DBMS OF Pakistan Science and Technology

Database Design Document

V 3.0

By

1	*Anam Fatima*	*NUM-BSCS-2022-01*
2	*Sultan Haider*	*NUM-BSCS-2022-48*
3	*Abdul Qadeer*	*NUM-BSCS-2022-56*

Department of Computer Sciences

Namal University

Mianwali, Pakistan

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REVISION HISTORY

Date	Version	Description	Approved by
10/06/24	V 2.1	Removed Associative Entity SoftwareHouseTelecomProvider	Mam ASIYA
10/06/24	V2.2	The relationship between Software House and Telecommunication is changed to One-to Many	Mam ASIYA
10/06/24	V2.3	The relationship between software House and software development companies is changed to many to many and thus added associative entity Software Projects	Mam ASIYA
10/06/24	V2.4	Improved the structure of ERD	Mam ASIYA
22/04/24	V 1.1	- Corrected indentation on title page	Mam ASIYA
22/04/24	V 1.2	- Removed one logo from the title page	Mam ASIYA
22/04/24	V 1.3	- Specified the type of data the project will store in the introduction	Mam ASIYA
22/04/24	V 1.4	-removed objective point 3 in which we were providing the recommendations. -removed the further contribution line from objective point 5 in the field of science and tech	Mam ASIYA
22/04/24	V 1.5	- Removed Recommendation Generation from project scope	Mam ASIYA
22/04/24	V 1.6	- Removed Visualization Tool from project scope	Mam ASIYA
22/04/24	V 1.7	- Improved System Functionality	Mam ASIYA

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CHAPTER 1: PROJECT OVERVIEW

1.1. INTRODUCTION:

Our project aims to develop a specialized Database Management System (DBMS) tailored for Pakistan's science and technology sector, leveraging MySQL and Python for efficient data management and predictive analytics. Key datasets include Tech Indicators, Software Houses, Software Development Companies, Freelancers, Telecommunication Statistics, Telecommunication, Scientists, Software House Telecom Provider, and Freelancer Company Assignment. **[1] [2]** By analyzing these datasets, our DBMS will provide valuable insights, fostering progress in Pakistan's science and technology landscape.

1.2. PROBLEM STATEMENT:

There is a lack of specialized DBMS solutions tailored to the needs of science and technology domains, hindering efficient data management and analysis. Additionally, the absence of predictive analytics regarding Pakistan's future in science and technology limits strategic planning in this crucial sector.

1.3. PROJECT OBJECTIVES:

2. Develop a user-friendly DBMS for science and technology data management.
3. Predict Pakistan's future standing in science and technology based on data analysis.
4. Develop a comprehensive database system to catalog and organize information on scientific research, technological advancements, and innovations across various domains.
5. This database should facilitate efficient storage, retrieval, and analysis of data, enabling technologists to access relevant information.

5.2. DOCUMENT OBJECTIVES:

6. **Clarity:** Ensure that the documentation clearly articulates the goals, scope, and significance of the database project to stakeholders and team members.
7. **Conciseness:** Present the information in a concise manner, avoiding unnecessary details while covering all essential aspects of the project.
8. **Coherence:** Organize the documentation in a logical and coherent manner, facilitating easy navigation and understanding for readers.
9. **Completeness:** Ensure that all relevant aspects of the project, including data description, system architecture, functional and non-functional requirements, implementation plan, and testing approach, are adequately addressed.
10. **Accessibility:** Make the documentation accessible to a diverse audience, including project developers and other interested parties(instructor, groupmates), by using clear language and avoiding technical jargon whenever possible.

CHAPTER 2: DETAILED DATABASE DESIGN

2.1. ENTITY:

Sr. No	Entity Name	Description
01	Tech Indicators	Tech Indicators is a collection of data representing scientific and technological indicators along with their values across Pakistan in different years.
02	Software Houses	Software house is a registered software development center operating within Pakistan showing the description of these centers.
03	Software Development Companies	Software Development Companies are an established software development firms with ratings, locations, and notable client lists, documented within the system.
04	Freelancers	Freelancers are individuals offering their services independently within the Pakistani market.
05	Telecommunication Statistics	Telecommunication statistics is the collection of telecommunications metrics over time in Pakistan.
06	Telecommunication	Telecommunication is a monthly usage statistics associated with major telecom providers operating in Pakistan.
07	Scientist	Scientists are the individuals recognized within the system for their contributions to science, affiliated with specific disciplines and institutions within Pakistan.
08	Software Project (Associative)	Software Project act as a linker between the software houses and the software development companies which assigns projects to various Software Houses.
09	Freelancer Company Assignment (Associative)	Freelancer Company Assignment acts as a linker that establishes connections between individual freelancers and the companies they work for or collaborate with.

2.2. DATA DICTIONARY:

2.2.1. Tech Indicators:

Sr. No	Name	Data Type	Constraint	Description
01	Technology ID (Primary Key)	Number	NOT NULL	Technology ID of the indicator and year
02	Indicator	Text	None	The name of scientific and technological indicator
03	Indicator Code	Text	None	A unique Code identifying the indicator
04	Value	Number	None	The value of indicator in specific year

05	Year	Number	BETWEEN 1990 to 2022	The year in which data is measured

2.2.2. Software Houses:

Sr. No	Name	Data Type	Constraint	Description
01	Software House ID (Primary Key)	Number	NOT NULL	Software House ID of each software house
02	Name	Text	Between 1 and 70	The name of the sotware house
03	Description	Text	None	A one-liner description of each software house

2.2.3. Software Development Companies:

Sr. No	Name	Data Type	Constraint	Description
01	Company ID (Primary Key)	Number	NOT NULL	The ID of the software development companies
02	Company Name	Text	Between 1 and 70	The name of the software development company associated with the ID
03	Rating	Number	Between 0 and 5	The rating or reputation of the company
04	Location	Text	Any constraint	The location of the company (city)
05	Company Clients	Text	Multi valued attribute	The clients with which the company is associated

2.2.4. Freelancers:

Sr. No	Name	Data Type	Constraint	Description
01	Freelancer ID (Primary Key)	Number	NOT NULL	Freelancer ID of each individual
02	Name	Text	Between 1 and 70	The name of the person
03	Profession	Text	Multi valued attribute	The profession or expertise o the freelancer
04	Reviews	Number	None	The total numbers of reviews or feedback received from the clients
05	Hourly Rate	Currency	Must be In Dollars	The hourly rate charged by the freelancer

2.2.5. Telecommunication Statistics:

Sr. No	Name	Data Type	Constraint	Description
01	TS ID (Primary Key)	Number	NOT NULL	The ID of each statistic

02	Year	Number	Between 2010 to 2020	The year in which the statistics are measured
03	Cellular Mobile	Number	NONE	Statistics related to cellular mobile services
04	Wireless Local	Number	NONE	Statistics related to wireless local telecommunication services

2.2.6. Telecommunication:

Sr. No	Name	Data Type	Constraint	Description
01	Telecommunication ID (Primary Key)	Number	NOT NULL	Telecommunication ID of the given month and service provider
02	Month	Text	January-December	The month for which statistics are recorded
03	Jazz	Number	NONE	Usage statistics associated with Jazz telecom provider.
04	Zong	Number	NONE	Usage statistics associated with each Ufone provider.
05	Ufone	Number	NONE	Usage statistics associated with Ufone telecom provider.
06	Telenor	Number	NONE	Usage statistics associated with each Telenor provider.
07	Warid	Number	NONE	Usage statistics associated with Warid telecom provider.

2.2.7. Scientists:

Sr. No	Name	Data Type	Constraint	Description
01	Scientist ID (Primary Key)	Number	NOT NULL	Unique Id of each scientist
02	Name	Text	NONE	The name of scientist
03	Discipline	Text	NONE	Scientific discipline or field of expertise
04	Affiliation	Text	NONE	Institution with which scientist is affiliated
05	Qualification	Text	NONE	Academic Qualification or degree of each scientist

2.2.8. Software Project (Associative)

Sr. No	Name	Data Type	Constraint	Description

01	Software Project ID (Primary Key)	Number	NOT NULL	Unique ID
02	Project Type	text	NONE	Type of project assigned by the software company to software house

2.2.9. Freelancer Company Assignment (Associative)

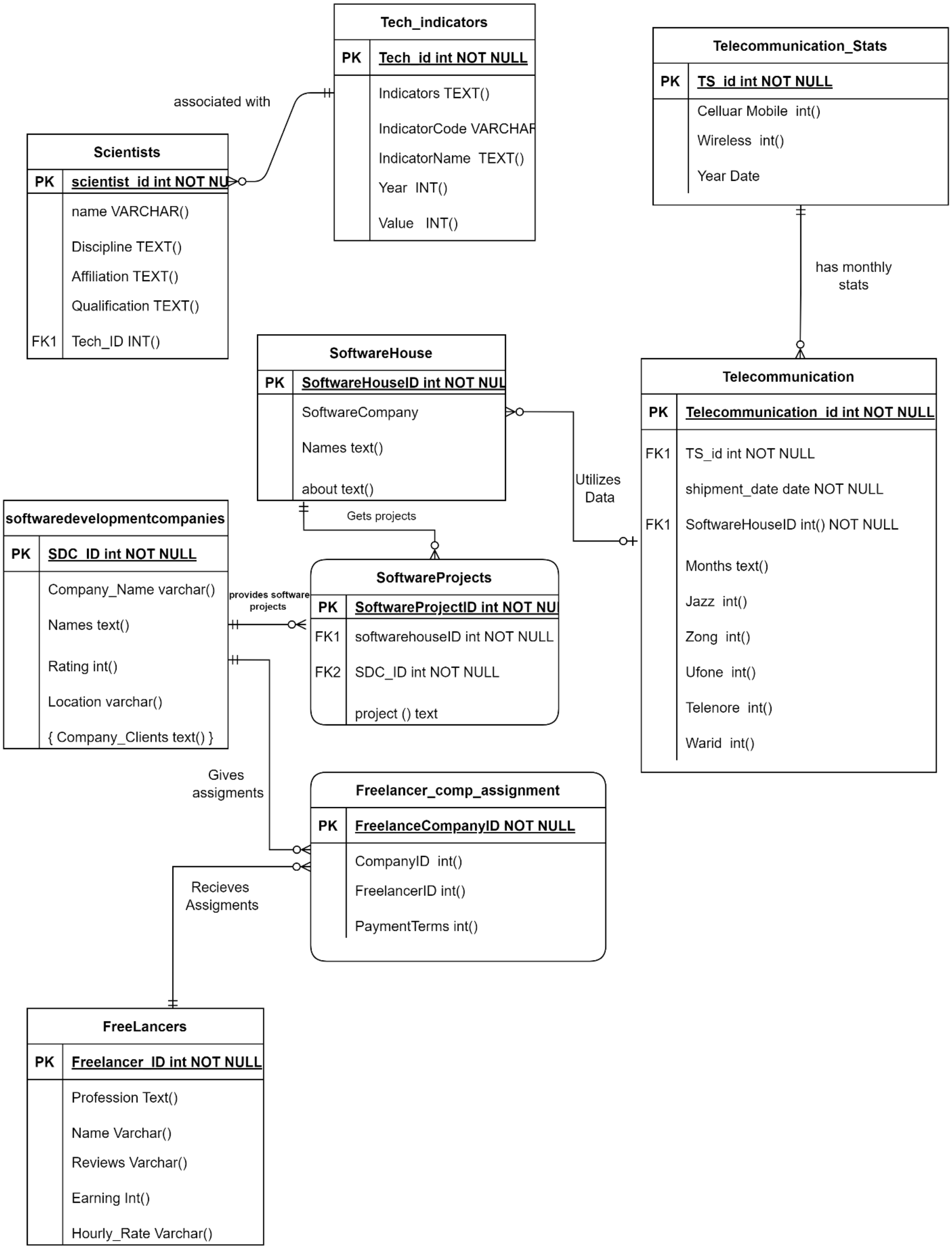
Sr. No	Name	Data Type	Constraint	Description
01	Freelance_Company ID (Primary Key)	Number	NOT NULL	Unique ID
02	Payment Terms	Currency	Must be In Dollars	The total earnings of the freelancer

2.3. RELATIONSHIPS:

Sr. No	Participating Entities	Relation	Business Rule
01	Software Houses, Software Development Companies	Software Development Companies provides projects to Software Houses	One Software Development company provides project to many software houses. One software house can get project from multiple Software Development company.
02	Telecommunication, Telecommunication statistics	Telecommunication relates monthly Telecommunication statistics	One statistic is of one Telecommunication. One telecommunication can have more than one statistics.
03	Tech Indicators, Scientist	Tech Indicators associates Scientist data	Multiple scientists can be associated with the same indicator. Each individual scientist record is linked to only one indicator
04	Freelancer, Software Development Companies	Freelancer interacts with Software Development Companies	One Freelancer (individual) can have multiple assignments by multiple Software Development Companies. Many software development companies give assignments to various freelancers.
05	Software House , Telecommunication	Telecommunication represents Internet usage by the software houses	One software house utilizes communication and internet from many telecommunication companies and have records of many

			months. Many telecommunication record represents one software house..

2.4. ENTITY RELATIONSHIP DIAGRAM:



	Tech_indicators
PK	Tech_id int NOT NULL
	Indicators TEXT()
	IndicatorCode VARCHAF
	IndicatorName TEXT()
	Year INT()
	Value INT()

	Telecommunication_Stats
PK	TS_id int NOT NULL
	Celluar Mobile int()
	Wireless int()
	Year Date

	Scientists
PK	scientist_id int NOT NU
	name VARCHAR()
	Discipline TEXT()
	Affiliation TEXT()
	Qualification TEXT()
FK1	Tech_ID INT()

	SoftwareHouse
PK	SoftwareHouseID int NOT NUL
	SoftwareCompany
	Names text()
	about text()

	Telecommunication
PK	Telecommunication_id int NOT NULL
FK1	TS_id int NOT NULL
	shipment_date date NOT NULL
FK1	SoftwareHouseID int() NOT NULL
	Months text()
	Jazz int()
	Zong int()
	Ufone int()
	Telenore int()
	Warid int()

	softwaredevelopmentcompanies
PK	SDC_ID int NOT NULL
	Company_Name varchar()
	Names text()
	Rating int()
	Location varchar()
	{ Company_Clients text() }

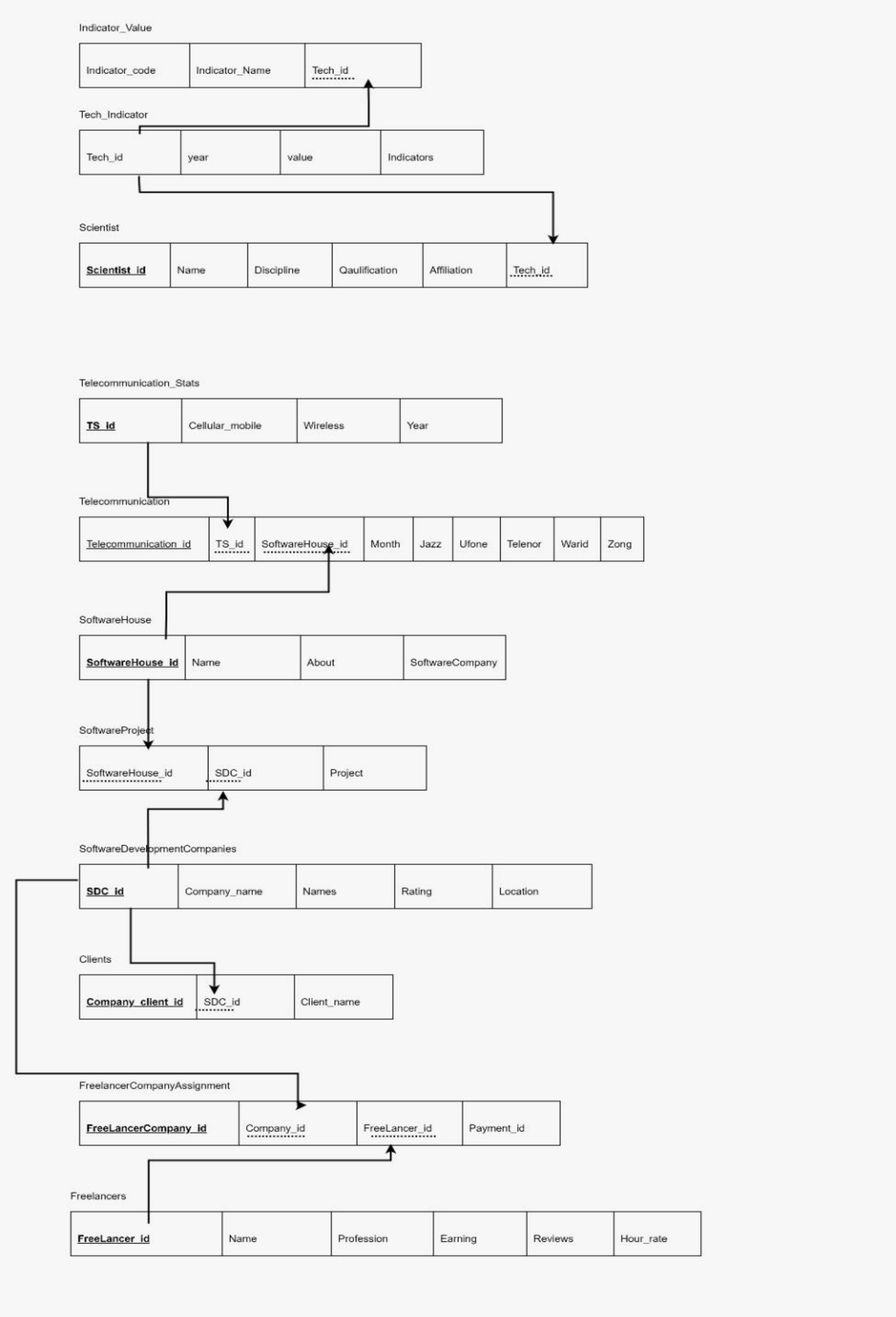
	SoftwareProjects
PK	SoftwareProjectID int NOT NUI
FK1	softwarehouseID int NOT NULL
FK2	SDC_ID int NOT NULL
	project () text

	Freelancer_comp_assignment
PK	FreelanceCompanyID NOT NULL
	CompanyID int()
	FreelancerID int()
	PaymentTerms int()

	FreeLancers
PK	Freelancer_ID int NOT NULL
	Profession Text()
	Name Varchar()
	Reviews Varchar()
	Earning Int()
	Hourly_Rate Varchar()

CHAPTER 3 : LOGICAL DATABASE DESIGN

3.1. RELATIONAL SCHEMA:



Indicator_Value

Indicator_code	Indicator_Name	Tech_id

Tech_Indicator

Tech_id	year	value	Indicators

Scientist

Scientist_id	Name	Discipline	Qaulification	Affiliation	Tech_id

Telecommunication_Stats

TS_Id	Cellular_mobile	Wireless	Year

Telecommunication

Telecommunication_id	TS_id	SoftwareHouse_id	Month	Jazz	Ufone	Telenor	Warid	Zong

SoftwareHouse

SoftwareHouse_Id	Name	About	SoftwareCompany

SoftwareProject

SoftwareHouse_id	SDC_id	Project

SoftwareDevelopmentCompanies

SDC_Id	Company_name	Names	Rating	Location

Clients

Company_client_Id	SDC_id	Client_name

FreelancerCompanyAssignment

FreeLancerCompany_Id	Company_id	FreeLancer_id	Payment_id

Freelancers

FreeLancer_Id	Name	Profession	Earning	Reviews	Hour_rate

3.2. FUNCTIONAL DEPENDENCIES:

The functional dependencies for each table.

