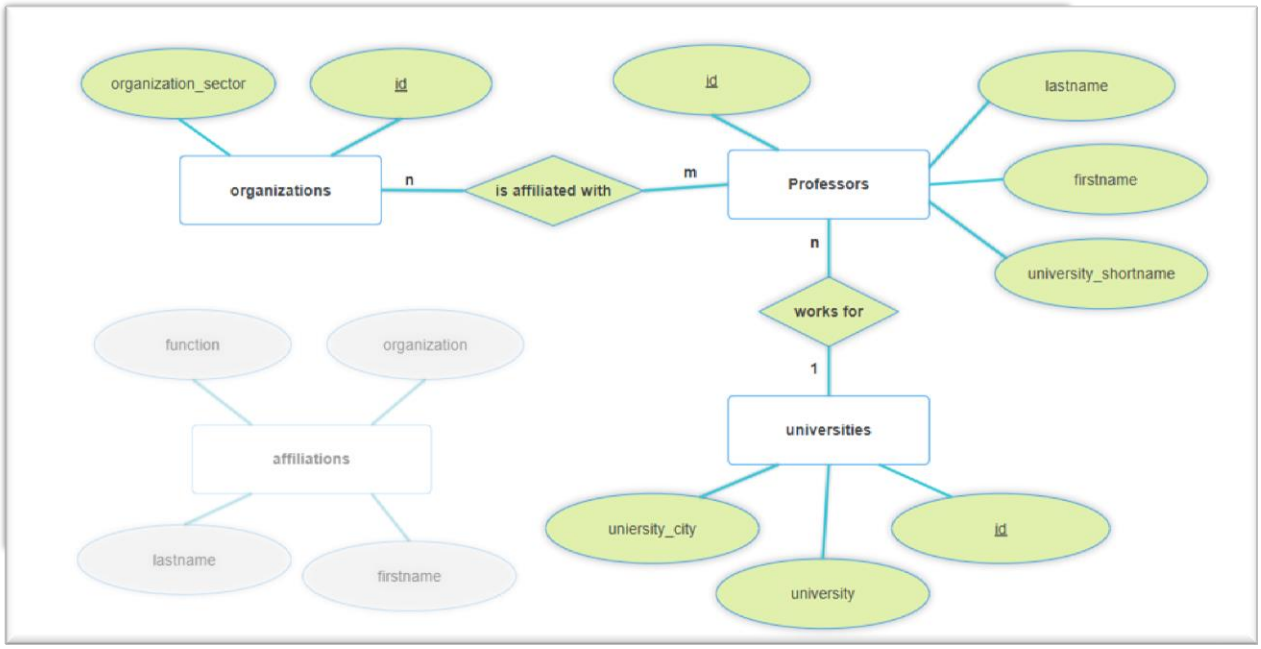
- Store professor information (first name, last name, etc.).
- Store University details (short name, city, etc.).
- Track affiliations between professors and organizations.
- Ensure data integrity using primary and foreign keys.
- Allow querying for reports, such as professors by university or organization sector.

2. Functional Description:

2.1. Method of use

This database will primarily be used by university administrators and researchers. Administrators can update professor affiliations, while researchers can query the database for insights, such as the distribution of professors by organization sector or city.

3. Entity Data Model



In the final schema, redundancy has been minimized by organizing the data into three tables: `organizations`, `professors`, and `universities`. The `professors` table is linked to the `universities` table through a foreign key, establishing a one-to-many relationship. Additionally, the `organizations` and `professors` tables are connected via the `affiliations` table, which implements a many-to-many relationship using foreign keys.

4. Table Design (Schema) Screenshots

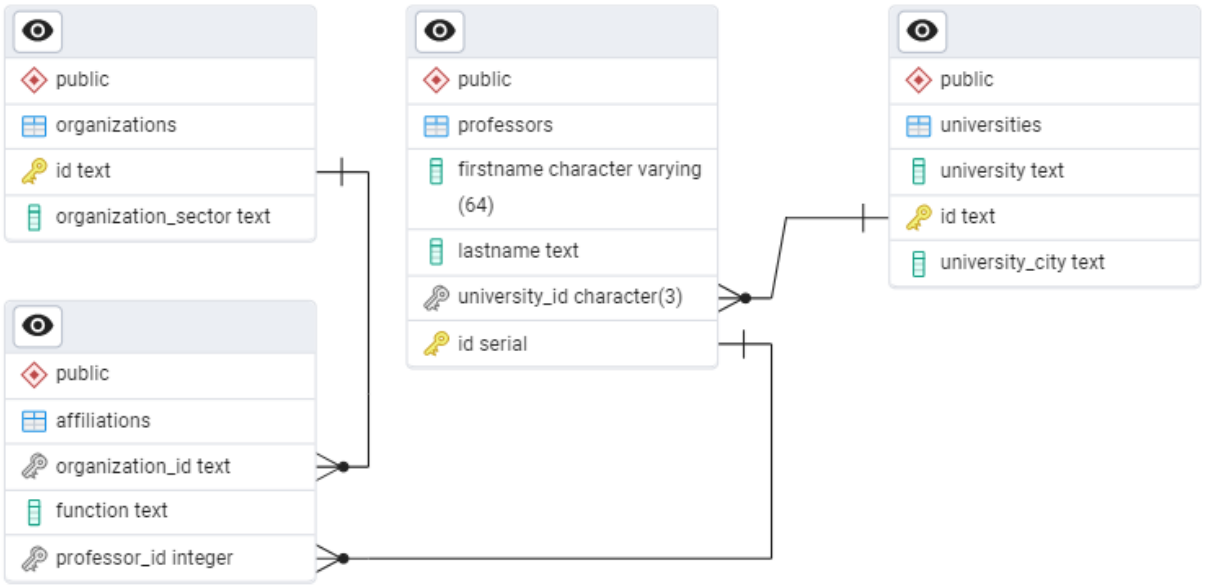
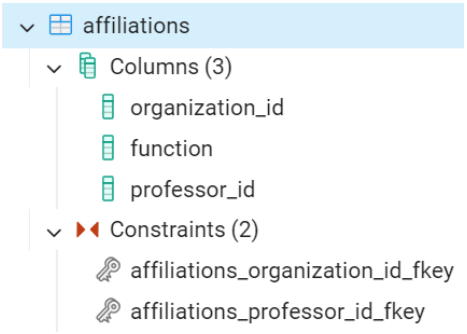
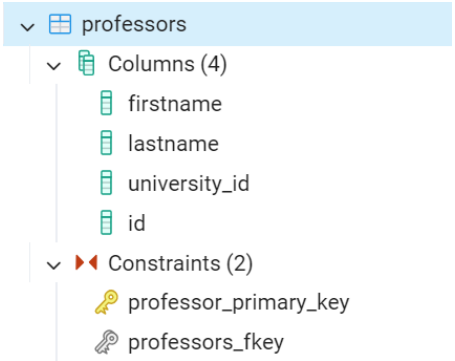
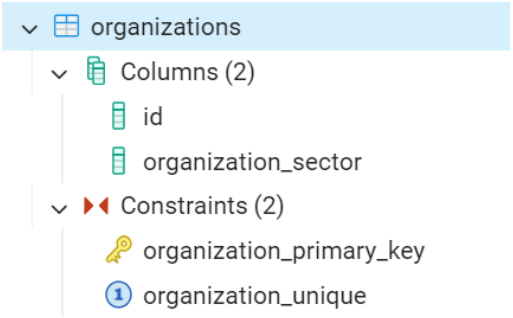