1. **Tech_Indicator**:
   - TechID → year, Value, Indicator_Code
2. **Indicator_Value**:
   - Indicator_Code → Indicator_Name
3. **Scientist**:
   - ScientistID → Name, Discipline, Qualification, Affiliation, TechID
   - TechID → Tech_Indicator (Foreign Key Dependency)
4. **Telecommunication_Stats**:
   - TSID → Cellular_Mobile, Wireless, Year
5. **SoftwareHouse**:
   - SoftwareHouse_ID → Name, About, SoftwareCompany
6. **Telecommunication**:
   - Telecommunication_id → TSID, SoftwareHouse_ID, Month, Jazz, Ufone, Telenor, Warid, Zong
   - TSID → Telecommunication_Stats (Foreign Key Dependency)
   - SoftwareHouse_ID → SoftwareHouse (Foreign Key Dependency)
7. **SoftwareDevelopmentCompanies**:
   - SDC_ID → Company_Name, Rating, Location
8. **SoftwareProject**:
   - SoftwareHouse_ID, SDC_ID → Project
   - SoftwareHouse_ID → SoftwareHouse (Foreign Key Dependency)
   - SDC_ID → SoftwareDevelopmentCompanies (Foreign Key Dependency)
9. **Clients**:
   - CompanyClient_ID → SDC_ID, Client_Name
   - SDC_ID → SoftwareDevelopmentCompanies (Foreign Key Dependency)
10. **Freelancers**:
    - Freelancer_ID → Name, Profession, Earning, Reviews, Hour_Rate
11. **FreelancerCompanyAssignment**:
    - FreelancerCompany_ID → Company_ID, Freelancer_ID, Payment
    - Freelancer_ID → Freelancers (Foreign Key Dependency)
    - Company_ID → SoftwareDevelopmentCompanies (Foreign Key Dependency)

3.3. NORMALIZATION:

Let's check each table for these normal forms:

1. **Tech_Indicator**: Already in 3NF.
   - Primary Key: TechID
   - Transitive dependeny of IndicatorValue on IndicatorCode
2. **Scientist**: Already in 3NF.
   - Primary Key: ScientistID
   - No partial or transitive dependencies.

3. **Telecommunication_Stats**: Already in 3NF.
    - Primary Key: TSID
    - No partial or transitive dependencies.
4. **SoftwareHouse**: Already in 3NF.
    - Primary Key: SoftwareHouse_ID
    - No partial or transitive dependencies.
5. **Telecommunication**: Already in 3NF.
    - Primary Key: Telecommunication_id
    - No partial or transitive dependencies.
6. **SoftwareDevelopmentCompanies**: Already in 3NF.
    - Primary Key: SDC_ID
    - Repetition due to Company Clients
7. **SoftwareProject**: Already in 3NF.
    - Primary Key: (SoftwareHouse_ID, SDC_ID)
    - No partial or transitive dependencies.
8. **Freelancers**: Already in 3NF.
    - Primary Key: Freelancer_ID
    - No partial or transitive dependencies.
9. **FreelancerCompanyAssignment**: Already in 3NF.
    - Primary Key: FreelancerCompany_ID
    - No partial or transitive dependencies.

To normalize the tables, we need to ensure they are in 1NF, 2NF, and 3NF.

First Normal Form (1NF):

- Ensure that all attributes have atomic values.

There is repetition in the table SoftwareDevelopmentCompanies due to the Multi-Valued attribute **Company clients.** Hence, to remove the redundancy we will split the table in 2 tables as:

SoftwareDevelopmentCompany

SDCID	CompanyName	Rating	Location

Clients

CompanyClientID	**_ _SDCID_ _**	ClientName

Now all the tables are in First natural Form.

Second Normal Form (2NF):

- Ensure that all non-key attributes are fully functionally dependent on the primary key.
- Removes partial dependencies.
- There is no partial Depedency so Every relation is in Second Normal Form.

Third Normal Form (3NF):

There is Transitive Depedency of Indicator value on Indicator in the Tech_Indicator Tabe. Hence, to remove the transitive dependency we will split in 2 tables as follow:

Tech_Indicaor

TechID	Year	Value	Indicator_Code

Indicator_Value

Indicator_Code	IndicatorName

Now all the tables are in Third natural Form.

NORMALIZED TABLE:

Now we have the normalized forms of each table as follow:

1. **Tech_Indicator**: Already in 3NF.
   - Primary Key: TechID
   - No partial or transitive dependencies.
2. **Indicator_Value**: Already in 3NF.
   - Primary Key: Indicator_Code
   - No partial or transitive dependencies.
3. **Scientist**: Already in 3NF.
   - Primary Key: ScientistID
   - No partial or transitive dependencies.
4. **Telecommunication_Stats**: Already in 3NF.
   - Primary Key: TSID
   - No partial or transitive dependencies.
5. **SoftwareHouse**: Already in 3NF.
   - Primary Key: SoftwareHouse_ID
   - No partial or transitive dependencies.
6. **Telecommunication**: Already in 3NF.
   - Primary Key: Telecommunication_id
   - No partial or transitive dependencies.
7. **SoftwareDevelopmentCompanies**: Already in 3NF.
   - Primary Key: SDC_ID
   - No partial or transitive dependencies.
8. **SoftwareProject**: Already in 3NF.
   - Primary Key: (SoftwareHouse_ID, SDC_ID)
   - No partial or transitive dependencies.
9. **Clients**: Already in 3NF.
   - Primary Key: CompanyClient_ID
   - No partial or transitive dependencies.
10. **Freelancers**: Already in 3NF.
    - Primary Key: Freelancer_ID

    - No partial or transitive dependencies.

11. **FreelancerCompanyAssignment**: Already in 3NF.
    - Primary Key: FreelancerCompany_ID
    - No partial or transitive dependencies.

3NF Relations

After ensuring that all tables are in 3NF, we have the following relations:

1. Tech_Indicator (**TechID**, year, Value, Indicator_Code)
2. Indicator_Value (**Indicator_Code**, Indicator_Name)
3. Scientist (**ScientistID**, Name, Discipline, Qualification, Affiliation, TechID)
4. Telecommunication_Stats (**TSID**, Cellular_Mobile, Wireless, Year)
5. SoftwareHouse (**SoftwareHouse_ID**, Name, About, SoftwareCompany)
6. Telecommunication (**Telecommunication_id**, TSID, SoftwareHouse_ID, Month, Jazz, Ufone, Telenor, Warid, Zong)
7. SoftwareDevelopmentCompanies (**SDC_ID**, Company_Name, Rating, Location)
8. SoftwareProject (**SoftwareHouse_ID**, **SDC_ID**, Project)
9. Clients (**CompanyClient_ID,** SDC_ID**,** Client_Name)
10. Freelancers (**Freelancer_ID**, Name, Profession, Earning, Reviews, Hour_Rate)
11. FreelancerCompanyAssignment (**FreelancerCompany_ID**, Company_ID, Freelancer_ID, Payment)

These tables are now normalized to 3NF, ensuring there are no partial or transitive dependencies, and all functional dependencies are properly addressed.

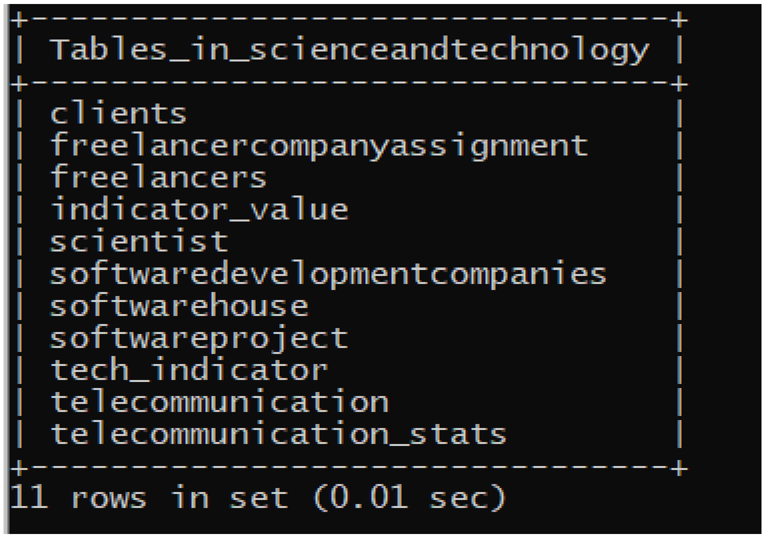
CHAPTER 4 : PHYSICAL DATABASE DESIGN

4.1. STRUCTURE OF THE TABLES:

Querry:

SHOW TABLES;

Output:

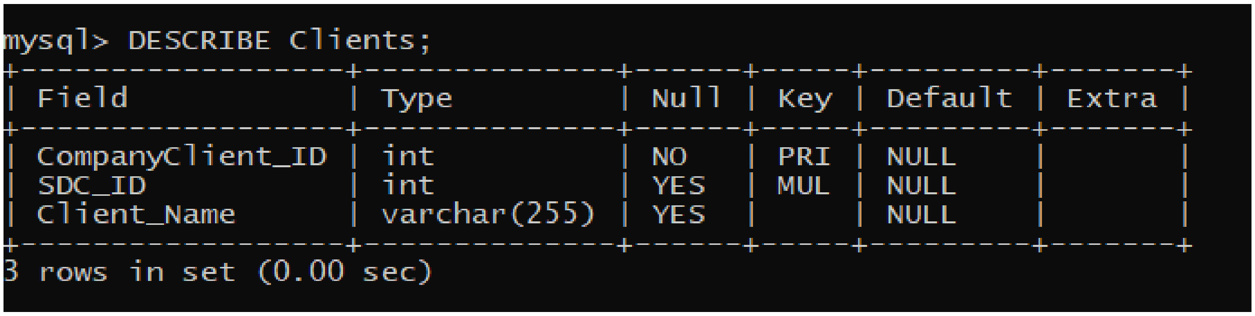


```
+--------------------------------+
| Tables_in_scienceandtechnology |
+--------------------------------+
| clients                        |
| freelancercompanyassignment    |
| freelancers                    |
| indicator_value                |
| scientist                      |
| softwaredevelopmentcompanies   |
| softwarehouse                  |
| softwareproject                |
| tech_indicator                 |
| telecommunication              |
| telecommunication_stats        |
+--------------------------------+
11 rows in set (0.01 sec)
```

Querry:

DESCRIBE Clients;

Output:

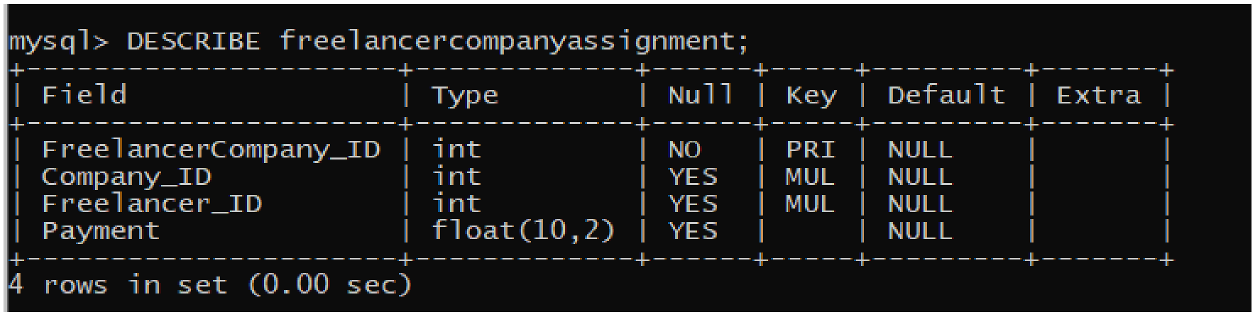


```
mysql> DESCRIBE Clients;
+------------------+--------------+------+-----+---------+-------+
| Field            | Type         | Null | Key | Default | Extra |
+------------------+--------------+------+-----+---------+-------+
| CompanyClient_ID | int          | NO   | PRI | NULL    |       |
| SDC_ID           | int          | YES  | MUL | NULL    |       |
| Client_Name      | varchar(255) | YES  |     | NULL    |       |
+------------------+--------------+------+-----+---------+-------+
3 rows in set (0.00 sec)
```

Querry:

DESCRIBE freelancercompanyassignment;

Output:

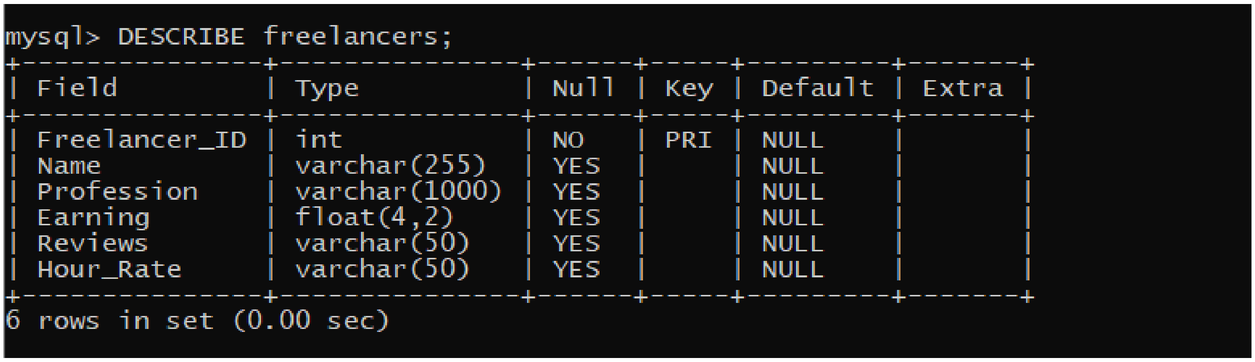


```
mysql> DESCRIBE freelancercompanyassignment;
+----------------------+-------------+------+-----+---------+-------+
| Field                | Type        | Null | Key | Default | Extra |
+----------------------+-------------+------+-----+---------+-------+
| FreelancerCompany_ID | int         | NO   | PRI | NULL    |       |
| Company_ID           | int         | YES  | MUL | NULL    |       |
| Freelancer_ID        | int         | YES  | MUL | NULL    |       |
| Payment              | float(10,2) | YES  |     | NULL    |       |
+----------------------+-------------+------+-----+---------+-------+
4 rows in set (0.00 sec)
```

Querry:

DECRIBE freelancers;

Output:

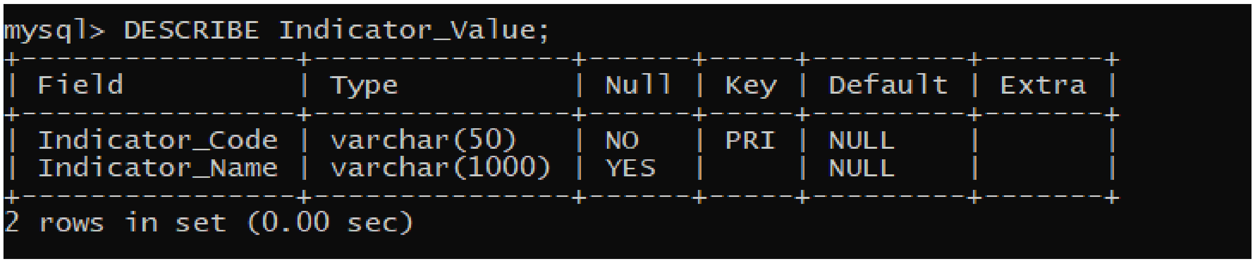


```
mysql> DESCRIBE freelancers;
+---------------+---------------+------+-----+---------+-------+
| Field         | Type          | Null | Key | Default | Extra |
+---------------+---------------+------+-----+---------+-------+
| Freelancer_ID | int           | NO   | PRI | NULL    |       |
| Name          | varchar(255)  | YES  |     | NULL    |       |
| Profession    | varchar(1000) | YES  |     | NULL    |       |
| Earning       | float(4,2)    | YES  |     | NULL    |       |
| Reviews       | varchar(50)   | YES  |     | NULL    |       |
| Hour_Rate     | varchar(50)   | YES  |     | NULL    |       |
+---------------+---------------+------+-----+---------+-------+
6 rows in set (0.00 sec)
```

Querry:

DESCRIBE Indicator_Value;

Output:

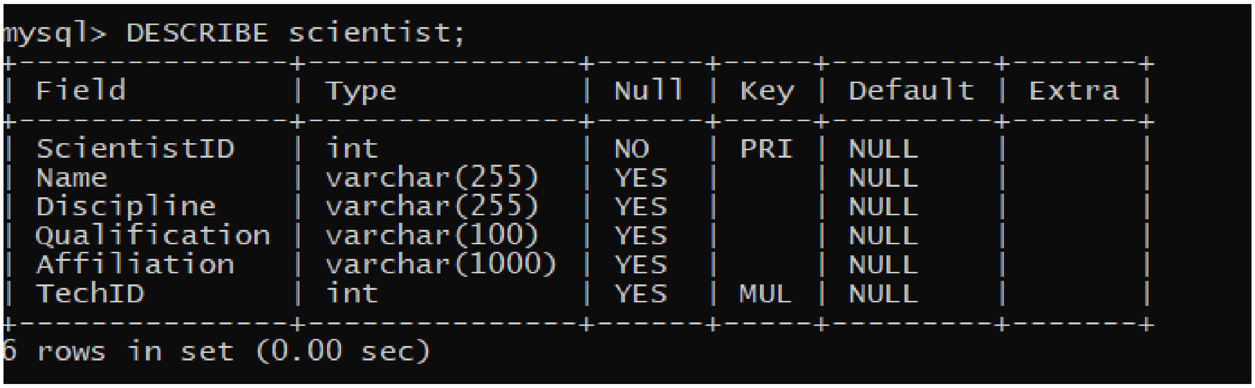


```
mysql> DESCRIBE Indicator_Value;
+----------------+---------------+------+-----+---------+-------+
| Field          | Type          | Null | Key | Default | Extra |
+----------------+---------------+------+-----+---------+-------+
| Indicator_Code | varchar(50)   | NO   | PRI | NULL    |       |
| Indicator_Name | varchar(1000) | YES  |     | NULL    |       |
+----------------+---------------+------+-----+---------+-------+
2 rows in set (0.00 sec)
```

Querry:

DESCRIBE Scientist;

Output:

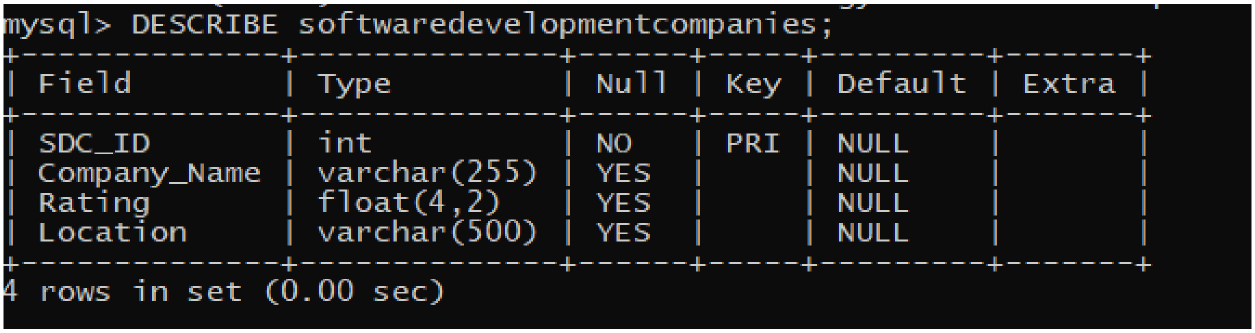


```
mysql> DESCRIBE scientist;
+---------------+---------------+------+-----+---------+-------+
| Field         | Type          | Null | Key | Default | Extra |
+---------------+---------------+------+-----+---------+-------+
| ScientistID   | int           | NO   | PRI | NULL    |       |
| Name          | varchar(255)  | YES  |     | NULL    |       |
| Discipline    | varchar(255)  | YES  |     | NULL    |       |
| Qualification | varchar(100)  | YES  |     | NULL    |       |
| Affiliation   | varchar(1000) | YES  |     | NULL    |       |
| TechID        | int           | YES  | MUL | NULL    |       |
+---------------+---------------+------+-----+---------+-------+
6 rows in set (0.00 sec)
```

Querry:

DESCRIBE SoftwareDevelopmentCompanies;

Output:

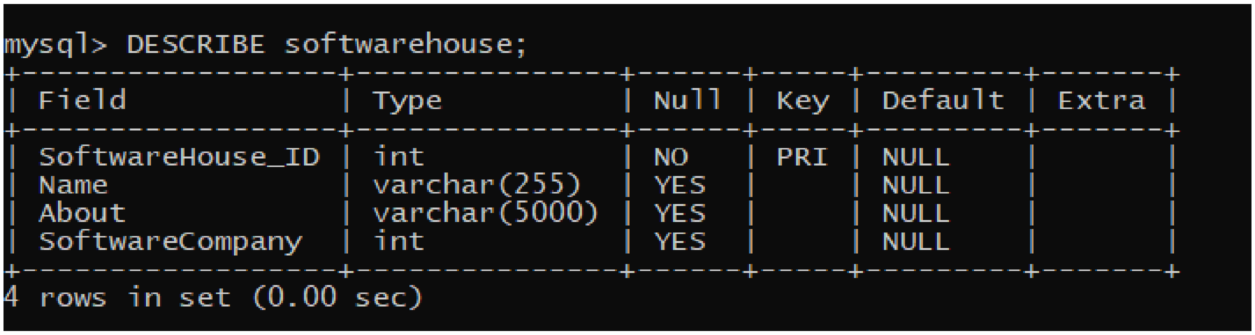


```
mysql> DESCRIBE softwaredevelopmentcompanies;
+--------------+--------------+------+-----+---------+-------+
| Field        | Type         | Null | Key | Default | Extra |
+--------------+--------------+------+-----+---------+-------+
| SDC_ID       | int          | NO   | PRI | NULL    |       |
| Company_Name | varchar(255) | YES  |     | NULL    |       |
| Rating       | float(4,2)   | YES  |     | NULL    |       |
| Location     | varchar(500) | YES  |     | NULL    |       |
+--------------+--------------+------+-----+---------+-------+
4 rows in set (0.00 sec)
```

Querry:

DESCRIBE SoftwareHouse;

Output:

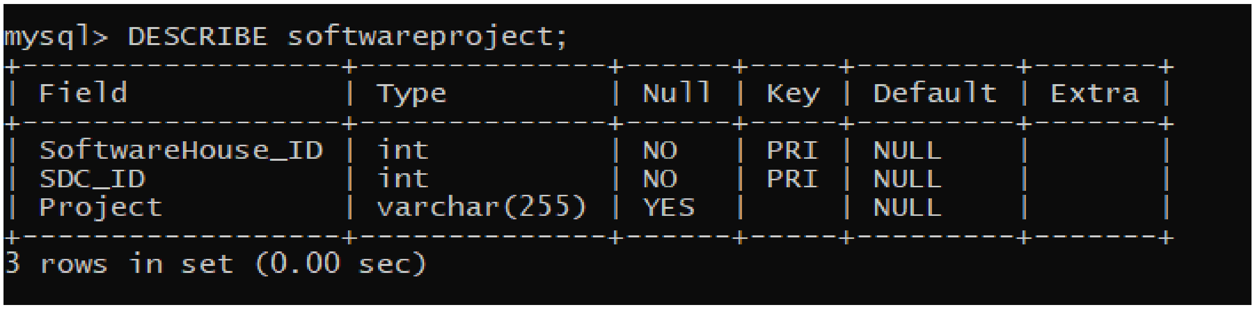


```
mysql> DESCRIBE softwarehouse;
+------------------+---------------+------+-----+---------+-------+
| Field            | Type          | Null | Key | Default | Extra |
+------------------+---------------+------+-----+---------+-------+
| SoftwareHouse_ID | int           | NO   | PRI | NULL    |       |
| Name             | varchar(255)  | YES  |     | NULL    |       |
| About            | varchar(5000) | YES  |     | NULL    |       |
| SoftwareCompany  | int           | YES  |     | NULL    |       |
+------------------+---------------+------+-----+---------+-------+
4 rows in set (0.00 sec)
```

Querry:

DESCRIBE SoftwareProject;

Output:

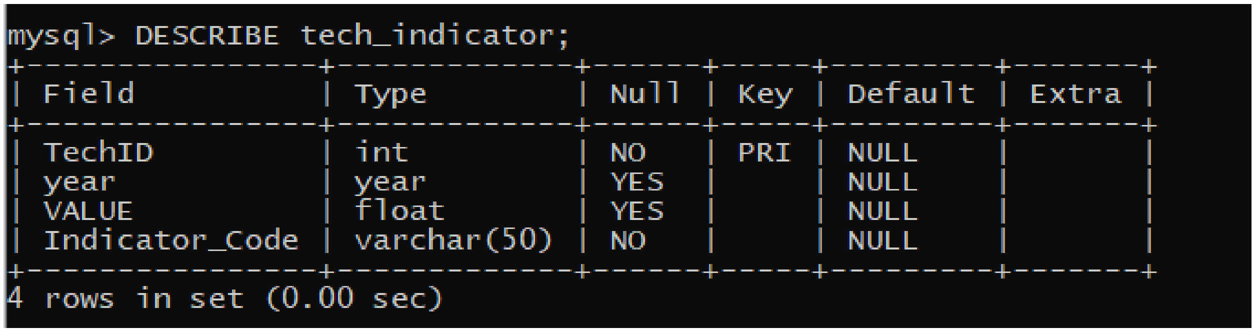


```
mysql> DESCRIBE softwareproject;
+------------------+--------------+------+-----+---------+-------+
| Field            | Type         | Null | Key | Default | Extra |
+------------------+--------------+------+-----+---------+-------+
| SoftwareHouse_ID | int          | NO   | PRI | NULL    |       |
| SDC_ID           | int          | NO   | PRI | NULL    |       |
| Project          | varchar(255) | YES  |     | NULL    |       |
+------------------+--------------+------+-----+---------+-------+
3 rows in set (0.00 sec)
```

Querry:

DESCRIBE tech_indicator;

Output:

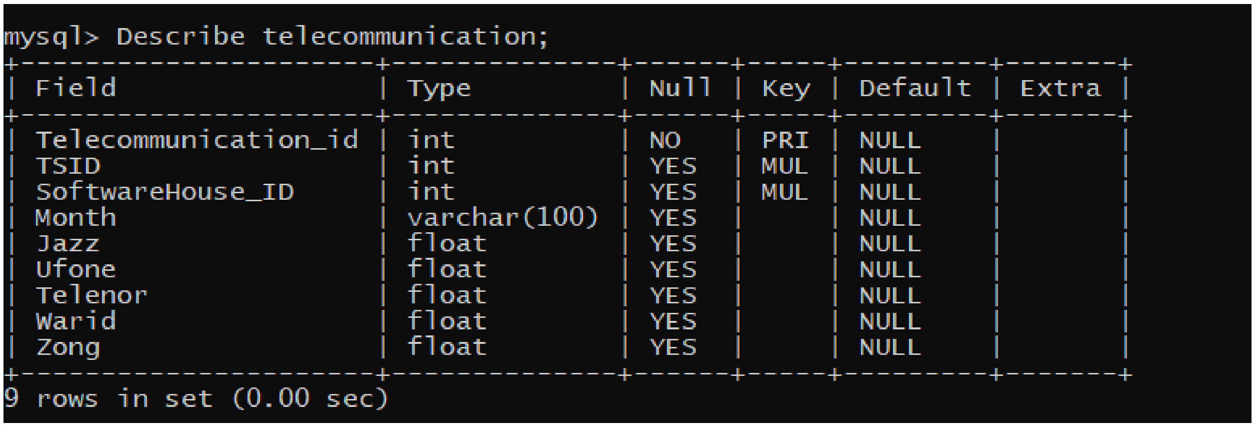


```
mysql> DESCRIBE tech_indicator;
+----------------+-------------+------+-----+---------+-------+
| Field          | Type        | Null | Key | Default | Extra |
+----------------+-------------+------+-----+---------+-------+
| TechID         | int         | NO   | PRI | NULL    |       |
| year           | year        | YES  |     | NULL    |       |
| VALUE          | float       | YES  |     | NULL    |       |
| Indicator_Code | varchar(50) | NO   |     | NULL    |       |
+----------------+-------------+------+-----+---------+-------+
4 rows in set (0.00 sec)
```

Querry:

DESCRIBE Telecommunication;

Output:

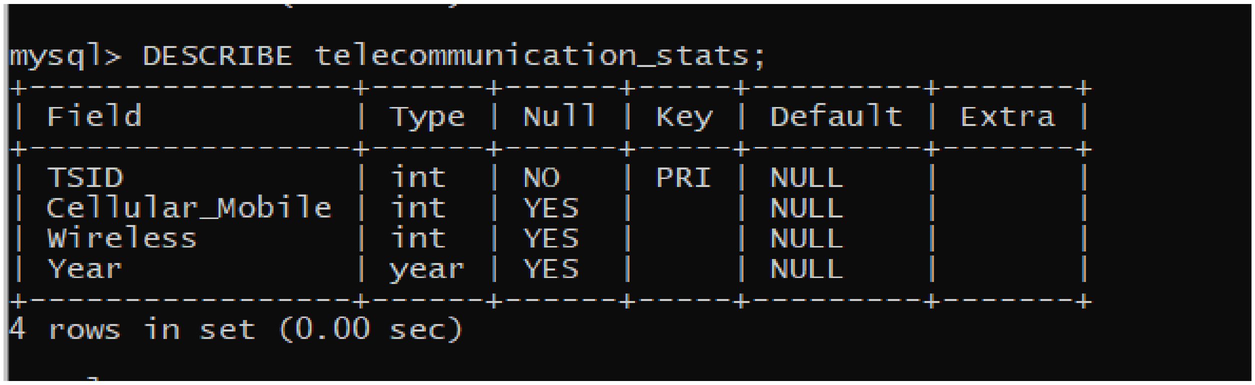


```
mysql> Describe telecommunication;
+----------------------+--------------+------+-----+---------+-------+
| Field                | Type         | Null | Key | Default | Extra |
+----------------------+--------------+------+-----+---------+-------+
| Telecommunication_id | int          | NO   | PRI | NULL    |       |
| TSID                 | int          | YES  | MUL | NULL    |       |
| SoftwareHouse_ID     | int          | YES  | MUL | NULL    |       |
| Month                | varchar(100) | YES  |     | NULL    |       |
| Jazz                 | float        | YES  |     | NULL    |       |
| Ufone                | float        | YES  |     | NULL    |       |
| Telenor              | float        | YES  |     | NULL    |       |
| Warid                | float        | YES  |     | NULL    |       |
| Zong                 | float        | YES  |     | NULL    |       |
+----------------------+--------------+------+-----+---------+-------+
9 rows in set (0.00 sec)
```

Querry:

DESCRIBE Telecommunication_Stats;

Output:



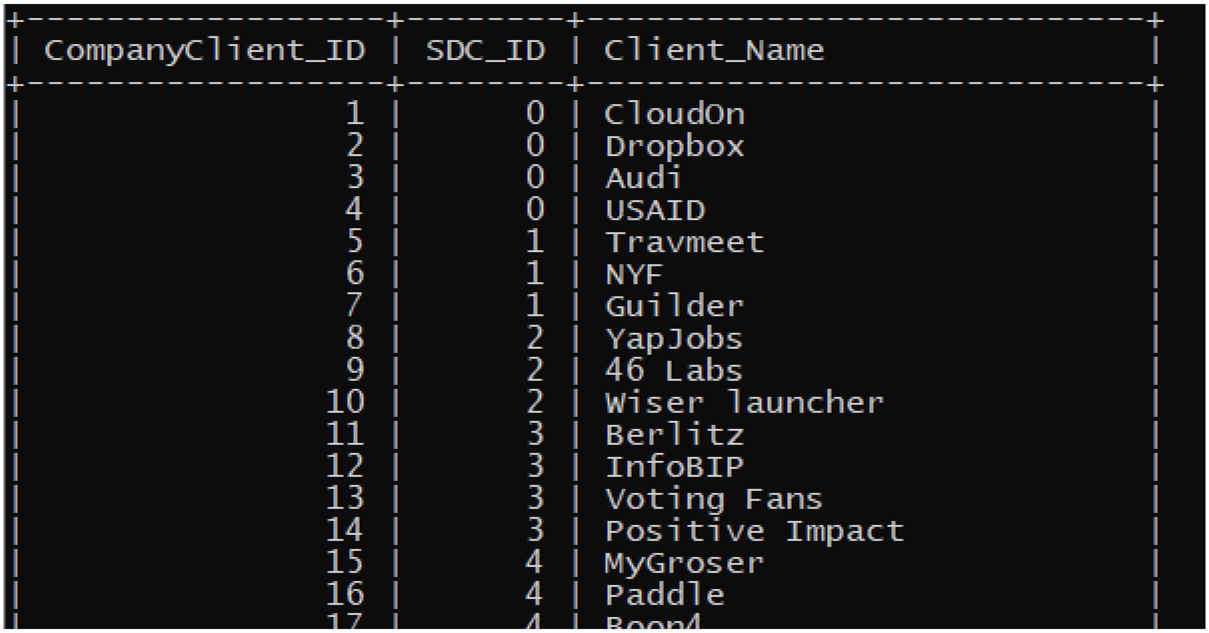
```
mysql> DESCRIBE telecommunication_stats;
+-----------------+------+------+-----+---------+-------+
| Field           | Type | Null | Key | Default | Extra |
+-----------------+------+------+-----+---------+-------+
| TSID            | int  | NO   | PRI | NULL    |       |
| Cellular_Mobile | int  | YES  |     | NULL    |       |
| Wireless        | int  | YES  |     | NULL    |       |
| Year            | year | YES  |     | NULL    |       |
+-----------------+------+------+-----+---------+-------+
4 rows in set (0.00 sec)
```