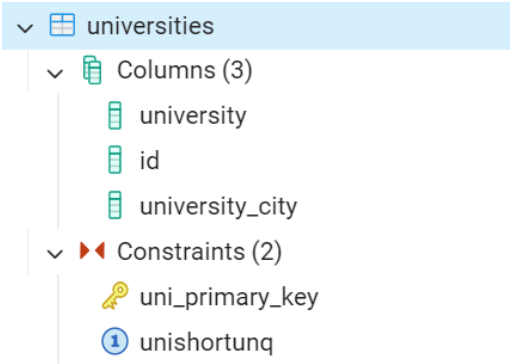
Table names:

Table Name	*Primary key and Constraint*	*Foreign Key(s)*	*Unique Constraints*
Professors	*Id : professor_primary_key*	*Professors_fkey*	
Universities	*Id: uni_primary_key*		*Unishortunq*
Organizations	*Id: organization_primary_key*		
Affiliations		*Affiliations_organization_id_fkey* *Affiliations_professor_id_fkey*	









5. Frontend Screenshots

Example Queries and the outputs (Create, Insert, Update, Delete, Joins, Referential integrity)

INSERT and REFERENTIAL INTEGRITY QUERY:

Inserting values with referential integrity. In which first we have to insert university then we can add a professor referencing university.

Query | Query History

```
1  INSERT INTO universities (university, id, university_city)
2  VALUES ('Islamia Uniersity of Bahwalpur', 'IUB', 'Bahawalpur')
3
4  INSERT INTO professors (firstname, lastname, university_id)
5  VALUES('Saad', 'Alvi', 'IUB')
6
7  SELECT firstname, lastname, university
8  FROM professors
9  JOIN universities
10 ON professors.university_id = universities.id
11 AND universities.university_city = 'Bahawalpur';
12
```

Data Output | Messages | Notifications

SQL

	firstname character varying (64)	lastname text	university text
1	Saad	Alvi	Islamia Uniersity of Bahwalpur

DELETE QUERY:

Query | Query History

```
26
27 -- Delete an affiliation
28 DELETE FROM affiliations
29 WHERE organization_id = 'NTU, Singapore';
30
31
32
33
```

Data Output | Messages | Notifications

```
DELETE 0

Query returned successfully in 140 msec.
```

UPDATE QUERY:

Query | Query History

```
31  UPDATE professors
32  SET university_id = 'IUB'
33  WHERE id = 5;
34
35  SELECT firstname, lastname, university_id, university
36  FROM professors
37  JOIN universities
38  ON professors.university_id = universities.id
39  WHERE professors.id = 5;
```

Data Output | Messages | Notifications

	firstname character varying (64)	lastname text	university_id character (3)	university text
1	Paolo	Ienne	IUB	Islamia Uniersity of Bahwalpur

JOINS QUERY:

Query | Query History

```
43  SELECT firstname, lastname, organization_id, university_id, university_city
44  FROM professors
45  JOIN affiliations
46  ON professors.id = affiliations.professor_id
47  JOIN universities
48  ON professors.university_id = universities.id
49  WHERE universities.university_city = 'Basel';
```

Data Output | Messages | Notifications

	firstname character varying (64)	lastname text	organization_id text
1	Andreas	Papassotiropoulos	GeneGuide AG, Basel
2	Antonio	Loprieno	Schweizerische Studienstiftung
3	Antonio	Loprieno	Pädagogische Hochschule Freiburg
4	Roland	Fankhauser	Liatowitsch & Partner
5	Pascal	Gantenbein	Hoffmann & Co. AG, Basel

Total rows: 75 of 75 Query complete 00:00:00.170 Ln 49, Col 46

6. Project Files

The final project is accessible via the following link.

https://drive.google.com/drive/folders/15bZltclA8WZIW6DOVoYqYFyfnmrqWiku?usp=sharing