4.2. DATA SAMPLES INSIDE TABLES:

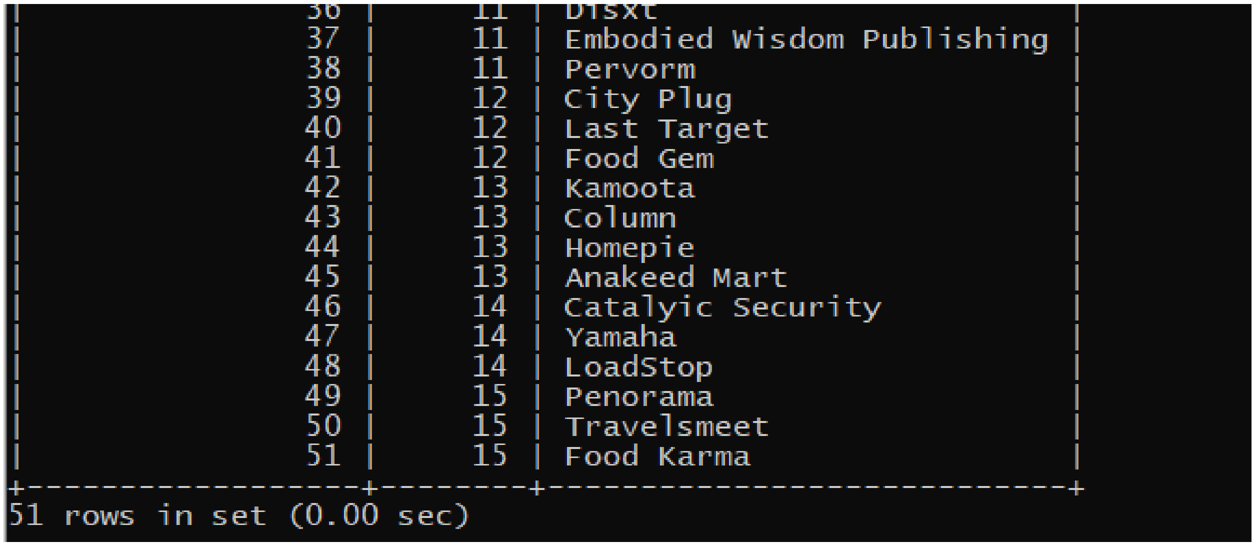
Querry:

SELECT * FROM Clients;

Output:



```
+-----------------+--------+---------------------------+
| CompanyClient_ID | SDC_ID | Client_Name              |
+-----------------+--------+---------------------------+
|               1 |      0 | CloudOn                   |
|               2 |      0 | Dropbox                   |
|               3 |      0 | Audi                      |
|               4 |      0 | USAID                     |
|               5 |      1 | Travmeet                  |
|               6 |      1 | NYF                       |
|               7 |      1 | Guilder                   |
|               8 |      2 | YapJobs                   |
|               9 |      2 | 46 Labs                   |
|              10 |      2 | Wiser launcher            |
|              11 |      3 | Berlitz                   |
|              12 |      3 | InfoBIP                   |
|              13 |      3 | Voting Fans               |
|              14 |      3 | Positive Impact           |
|              15 |      4 | MyGroser                  |
|              16 |      4 | Paddle                    |
|              17 |      4 | Boon4                     |
```

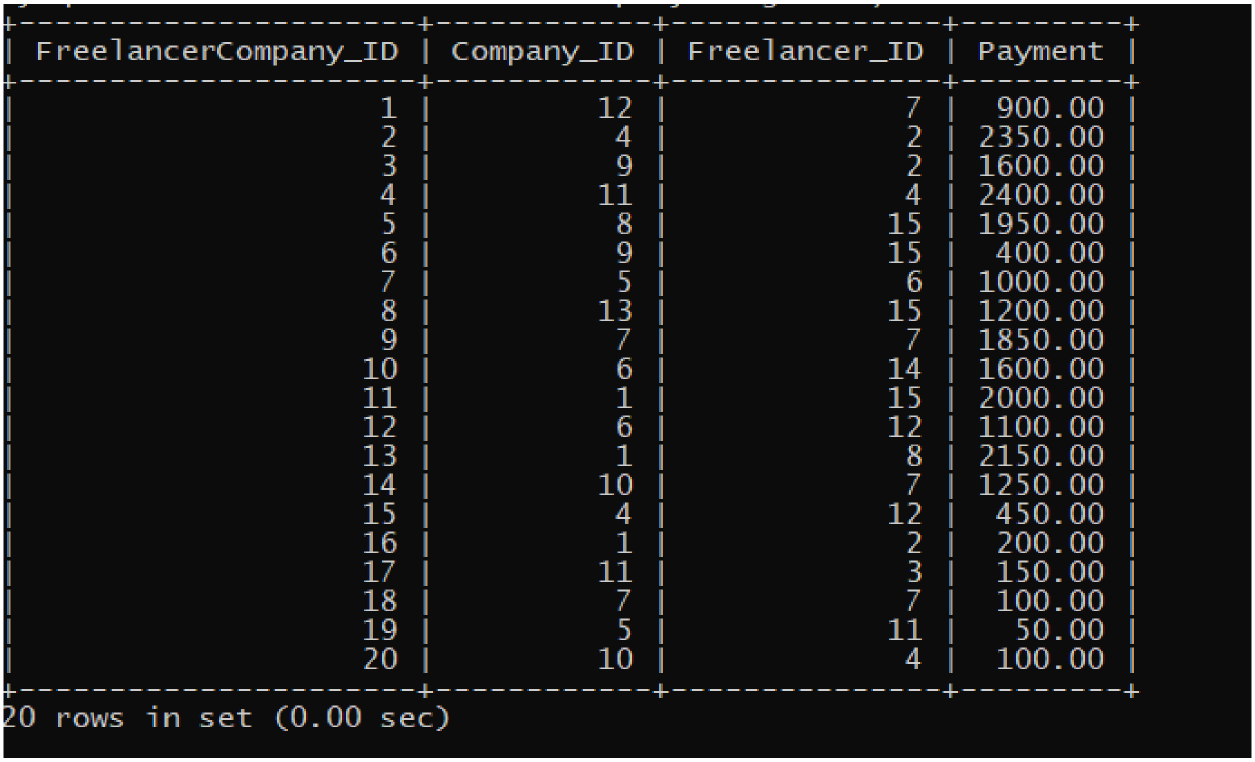


```
|                 36 |       11 | Disxt                       |
|                 37 |       11 | Embodied Wisdom Publishing  |
|                 38 |       11 | Pervorm                     |
|                 39 |       12 | City Plug                   |
|                 40 |       12 | Last Target                 |
|                 41 |       12 | Food Gem                    |
|                 42 |       13 | Kamoota                     |
|                 43 |       13 | Column                      |
|                 44 |       13 | Homepie                     |
|                 45 |       13 | Anakeed Mart                |
|                 46 |       14 | Catalyic Security           |
|                 47 |       14 | Yamaha                      |
|                 48 |       14 | LoadStop                    |
|                 49 |       15 | Penorama                    |
|                 50 |       15 | Travelsmeet                 |
|                 51 |       15 | Food Karma                  |
+--------------------+----------+-----------------------------+
51 rows in set (0.00 sec)
```

Querry:

SELECT * FROM freelancercompanyassignment;

Output:

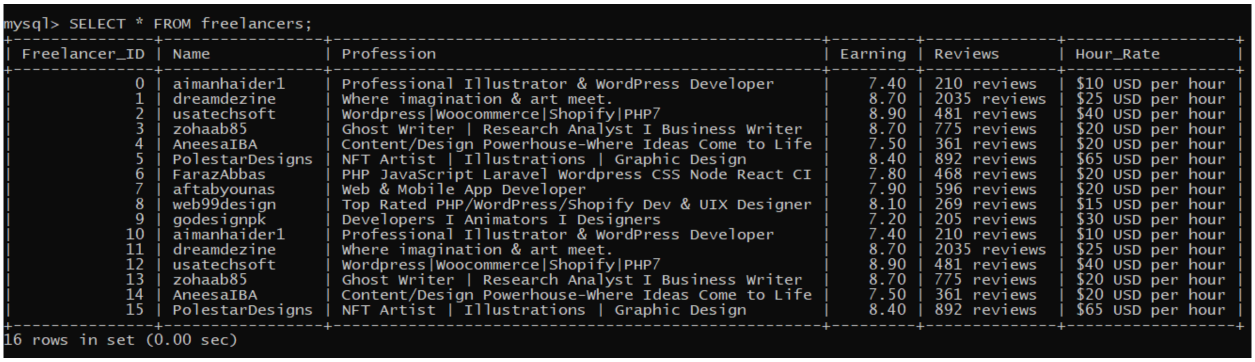


```
+----------------------+------------+---------------+---------+
| FreelancerCompany_ID | Company_ID | Freelancer_ID | Payment |
+----------------------+------------+---------------+---------+
|                    1 |         12 |             7 |  900.00 |
|                    2 |          4 |             2 | 2350.00 |
|                    3 |          9 |             2 | 1600.00 |
|                    4 |         11 |             4 | 2400.00 |
|                    5 |          8 |            15 | 1950.00 |
|                    6 |          9 |            15 |  400.00 |
|                    7 |          5 |             6 | 1000.00 |
|                    8 |         13 |            15 | 1200.00 |
|                    9 |          7 |             7 | 1850.00 |
|                   10 |          6 |            14 | 1600.00 |
|                   11 |          1 |            15 | 2000.00 |
|                   12 |          6 |            12 | 1100.00 |
|                   13 |          1 |             8 | 2150.00 |
|                   14 |         10 |             7 | 1250.00 |
|                   15 |          4 |            12 |  450.00 |
|                   16 |          1 |             2 |  200.00 |
|                   17 |         11 |             3 |  150.00 |
|                   18 |          7 |             7 |  100.00 |
|                   19 |          5 |            11 |   50.00 |
|                   20 |         10 |             4 |  100.00 |
+----------------------+------------+---------------+---------+
20 rows in set (0.00 sec)
```

Querry:

SELECT * FROM freelancers;

Output:

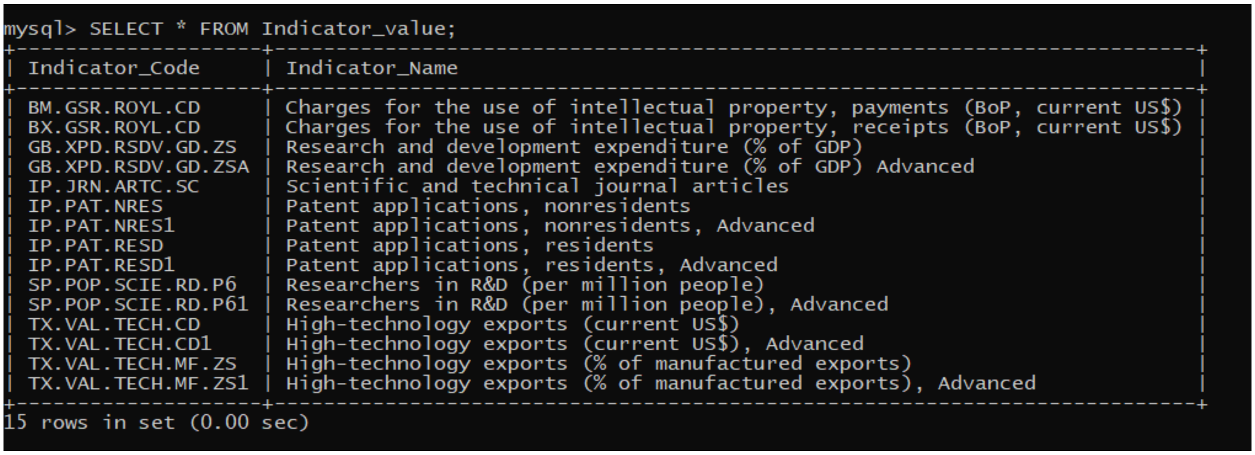


```
mysql> SELECT * FROM freelancers;
+---------------+-----------------+----------------------------------------------------+---------+--------------+------------------+
| Freelancer_ID | Name            | Profession                                         | Earning | Reviews      | Hour_Rate        |
+---------------+-----------------+----------------------------------------------------+---------+--------------+------------------+
|             0 | aimanhaider1    | Professional Illustrator & WordPress Developer     |    7.40 | 210 reviews  | $10 USD per hour |
|             1 | dreamdezine     | Where imagination & art meet.                      |    8.70 | 2035 reviews | $25 USD per hour |
|             2 | usatechsoft     | Wordpress|Woocommerce|Shopify|PHP7                 |    8.90 | 481 reviews  | $40 USD per hour |
|             3 | zohaab85        | Ghost Writer | Research Analyst I Business Writer  |    8.70 | 775 reviews  | $20 USD per hour |
|             4 | AneesaIBA       | Content/Design Powerhouse-Where Ideas Come to Life |    7.50 | 361 reviews  | $20 USD per hour |
|             5 | PolestarDesigns | NFT Artist | Illustrations | Graphic Design        |    8.40 | 892 reviews  | $65 USD per hour |
|             6 | FarazAbbas      | PHP JavaScript Laravel Wordpress CSS Node React CI |    7.80 | 468 reviews  | $20 USD per hour |
|             7 | aftabyounas     | Web & Mobile App Developer                         |    7.90 | 596 reviews  | $20 USD per hour |
|             8 | web99design     | Top Rated PHP/WordPress/Shopify Dev & UIX Designer |    8.10 | 269 reviews  | $15 USD per hour |
|             9 | godesignpk      | Developers I Animators I Designers                 |    7.20 | 205 reviews  | $30 USD per hour |
|            10 | aimanhaider1    | Professional Illustrator & WordPress Developer     |    7.40 | 210 reviews  | $10 USD per hour |
|            11 | dreamdezine     | Where imagination & art meet.                      |    8.70 | 2035 reviews | $25 USD per hour |
|            12 | usatechsoft     | Wordpress|Woocommerce|Shopify|PHP7                 |    8.90 | 481 reviews  | $40 USD per hour |
|            13 | zohaab85        | Ghost Writer | Research Analyst I Business Writer  |    8.70 | 775 reviews  | $20 USD per hour |
|            14 | AneesaIBA       | Content/Design Powerhouse-Where Ideas Come to Life |    7.50 | 361 reviews  | $20 USD per hour |
|            15 | PolestarDesigns | NFT Artist | Illustrations | Graphic Design        |    8.40 | 892 reviews  | $65 USD per hour |
+---------------+-----------------+----------------------------------------------------+---------+--------------+------------------+
16 rows in set (0.00 sec)
```

Querry:

SELECT * FROM Indicator_Value;

Output:

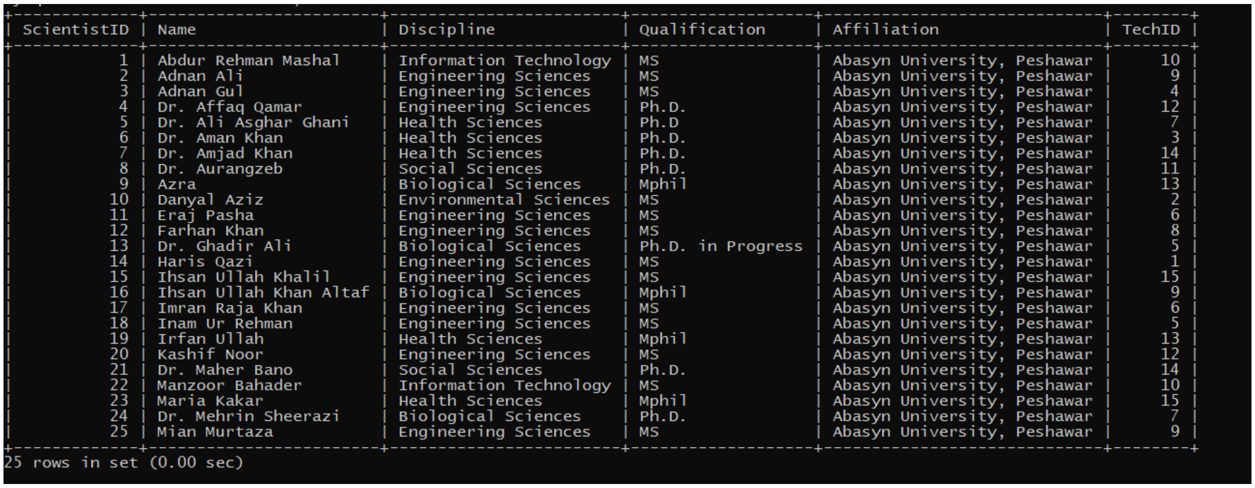


```
mysql> SELECT * FROM Indicator_value;
+--------------------+---------------------------------------------------------------------------+
| Indicator_Code     | Indicator_Name                                                            |
+--------------------+---------------------------------------------------------------------------+
| BM.GSR.ROYL.CD     | Charges for the use of intellectual property, payments (BoP, current US$) |
| BX.GSR.ROYL.CD     | Charges for the use of intellectual property, receipts (BoP, current US$) |
| GB.XPD.RSDV.GD.ZS  | Research and development expenditure (% of GDP)                           |
| GB.XPD.RSDV.GD.ZSA | Research and development expenditure (% of GDP) Advanced                  |
| IP.JRN.ARTC.SC     | Scientific and technical journal articles                                 |
| IP.PAT.NRES        | Patent applications, nonresidents                                         |
| IP.PAT.NRES1       | Patent applications, nonresidents, Advanced                               |
| IP.PAT.RESD        | Patent applications, residents                                            |
| IP.PAT.RESD1       | Patent applications, residents, Advanced                                  |
| SP.POP.SCIE.RD.P6  | Researchers in R&D (per million people)                                   |
| SP.POP.SCIE.RD.P61 | Researchers in R&D (per million people), Advanced                         |
| TX.VAL.TECH.CD     | High-technology exports (current US$)                                     |
| TX.VAL.TECH.CD1    | High-technology exports (current US$), Advanced                           |
| TX.VAL.TECH.MF.ZS  | High-technology exports (% of manufactured exports)                       |
| TX.VAL.TECH.MF.ZS1 | High-technology exports (% of manufactured exports), Advanced             |
+--------------------+---------------------------------------------------------------------------+
15 rows in set (0.00 sec)
```

Querry:

SELECT * FROM Scientist;

Output:

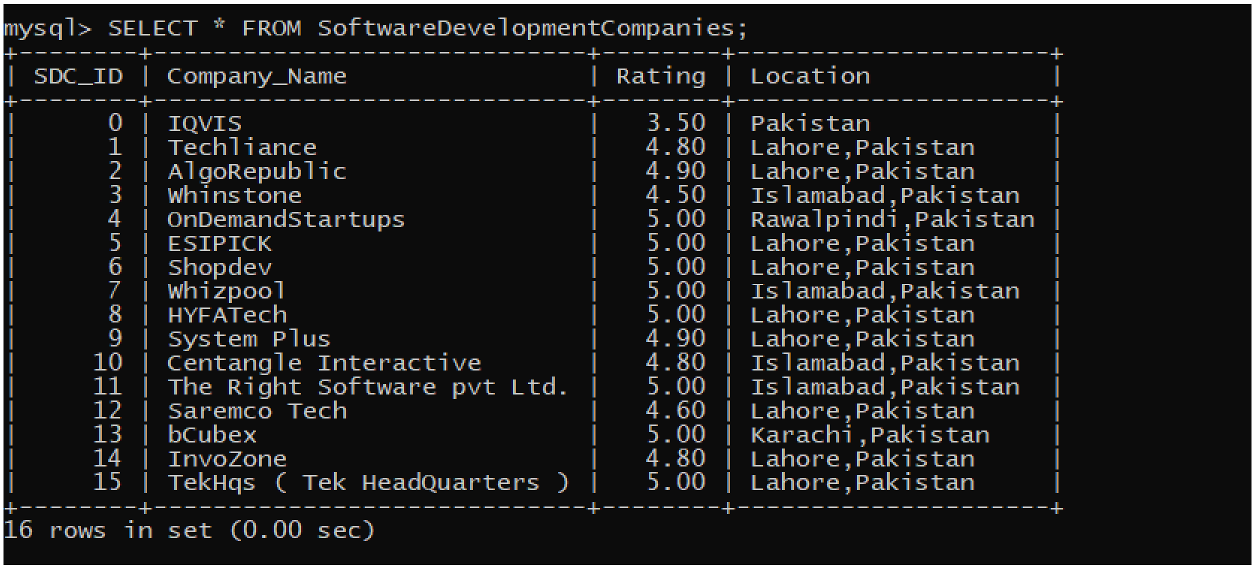


```
+-------------+------------------------+------------------------+-------------------+-----------------------------+--------+
| ScientistID | Name                   | Discipline             | Qualification     | Affiliation                 | TechID |
+-------------+------------------------+------------------------+-------------------+-----------------------------+--------+
|           1 | Abdur Rehman Mashal    | Information Technology | MS                | Abasyn University, Peshawar |     10 |
|           2 | Adnan Ali              | Engineering Sciences   | MS                | Abasyn University, Peshawar |      9 |
|           3 | Adnan Gul              | Engineering Sciences   | MS                | Abasyn University, Peshawar |      4 |
|           4 | Dr. Affaq Qamar        | Engineering Sciences   | Ph.D.             | Abasyn University, Peshawar |     12 |
|           5 | Dr. Ali Asghar Ghani   | Health Sciences        | Ph.D              | Abasyn University, Peshawar |      7 |
|           6 | Dr. Aman Khan          | Health Sciences        | Ph.D.             | Abasyn University, Peshawar |      3 |
|           7 | Dr. Amjad Khan         | Health Sciences        | Ph.D.             | Abasyn University, Peshawar |     14 |
|           8 | Dr. Aurangzeb          | Social Sciences        | Ph.D.             | Abasyn University, Peshawar |     11 |
|           9 | Azra                   | Biological Sciences    | Mphil             | Abasyn University, Peshawar |     13 |
|          10 | Danyal Aziz            | Environmental Sciences | MS                | Abasyn University, Peshawar |      2 |
|          11 | Eraj Pasha             | Engineering Sciences   | MS                | Abasyn University, Peshawar |      6 |
|          12 | Farhan Khan            | Engineering Sciences   | MS                | Abasyn University, Peshawar |      8 |
|          13 | Dr. Ghadir Ali         | Biological Sciences    | Ph.D. in Progress | Abasyn University, Peshawar |      5 |
|          14 | Haris Qazi             | Engineering Sciences   | MS                | Abasyn University, Peshawar |      1 |
|          15 | Ihsan Ullah Khalil     | Engineering Sciences   | MS                | Abasyn University, Peshawar |     15 |
|          16 | Ihsan Ullah Khan Altaf | Biological Sciences    | Mphil             | Abasyn University, Peshawar |      9 |
|          17 | Imran Raja Khan        | Engineering Sciences   | MS                | Abasyn University, Peshawar |      6 |
|          18 | Inam Ur Rehman         | Engineering Sciences   | MS                | Abasyn University, Peshawar |      5 |
|          19 | Irfan Ullah            | Health Sciences        | Mphil             | Abasyn University, Peshawar |     13 |
|          20 | Kashif Noor            | Engineering Sciences   | MS                | Abasyn University, Peshawar |     12 |
|          21 | Dr. Maher Bano         | Social Sciences        | Ph.D.             | Abasyn University, Peshawar |     14 |
|          22 | Manzoor Bahader        | Information Technology | MS                | Abasyn University, Peshawar |     10 |
|          23 | Maria Kakar            | Health Sciences        | Mphil             | Abasyn University, Peshawar |     15 |
|          24 | Dr. Mehrin Sheerazi    | Biological Sciences    | Ph.D.             | Abasyn University, Peshawar |      7 |
|          25 | Mian Murtaza           | Engineering Sciences   | MS                | Abasyn University, Peshawar |      9 |
+-------------+------------------------+------------------------+-------------------+-----------------------------+--------+
25 rows in set (0.00 sec)
```

Querry:

SELECT * FROM SoftwareDevelopmentCompanies;

Output:

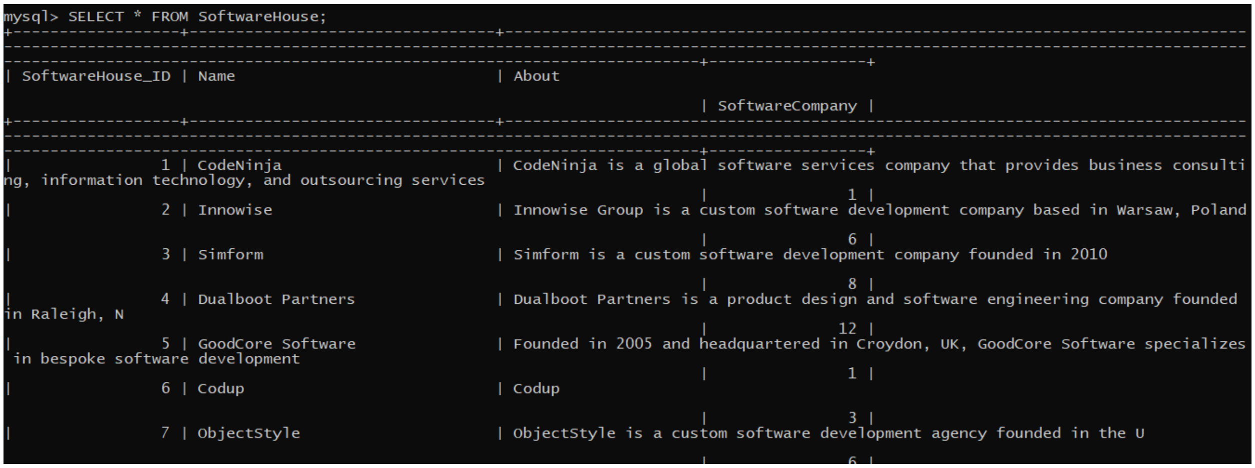


```
mysql> SELECT * FROM SoftwareDevelopmentCompanies;
+--------+-----------------------------+--------+---------------------+
| SDC_ID | Company_Name                | Rating | Location            |
+--------+-----------------------------+--------+---------------------+
|      0 | IQVIS                       |   3.50 | Pakistan            |
|      1 | Techliance                  |   4.80 | Lahore,Pakistan     |
|      2 | AlgoRepublic                |   4.90 | Lahore,Pakistan     |
|      3 | Whinstone                   |   4.50 | Islamabad,Pakistan  |
|      4 | OnDemandStartups            |   5.00 | Rawalpindi,Pakistan |
|      5 | ESIPICK                     |   5.00 | Lahore,Pakistan     |
|      6 | Shopdev                     |   5.00 | Lahore,Pakistan     |
|      7 | Whizpool                    |   5.00 | Islamabad,Pakistan  |
|      8 | HYFATech                    |   5.00 | Lahore,Pakistan     |
|      9 | System Plus                 |   4.90 | Lahore,Pakistan     |
|     10 | Centangle Interactive       |   4.80 | Islamabad,Pakistan  |
|     11 | The Right Software pvt Ltd. |   5.00 | Islamabad,Pakistan  |
|     12 | Saremco Tech                |   4.60 | Lahore,Pakistan     |
|     13 | bCubex                      |   5.00 | Karachi,Pakistan    |
|     14 | InvoZone                    |   4.80 | Lahore,Pakistan     |
|     15 | TekHqs ( Tek HeadQuarters ) |   5.00 | Lahore,Pakistan     |
+--------+-----------------------------+--------+---------------------+
16 rows in set (0.00 sec)
```

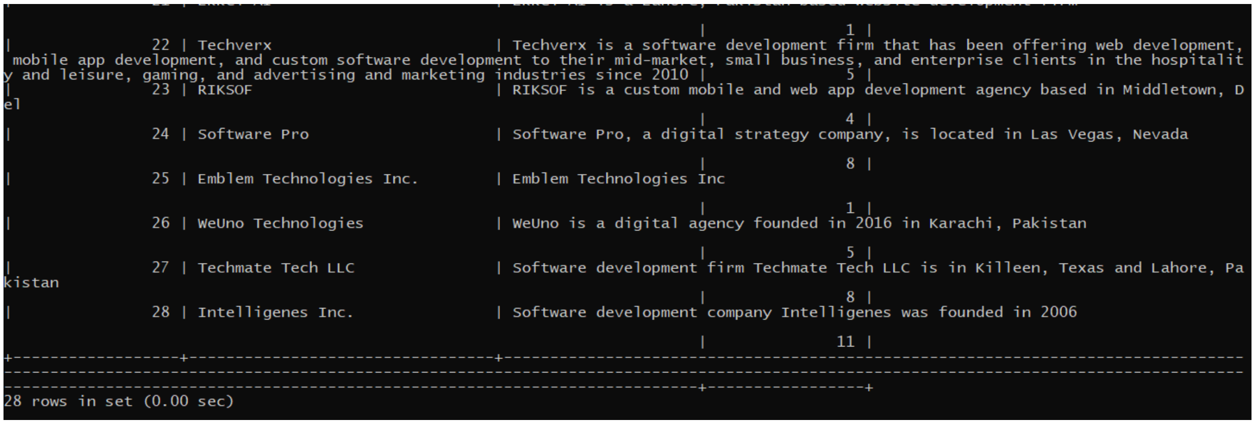
Querry:

SELECT * FROM SoftwareHouse;

Output:



```
mysql> SELECT * FROM SoftwareHouse;
+------------------+--------------------------------+--------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------+-----------------+
| SoftwareHouse_ID | Name                           | About

                                                                                | SoftwareCompany |
+------------------+--------------------------------+--------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------+-----------------+
|                1 | CodeNinja                      | CodeNinja is a global software services company that provides business consulti
ng, information technology, and outsourcing services
                                                                                |               1 |
|                2 | Innowise                       | Innowise Group is a custom software development company based in Warsaw, Poland

                                                                                |               6 |
|                3 | Simform                        | Simform is a custom software development company founded in 2010

                                                                                |               8 |
|                4 | Dualboot Partners              | Dualboot Partners is a product design and software engineering company founded
in Raleigh, N
                                                                                |              12 |
|                5 | GoodCore Software              | Founded in 2005 and headquartered in Croydon, UK, GoodCore Software specializes
 in bespoke software development
                                                                                |               1 |
|                6 | Codup                          | Codup

                                                                                |               3 |
|                7 | ObjectStyle                    | ObjectStyle is a custom software development agency founded in the U

                                                                                |               6 |
```

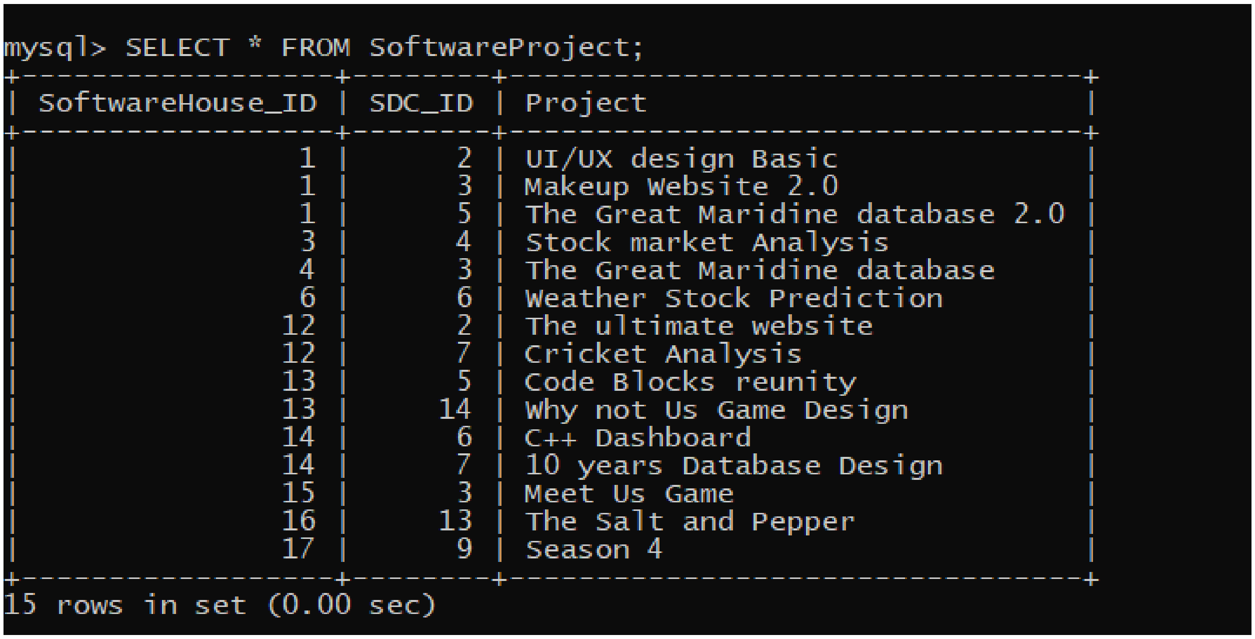


```
|               21 | Ekkel AI                       | Ekkel AI is a Lahore, Pakistan based website development firm

                                                                                |               1 |
|               22 | Techverx                       | Techverx is a software development firm that has been offering web development,
 mobile app development, and custom software development to their mid-market, small business, and enterprise clients in the hospitalit
y and leisure, gaming, and advertising and marketing industries since 2010 |               5 |
|               23 | RIKSOF                         | RIKSOF is a custom mobile and web app development agency based in Middletown, D
el
                                                                                |               4 |
|               24 | Software Pro                   | Software Pro, a digital strategy company, is located in Las Vegas, Nevada

                                                                                |               8 |
|               25 | Emblem Technologies Inc.       | Emblem Technologies Inc

                                                                                |               1 |
|               26 | WeUno Technologies             | WeUno is a digital agency founded in 2016 in Karachi, Pakistan

                                                                                |               5 |
|               27 | Techmate Tech LLC              | Software development firm Techmate Tech LLC is in Killeen, Texas and Lahore, Pa
kistan
                                                                                |               8 |
|               28 | Intelligenes Inc.              | Software development company Intelligenes was founded in 2006

                                                                                |              11 |
+------------------+--------------------------------+--------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------+-----------------+
28 rows in set (0.00 sec)
```

Querry:

SELECT * FROM SoftwareProject;

Output:

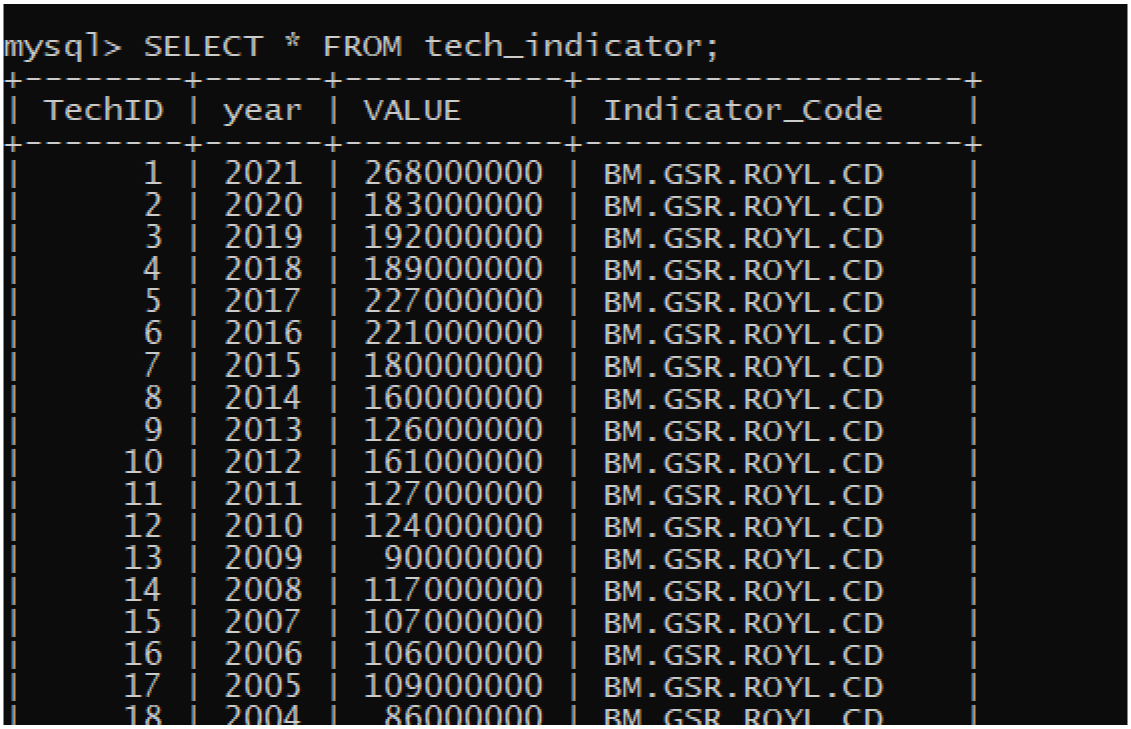


```
mysql> SELECT * FROM SoftwareProject;
+------------------+--------+---------------------------------+
| SoftwareHouse_ID | SDC_ID | Project                         |
+------------------+--------+---------------------------------+
|                1 |      2 | UI/UX design Basic              |
|                1 |      3 | Makeup Website 2.0              |
|                1 |      5 | The Great Maridine database 2.0 |
|                3 |      4 | Stock market Analysis           |
|                4 |      3 | The Great Maridine database     |
|                6 |      6 | Weather Stock Prediction        |
|               12 |      2 | The ultimate website            |
|               12 |      7 | Cricket Analysis                |
|               13 |      5 | Code Blocks reunity             |
|               13 |     14 | Why not Us Game Design          |
|               14 |      6 | C++ Dashboard                   |
|               14 |      7 | 10 years Database Design        |
|               15 |      3 | Meet Us Game                    |
|               16 |     13 | The Salt and Pepper             |
|               17 |      9 | Season 4                        |
+------------------+--------+---------------------------------+
15 rows in set (0.00 sec)
```

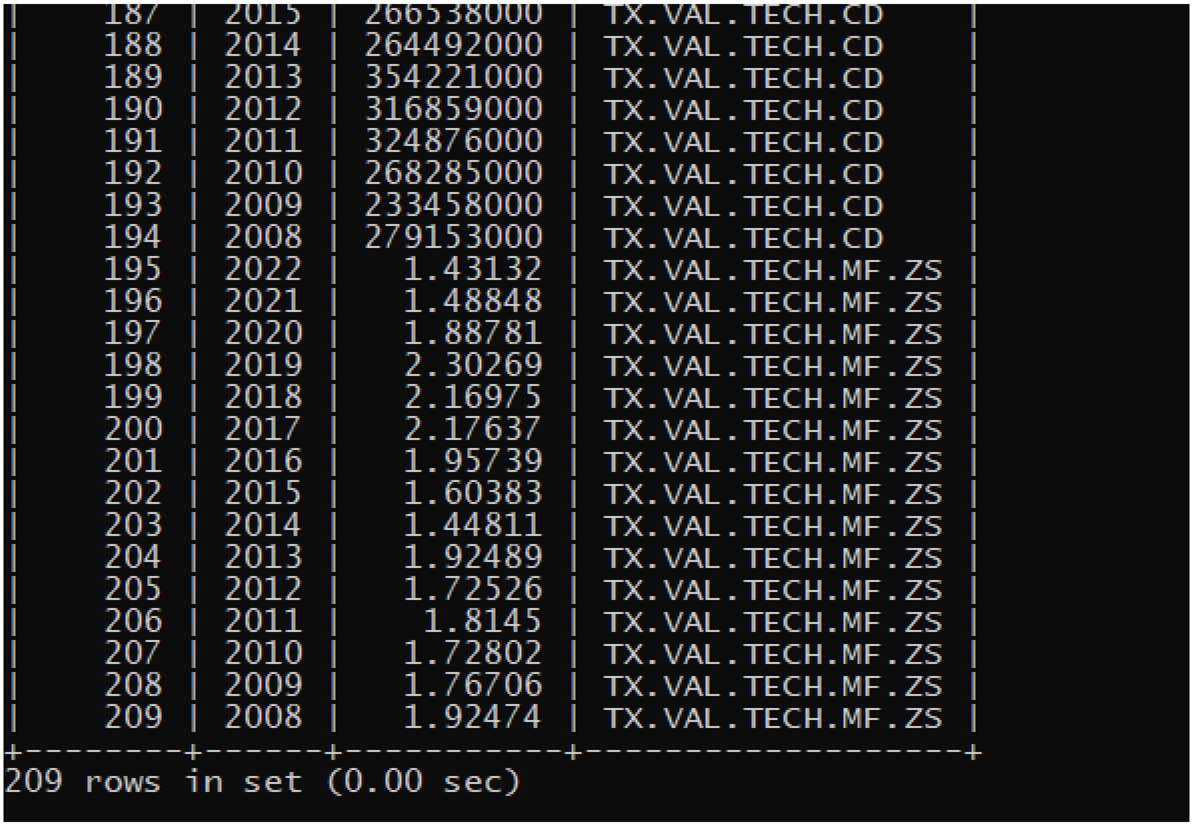
Querry:

SELECT * FROM tech_indicator;

Output:



```
mysql> SELECT * FROM tech_indicator;
+--------+------+-----------+-------------------+
| TechID | year | VALUE     | Indicator_Code    |
+--------+------+-----------+-------------------+
|      1 | 2021 | 268000000 | BM.GSR.ROYL.CD    |
|      2 | 2020 | 183000000 | BM.GSR.ROYL.CD    |
|      3 | 2019 | 192000000 | BM.GSR.ROYL.CD    |
|      4 | 2018 | 189000000 | BM.GSR.ROYL.CD    |
|      5 | 2017 | 227000000 | BM.GSR.ROYL.CD    |
|      6 | 2016 | 221000000 | BM.GSR.ROYL.CD    |
|      7 | 2015 | 180000000 | BM.GSR.ROYL.CD    |
|      8 | 2014 | 160000000 | BM.GSR.ROYL.CD    |
|      9 | 2013 | 126000000 | BM.GSR.ROYL.CD    |
|     10 | 2012 | 161000000 | BM.GSR.ROYL.CD    |
|     11 | 2011 | 127000000 | BM.GSR.ROYL.CD    |
|     12 | 2010 | 124000000 | BM.GSR.ROYL.CD    |
|     13 | 2009 |  90000000 | BM.GSR.ROYL.CD    |
|     14 | 2008 | 117000000 | BM.GSR.ROYL.CD    |
|     15 | 2007 | 107000000 | BM.GSR.ROYL.CD    |
|     16 | 2006 | 106000000 | BM.GSR.ROYL.CD    |
|     17 | 2005 | 109000000 | BM.GSR.ROYL.CD    |
|     18 | 2004 |  86000000 | BM.GSR.ROYL.CD    |
```

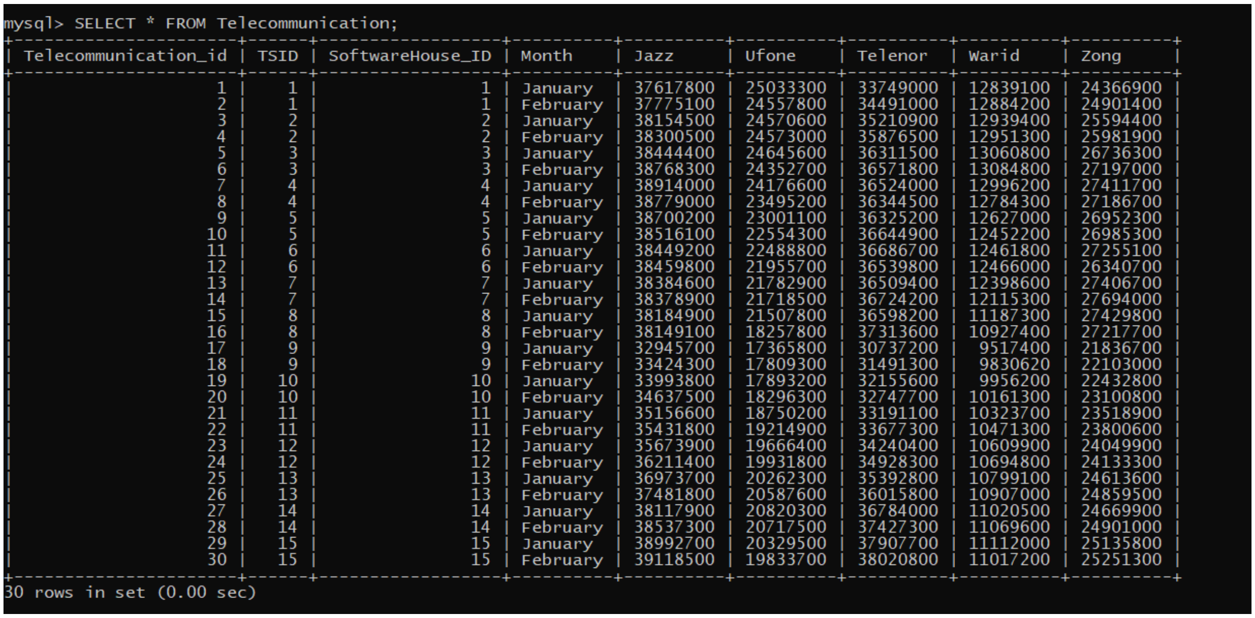


```
|      187 | 2015 | 266538000 | TX.VAL.TECH.CD    |
|      188 | 2014 | 264492000 | TX.VAL.TECH.CD    |
|      189 | 2013 | 354221000 | TX.VAL.TECH.CD    |
|      190 | 2012 | 316859000 | TX.VAL.TECH.CD    |
|      191 | 2011 | 324876000 | TX.VAL.TECH.CD    |
|      192 | 2010 | 268285000 | TX.VAL.TECH.CD    |
|      193 | 2009 | 233458000 | TX.VAL.TECH.CD    |
|      194 | 2008 | 279153000 | TX.VAL.TECH.CD    |
|      195 | 2022 |   1.43132 | TX.VAL.TECH.MF.ZS |
|      196 | 2021 |   1.48848 | TX.VAL.TECH.MF.ZS |
|      197 | 2020 |   1.88781 | TX.VAL.TECH.MF.ZS |
|      198 | 2019 |   2.30269 | TX.VAL.TECH.MF.ZS |
|      199 | 2018 |   2.16975 | TX.VAL.TECH.MF.ZS |
|      200 | 2017 |   2.17637 | TX.VAL.TECH.MF.ZS |
|      201 | 2016 |   1.95739 | TX.VAL.TECH.MF.ZS |
|      202 | 2015 |   1.60383 | TX.VAL.TECH.MF.ZS |
|      203 | 2014 |   1.44811 | TX.VAL.TECH.MF.ZS |
|      204 | 2013 |   1.92489 | TX.VAL.TECH.MF.ZS |
|      205 | 2012 |   1.72526 | TX.VAL.TECH.MF.ZS |
|      206 | 2011 |    1.8145 | TX.VAL.TECH.MF.ZS |
|      207 | 2010 |   1.72802 | TX.VAL.TECH.MF.ZS |
|      208 | 2009 |   1.76706 | TX.VAL.TECH.MF.ZS |
|      209 | 2008 |   1.92474 | TX.VAL.TECH.MF.ZS |
+----------+------+-----------+-------------------+
209 rows in set (0.00 sec)
```

Querry:

SELECT * FROM Telecommunication;

Output:

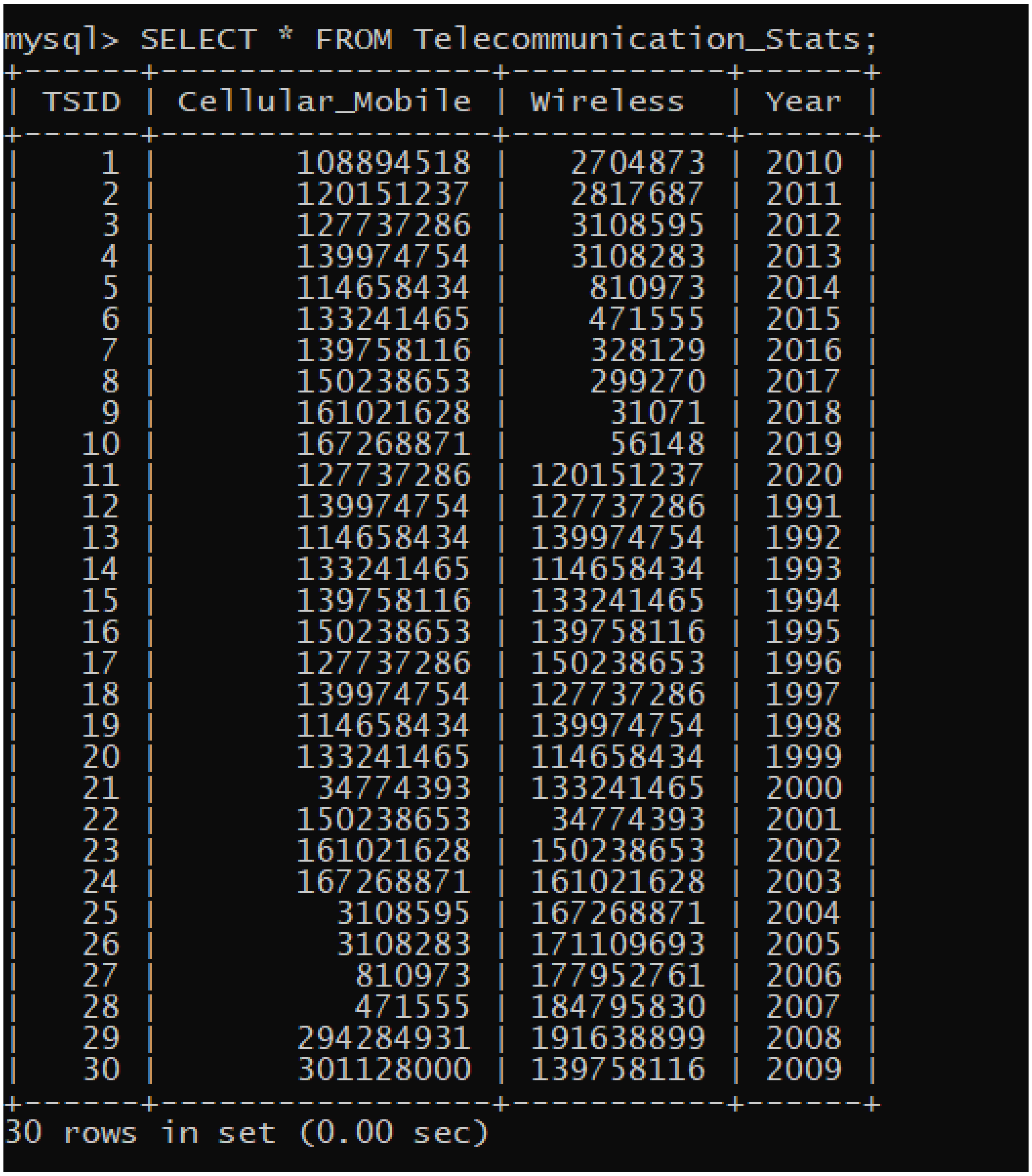


```
mysql> SELECT * FROM Telecommunication;
+----------------------+------+------------------+----------+----------+----------+----------+----------+----------+
| Telecommunication_id | TSID | SoftwareHouse_ID | Month    | Jazz     | Ufone    | Telenor  | Warid    | Zong     |
+----------------------+------+------------------+----------+----------+----------+----------+----------+----------+
|                    1 |    1 |                1 | January  | 37617800 | 25033300 | 33749000 | 12839100 | 24366900 |
|                    2 |    1 |                1 | February | 37775100 | 24557800 | 34491000 | 12884200 | 24901400 |
|                    3 |    2 |                2 | January  | 38154500 | 24570600 | 35210900 | 12939400 | 25594400 |
|                    4 |    2 |                2 | February | 38300500 | 24573000 | 35876500 | 12951300 | 25981900 |
|                    5 |    3 |                3 | January  | 38444400 | 24645600 | 36311500 | 13060800 | 26736300 |
|                    6 |    3 |                3 | February | 38768300 | 24352700 | 36571800 | 13084800 | 27197000 |
|                    7 |    4 |                4 | January  | 38914000 | 24176600 | 36524000 | 12996200 | 27411700 |
|                    8 |    4 |                4 | February | 38779000 | 23495200 | 36344500 | 12784300 | 27186700 |
|                    9 |    5 |                5 | January  | 38700200 | 23001100 | 36325200 | 12627000 | 26952300 |
|                   10 |    5 |                5 | February | 38516100 | 22554300 | 36644900 | 12452200 | 26985300 |
|                   11 |    6 |                6 | January  | 38449200 | 22488800 | 36686700 | 12461800 | 27255100 |
|                   12 |    6 |                6 | February | 38459800 | 21955700 | 36539800 | 12466000 | 26340700 |
|                   13 |    7 |                7 | January  | 38384600 | 21782900 | 36509400 | 12398600 | 27406700 |
|                   14 |    7 |                7 | February | 38378900 | 21718500 | 36724200 | 12115300 | 27694000 |
|                   15 |    8 |                8 | January  | 38184900 | 21507800 | 36598200 | 11187300 | 27429800 |
|                   16 |    8 |                8 | February | 38149100 | 18257800 | 37313600 | 10927400 | 27217700 |
|                   17 |    9 |                9 | January  | 32945700 | 17365800 | 30737200 |  9517400 | 21836700 |
|                   18 |    9 |                9 | February | 33424300 | 17809300 | 31491300 |  9830620 | 22103000 |
|                   19 |   10 |               10 | January  | 33993800 | 17893200 | 32155600 |  9956200 | 22432800 |
|                   20 |   10 |               10 | February | 34637500 | 18296300 | 32747700 | 10161300 | 23100800 |
|                   21 |   11 |               11 | January  | 35156600 | 18750200 | 33191100 | 10323700 | 23518900 |
|                   22 |   11 |               11 | February | 35431800 | 19214900 | 33677300 | 10471300 | 23800600 |
|                   23 |   12 |               12 | January  | 35673900 | 19666400 | 34240400 | 10609900 | 24049900 |
|                   24 |   12 |               12 | February | 36211400 | 19931800 | 34928300 | 10694800 | 24133300 |
|                   25 |   13 |               13 | January  | 36973700 | 20262300 | 35392800 | 10799100 | 24613600 |
|                   26 |   13 |               13 | February | 37481800 | 20587600 | 36015800 | 10907000 | 24859500 |
|                   27 |   14 |               14 | January  | 38117900 | 20820300 | 36784000 | 11020500 | 24669900 |
|                   28 |   14 |               14 | February | 38537300 | 20717500 | 37427300 | 11069600 | 24901000 |
|                   29 |   15 |               15 | January  | 38992700 | 20329500 | 37907700 | 11112000 | 25135800 |
|                   30 |   15 |               15 | February | 39118500 | 19833700 | 38020800 | 11017200 | 25251300 |
+----------------------+------+------------------+----------+----------+----------+----------+----------+----------+
30 rows in set (0.00 sec)
```

Querry:

SELECT * FROM Telecommunication_Stats;

Output:



```
mysql> SELECT * FROM Telecommunication_Stats;
+------+-----------------+-----------+------+
| TSID | Cellular_Mobile | Wireless  | Year |
+------+-----------------+-----------+------+
|    1 |       108894518 |   2704873 | 2010 |
|    2 |       120151237 |   2817687 | 2011 |
|    3 |       127737286 |   3108595 | 2012 |
|    4 |       139974754 |   3108283 | 2013 |
|    5 |       114658434 |    810973 | 2014 |
|    6 |       133241465 |    471555 | 2015 |
|    7 |       139758116 |    328129 | 2016 |
|    8 |       150238653 |    299270 | 2017 |
|    9 |       161021628 |     31071 | 2018 |
|   10 |       167268871 |     56148 | 2019 |
|   11 |       127737286 | 120151237 | 2020 |
|   12 |       139974754 | 127737286 | 1991 |
|   13 |       114658434 | 139974754 | 1992 |
|   14 |       133241465 | 114658434 | 1993 |
|   15 |       139758116 | 133241465 | 1994 |
|   16 |       150238653 | 139758116 | 1995 |
|   17 |       127737286 | 150238653 | 1996 |
|   18 |       139974754 | 127737286 | 1997 |
|   19 |       114658434 | 139974754 | 1998 |
|   20 |       133241465 | 114658434 | 1999 |
|   21 |        34774393 | 133241465 | 2000 |
|   22 |       150238653 |  34774393 | 2001 |
|   23 |       161021628 | 150238653 | 2002 |
|   24 |       167268871 | 161021628 | 2003 |
|   25 |         3108595 | 167268871 | 2004 |
|   26 |         3108283 | 171109693 | 2005 |
|   27 |          810973 | 177952761 | 2006 |
|   28 |          471555 | 184795830 | 2007 |
|   29 |       294284931 | 191638899 | 2008 |
|   30 |       301128000 | 139758116 | 2009 |
+------+-----------------+-----------+------+
30 rows in set (0.00 sec)
```

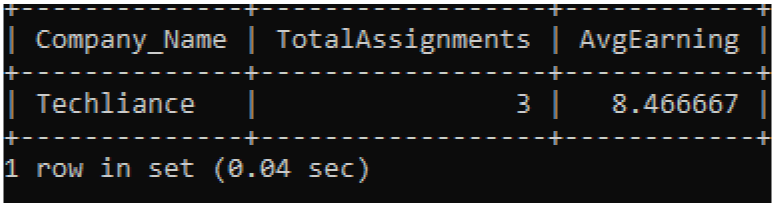
4.3. QUERIES RESULTS:

Querry:

SELECT sdc.Company_Name, COUNT(fca.FreelancerCompany_ID) AS TotalAssignments, AVG(f.Earning) AS AvgEarning FROM SoftwareDevelopmentCompanies sdc JOIN FreelancerCompanyAssignment fca ON sdc.SDC_ID = fca.Company_ID JOIN Freelancers f ON fca.Freelancer_ID = f.Freelancer_ID GROUP BY sdc.Company_Name HAVING COUNT(fca.FreelancerCompany_ID) > 2 AND AVG(f.Earning) > (SELECT AVG(Earning) FROM

Freelancers) ORDER BY TotalAssignments DESC;

Output:

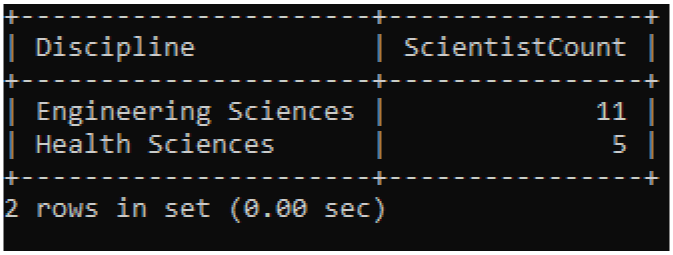


```
+--------------+------------------+------------+
| Company_Name | TotalAssignments | AvgEarning |
+--------------+------------------+------------+
| Techliance   |                3 |   8.466667 |
+--------------+------------------+------------+
1 row in set (0.04 sec)
```

Querry:

SELECT s.Discipline, COUNT(s.ScientistID) AS ScientistCount FROM Scientist s GROUP BY s.Discipline HAVING COUNT(s.ScientistID) > 4;

Output:

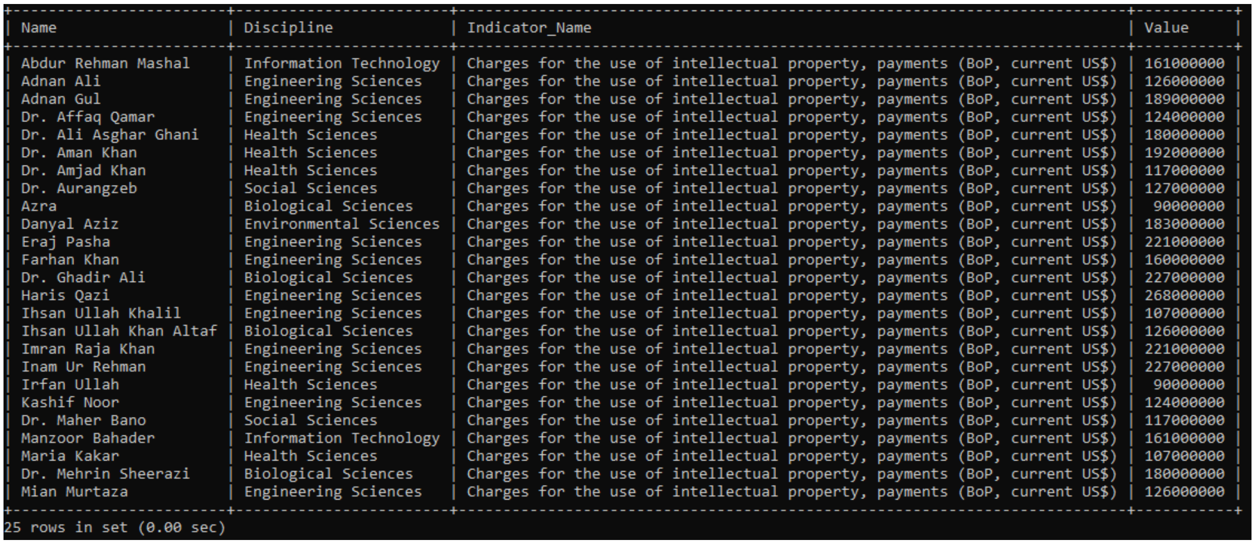


```
+----------------------+----------------+
| Discipline           | ScientistCount |
+----------------------+----------------+
| Engineering Sciences |             11 |
| Health Sciences      |              5 |
+----------------------+----------------+
2 rows in set (0.00 sec)
```

Querry:

SELECT s.Name, s.Discipline, i.Indicator_Name, t.Value FROM Scientist s JOIN Tech_Indicator t ON s.TechID = t.TechID JOIN Indicator_Value i ON t.Indicator_Code = i.Indicator_Code;

Output:

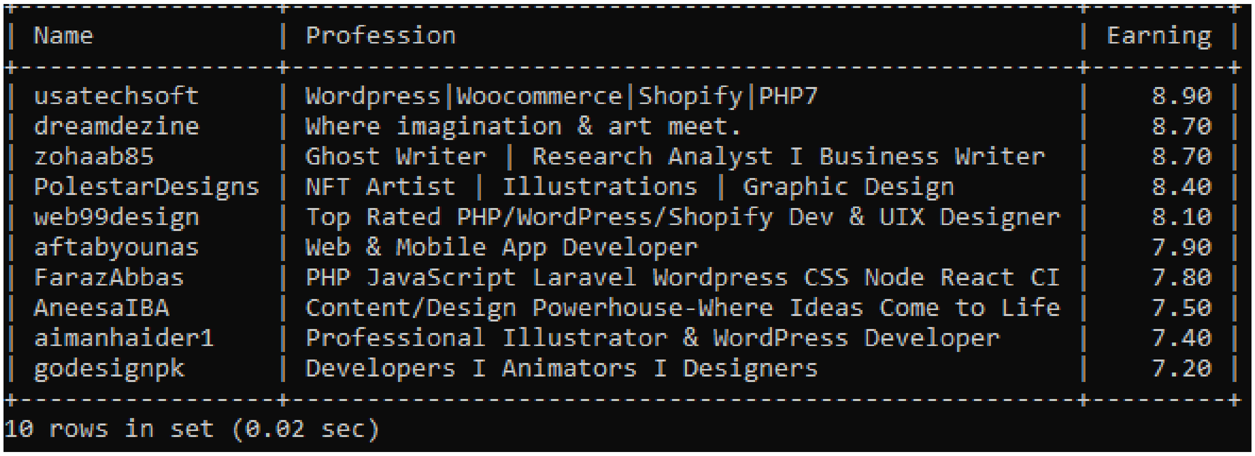


```
+------------------------+------------------------+---------------------------------------------------------------------------+-----------+
| Name                   | Discipline             | Indicator_Name                                                            | Value     |
+------------------------+------------------------+---------------------------------------------------------------------------+-----------+
| Abdur Rehman Mashal    | Information Technology | Charges for the use of intellectual property, payments (BoP, current US$) | 161000000 |
| Adnan Ali              | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 126000000 |
| Adnan Gul              | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 189000000 |
| Dr. Affaq Qamar        | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 124000000 |
| Dr. Ali Asghar Ghani   | Health Sciences        | Charges for the use of intellectual property, payments (BoP, current US$) | 180000000 |
| Dr. Aman Khan          | Health Sciences        | Charges for the use of intellectual property, payments (BoP, current US$) | 192000000 |
| Dr. Amjad Khan         | Health Sciences        | Charges for the use of intellectual property, payments (BoP, current US$) | 117000000 |
| Dr. Aurangzeb          | Social Sciences        | Charges for the use of intellectual property, payments (BoP, current US$) | 127000000 |
| Azra                   | Biological Sciences    | Charges for the use of intellectual property, payments (BoP, current US$) |  90000000 |
| Danyal Aziz            | Environmental Sciences | Charges for the use of intellectual property, payments (BoP, current US$) | 183000000 |
| Eraj Pasha             | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 221000000 |
| Farhan Khan            | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 160000000 |
| Dr. Ghadir Ali         | Biological Sciences    | Charges for the use of intellectual property, payments (BoP, current US$) | 227000000 |
| Haris Qazi             | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 268000000 |
| Ihsan Ullah Khalil     | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 107000000 |
| Ihsan Ullah Khan Altaf | Biological Sciences    | Charges for the use of intellectual property, payments (BoP, current US$) | 126000000 |
| Imran Raja Khan        | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 221000000 |
| Inam Ur Rehman         | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 227000000 |
| Irfan Ullah            | Health Sciences        | Charges for the use of intellectual property, payments (BoP, current US$) |  90000000 |
| Kashif Noor            | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 124000000 |
| Dr. Maher Bano         | Social Sciences        | Charges for the use of intellectual property, payments (BoP, current US$) | 117000000 |
| Manzoor Bahader        | Information Technology | Charges for the use of intellectual property, payments (BoP, current US$) | 161000000 |
| Maria Kakar            | Health Sciences        | Charges for the use of intellectual property, payments (BoP, current US$) | 107000000 |
| Dr. Mehrin Sheerazi    | Biological Sciences    | Charges for the use of intellectual property, payments (BoP, current US$) | 180000000 |
| Mian Murtaza           | Engineering Sciences   | Charges for the use of intellectual property, payments (BoP, current US$) | 126000000 |
+------------------------+------------------------+---------------------------------------------------------------------------+-----------+
25 rows in set (0.00 sec)
```

Querry:

SELECT Name, Profession, MAX(Earning) AS Earning FROM Freelancers GROUP BY Name, Profession ORDER BY Earning DESC;

Output:

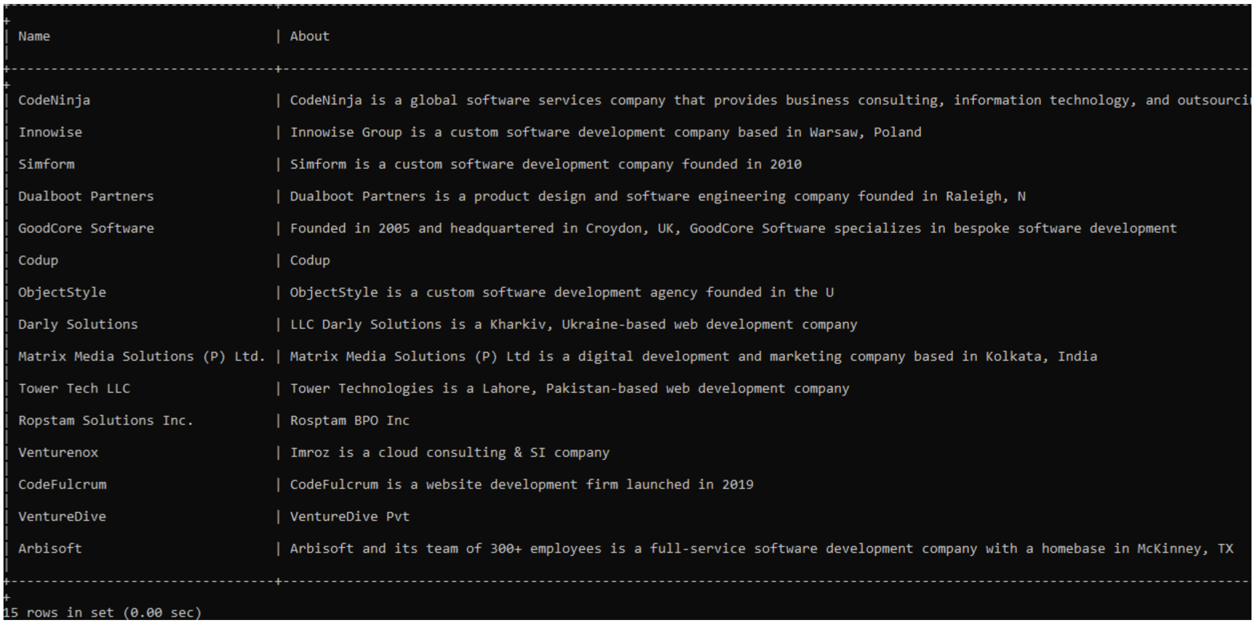


```
+-----------------+----------------------------------------------------+---------+
| Name            | Profession                                         | Earning |
+-----------------+----------------------------------------------------+---------+
| usatechsoft     | Wordpress|Woocommerce|Shopify|PHP7                 |    8.90 |
| dreamdezine     | Where imagination & art meet.                      |    8.70 |
| zohaab85        | Ghost Writer | Research Analyst I Business Writer  |    8.70 |
| PolestarDesigns | NFT Artist | Illustrations | Graphic Design        |    8.40 |
| web99design     | Top Rated PHP/WordPress/Shopify Dev & UIX Designer |    8.10 |
| aftabyounas     | Web & Mobile App Developer                         |    7.90 |
| FarazAbbas      | PHP JavaScript Laravel Wordpress CSS Node React CI |    7.80 |
| AneesaIBA       | Content/Design Powerhouse-Where Ideas Come to Life |    7.50 |
| aimanhaider1    | Professional Illustrator & WordPress Developer     |    7.40 |
| godesignpk      | Developers I Animators I Designers                 |    7.20 |
+-----------------+----------------------------------------------------+---------+
10 rows in set (0.02 sec)
```

Querry:

SELECT Name, About FROM SoftwareHouse WHERE SoftwareHouse_ID IN (SELECT SoftwareHouse_ID FROM Telecommunication WHERE Jazz > 50);

Output:

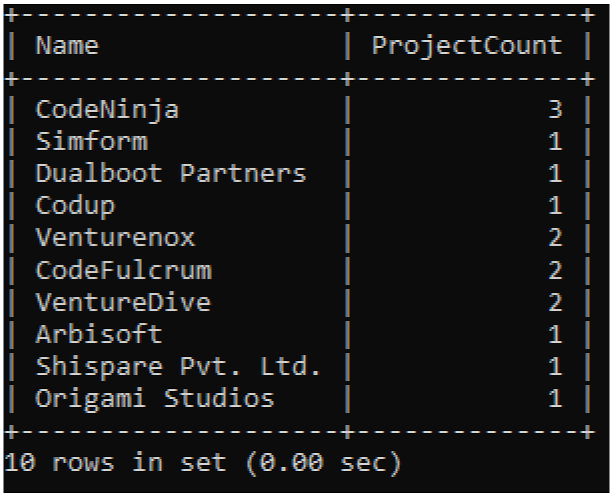


```
+--------------------------------+------------------------------------------------------------------------------------------------------------
+
| Name                           | About
|
+--------------------------------+------------------------------------------------------------------------------------------------------------
+
| CodeNinja                      | CodeNinja is a global software services company that provides business consulting, information technology, and outsourci
|
| Innowise                       | Innowise Group is a custom software development company based in Warsaw, Poland
|
| Simform                        | Simform is a custom software development company founded in 2010
|
| Dualboot Partners              | Dualboot Partners is a product design and software engineering company founded in Raleigh, N
|
| GoodCore Software              | Founded in 2005 and headquartered in Croydon, UK, GoodCore Software specializes in bespoke software development
|
| Codup                          | Codup
|
| ObjectStyle                    | ObjectStyle is a custom software development agency founded in the U
|
| Darly Solutions                | LLC Darly Solutions is a Kharkiv, Ukraine-based web development company
|
| Matrix Media Solutions (P) Ltd. | Matrix Media Solutions (P) Ltd is a digital development and marketing company based in Kolkata, India
|
| Tower Tech LLC                 | Tower Technologies is a Lahore, Pakistan-based web development company
|
| Ropstam Solutions Inc.         | Rosptam BPO Inc
|
| Venturenox                     | Imroz is a cloud consulting & SI company
|
| CodeFulcrum                    | CodeFulcrum is a website development firm launched in 2019
|
| VentureDive                    | VentureDive Pvt
|
| Arbisoft                       | Arbisoft and its team of 300+ employees is a full-service software development company with a homebase in McKinney, TX
|
+--------------------------------+------------------------------------------------------------------------------------------------------------
+
15 rows in set (0.00 sec)
```

Querry:

SELECT sh.Name, COUNT(sp.Project) AS ProjectCount FROM SoftwareHouse sh JOIN SoftwareProject sp ON sh.SoftwareHouse_ID = sp.SoftwareHouse_ID GROUP BY sh.Name;

Output:

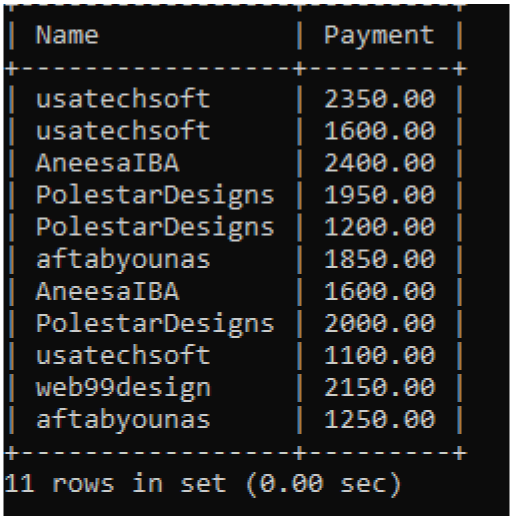


```
+---------------------+--------------+
| Name                | ProjectCount |
+---------------------+--------------+
| CodeNinja           |            3 |
| Simform             |            1 |
| Dualboot Partners   |            1 |
| Codup               |            1 |
| Venturenox          |            2 |
| CodeFulcrum         |            2 |
| VentureDive         |            2 |
| Arbisoft            |            1 |
| Shispare Pvt. Ltd.  |            1 |
| Origami Studios     |            1 |
+---------------------+--------------+
10 rows in set (0.00 sec)
```

Querry:

SELECT f.Name, fc.Payment FROM Freelancers f JOIN FreelancerCompanyAssignment fc ON f.Freelancer_ID = fc.Freelancer_ID WHERE fc.Payment > 1000;

Output:

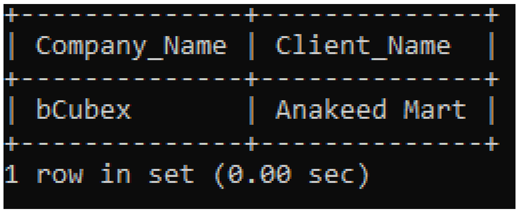


```
+-----------------+---------+
| Name            | Payment |
+-----------------+---------+
| usatechsoft     | 2350.00 |
| usatechsoft     | 1600.00 |
| AneesaIBA       | 2400.00 |
| PolestarDesigns | 1950.00 |
| PolestarDesigns | 1200.00 |
| aftabyounas     | 1850.00 |
| AneesaIBA       | 1600.00 |
| PolestarDesigns | 2000.00 |
| usatechsoft     | 1100.00 |
| web99design     | 2150.00 |
| aftabyounas     | 1250.00 |
+-----------------+---------+
11 rows in set (0.00 sec)
```

Querry:

SELECT SDC.Company_Name, c.Client_Name FROM SoftwareDevelopmentCompanies SDC JOIN Clients c ON SDC.SDC_ID = c.SDC_ID WHERE SDC.Rating > 4.5 AND c.Client_Name LIKE 'A%';

Output:

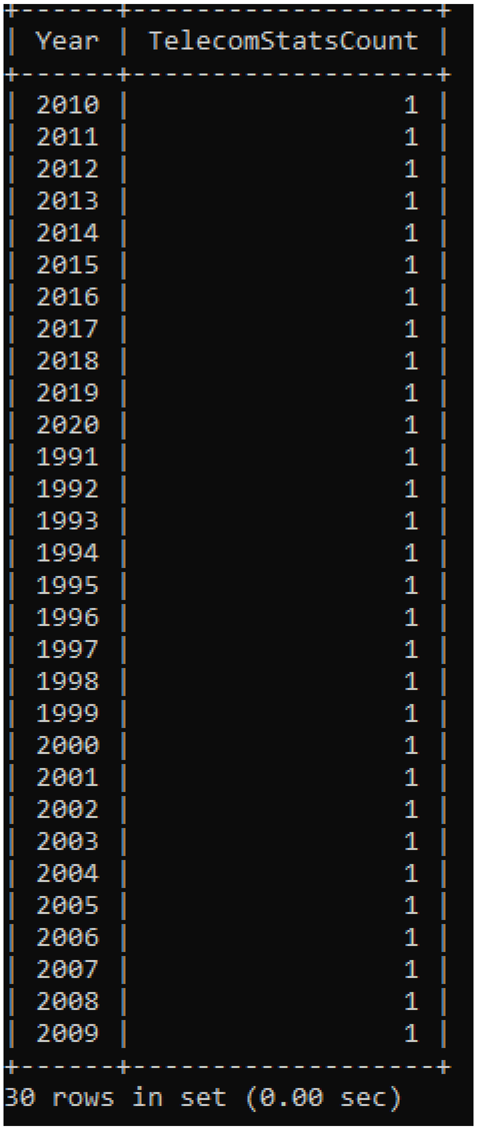


```
+--------------+--------------+
| Company_Name | Client_Name  |
+--------------+--------------+
| bCubex       | Anakeed Mart |
+--------------+--------------+
1 row in set (0.00 sec)
```

Querry:

SELECT t.Year, COUNT(t.TSID) AS TelecomStatsCount FROM Telecommunication_Stats t GROUP BY t.Year;

Output:

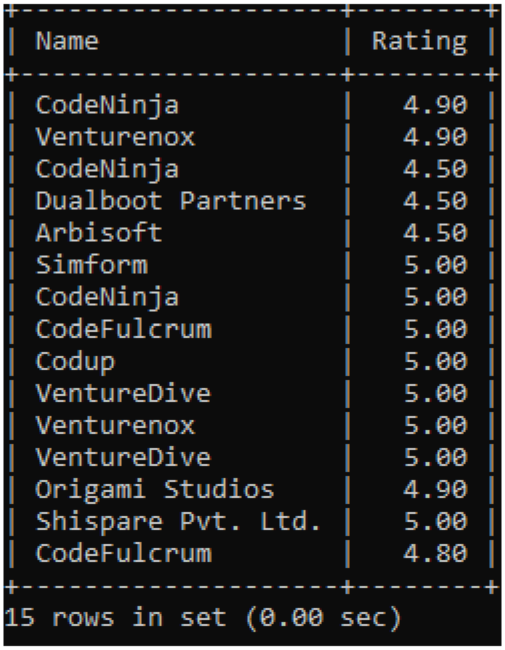


```
+------+-------------------+
| Year | TelecomStatsCount |
+------+-------------------+
| 2010 |                 1 |
| 2011 |                 1 |
| 2012 |                 1 |
| 2013 |                 1 |
| 2014 |                 1 |
| 2015 |                 1 |
| 2016 |                 1 |
| 2017 |                 1 |
| 2018 |                 1 |
| 2019 |                 1 |
| 2020 |                 1 |
| 1991 |                 1 |
| 1992 |                 1 |
| 1993 |                 1 |
| 1994 |                 1 |
| 1995 |                 1 |
| 1996 |                 1 |
| 1997 |                 1 |
| 1998 |                 1 |
| 1999 |                 1 |
| 2000 |                 1 |
| 2001 |                 1 |
| 2002 |                 1 |
| 2003 |                 1 |
| 2004 |                 1 |
| 2005 |                 1 |
| 2006 |                 1 |
| 2007 |                 1 |
| 2008 |                 1 |
| 2009 |                 1 |
+------+-------------------+
30 rows in set (0.00 sec)
```

Querry:

SELECT sc.Name,sdc.Rating FROM SoftwareDevelopmentCompanies sdc JOIN SoftwareProject sp ON sdc.SDC_ID = sp.SDC_ID JOIN SoftwareHouse sc ON sp.SoftwareHouse_ID = sc.SoftwareHouse_ID WHERE sdc.Rating > 4.0;

Output:

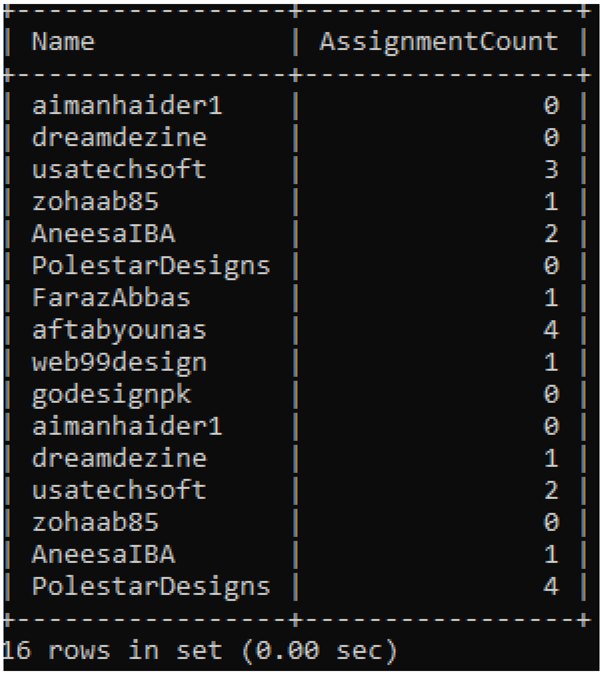


```
+---------------------+--------+
| Name                | Rating |
+---------------------+--------+
| CodeNinja           |   4.90 |
| Venturenox          |   4.90 |
| CodeNinja           |   4.50 |
| Dualboot Partners   |   4.50 |
| Arbisoft            |   4.50 |
| Simform             |   5.00 |
| CodeNinja           |   5.00 |
| CodeFulcrum         |   5.00 |
| Codup               |   5.00 |
| VentureDive         |   5.00 |
| Venturenox          |   5.00 |
| VentureDive         |   5.00 |
| Origami Studios     |   4.90 |
| Shispare Pvt. Ltd.  |   5.00 |
| CodeFulcrum         |   4.80 |
+---------------------+--------+
15 rows in set (0.00 sec)
```

Querry:

SELECT Name, (SELECT COUNT(*) FROM FreelancerCompanyAssignment fca WHERE fca.Freelancer_ID = f.Freelancer_ID) AS AssignmentCount FROM Freelancers f;

Output:

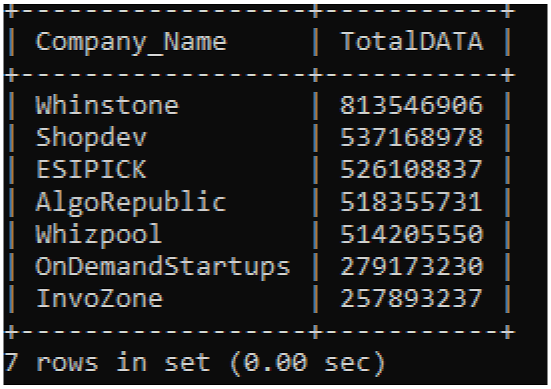


```
+-----------------+-----------------+
| Name            | AssignmentCount |
+-----------------+-----------------+
| aimanhaider1    |               0 |
| dreamdezine     |               0 |
| usatechsoft     |               3 |
| zohaab85        |               1 |
| AneesaIBA       |               2 |
| PolestarDesigns |               0 |
| FarazAbbas      |               1 |
| aftabyounas     |               4 |
| web99design     |               1 |
| godesignpk      |               0 |
| aimanhaider1    |               0 |
| dreamdezine     |               1 |
| usatechsoft     |               2 |
| zohaab85        |               0 |
| AneesaIBA       |               1 |
| PolestarDesigns |               4 |
+-----------------+-----------------+
16 rows in set (0.00 sec)
```

Querry:

SELECT sdc.Company_Name, SUM(t.Jazz + t.Ufone + t.Telenor + t.Warid + t.Zong) AS TotalDATA FROM SoftwareDevelopmentCompanies sdc JOIN SoftwareProject sp ON sdc.SDC_ID = sp.SDC_ID JOIN SoftwareHouse sh ON sp.SoftwareHouse_ID = sh.SoftwareHouse_ID JOIN Telecommunication t ON sh.SoftwareHouse_ID = t.SoftwareHouse_ID GROUP BY sdc.Company_Name HAVING SUM(t.Jazz + t.Ufone + t.Telenor + t.Warid + t.Zong) > 1000 ORDER BY TotalSubscribers DESC;

Output:



```
+------------------+-----------+
| Company_Name     | TotalDATA |
+------------------+-----------+
| Whinstone        | 813546906 |
| Shopdev          | 537168978 |
| ESIPICK          | 526108837 |
| AlgoRepublic     | 518355731 |
| Whizpool         | 514205550 |
| OnDemandStartups | 279173230 |
| InvoZone         | 257893237 |
+------------------+-----------+
7 rows in set (0.00 sec)
```

5.1. LANGUAGE/FRAMEWORK:

For the development of the GUI client in this project, we have chosen **Python** with the **Flask** framework, integrated with HTML, CSS, and JavaScript for the frontend.

Technologies Used:

1. **Python**: The main programming language used for the backend.
2. **Flask**: A lightweight WSGI web application framework for Python.
3. **HTML/CSS**: Used for structuring and styling the web pages.
4. **JavaScript**: Adds interactivity to the web pages.
5. **Bootstrap/CSS**: A CSS framework that helps in designing responsive web pages quickly.

Reasons for Choosing Python and Flask:

1. **Ease of Use**: Python is known for its simplicity and readability, making it an excellent choice for both beginners and experienced developers. Its straightforward syntax allows for rapid development and maintenance.
2. **Flask**: Flask is a lightweight web framework for Python that provides the necessary tools and libraries for building web applications. It is known for being simple yet powerful, offering flexibility without imposing a lot of structure, which is ideal for projects that require customization.
3. **Extensive Libraries**: Python's rich ecosystem of libraries and frameworks allows for quick integration of various functionalities.
4. **Community and Support**: Both Python and Flask have large, active communities that contribute to a wealth of documentation, tutorials, and third-party modules.

Key Features and Their Contributions:

- **Flask**: Provides a simple and flexible framework to build web applications, with powerful routing and templating.
- **HTML/CSS/JavaScript**: Enables the creation of dynamic and responsive web interfaces. We use these technologies to insert/manipulate data by forms.
- **Bootstrap/CSS**: Facilitates responsive design and ensures the application looks good on various devices and screen sizes.

5.2. DATABASE CONNECTIVITY:

*s*The GUI client connects to the MySQL database using the `mysql.connector` library. This library provides a robust way to connect to a MySQL database from a Python application. The connection is established using the `mysql.connector.connect` method, which requires database credentials and other parameters.

Code Snippet for Database Connection

```
from flask import Flask, render_template, request, redirect, url_for, flash, jsonify
import mysql.connector
from mysql.connector import Error

app = Flask(__name__)
app.secret_key = 'your_secret_key'

# Database connection
try:
    dataBase = mysql.connector.connect(
        host='your_host',
        user='your_username',
        password='your_password',
        database='your_database_name'
    )
    if dataBase.is_connected():
        cursor = dataBase.cursor(buffered=True)
        print("Successfully connected to the database")

except Error as e:
    print(f"Error while connecting to MySQL: {e}")

# Close database connection when app stops
@app.teardown_appcontext
def close_connection(exception):
    if dataBase.is_connected():
        cursor.close()
        dataBase.close()
        print("MySQL connection is closed")
```

```
if __name__ == '__main__':
    app.run(debug=True)
    if dataBase.is_connected():
        cursor.close() # Close the cursor object
        dataBase.close() # Close the database connection
        print("MySQL Connection is Closed.")
```

In this setup:

1. The `mysql.connector.connect` method establishes the connection using the provided host, username, password, and database name.
2. If the connection is successful, a cursor is created using `dataBase.cursor(buffered=True)`.
3. Error handling is implemented using a `try-except` block to catch and print any connection errors.
4. The `@app.teardown_appcontext` decorator ensures the database connection is closed when the Flask application context ends.

5.3. STORED PROCEDURES AND FUNCTIONS:

*Procedure: **InsertClient***

```
@app.route('/insert/<table>', methods=['POST'])
def process_insert(table):
    data = request.form
    if table == 'Clients':
        company_client_id = data["company_client_id"]
        sdc_id = data['sdc_id']
        client_name = data['client_name']
        try:
            query = f"INSERT INTO Clients (CompanyClient_ID, SDC_ID,
Client_Name) VALUES ({company_client_id}, {sdc_id}, '{client_name}');"
            cursor.execute(query)
            dataBase.commit()
            result = "Data Inserted Successfully."
        except Error as e:
            result = f"Error occurred: {e}"
            result = f"Error occured, {e}. "
    else:
        result = "Table not found"
    flash(result)
    return render_template(f'insert_forms/{table.lower()}.html')
```

Explanation:

- **Purpose:** Inserts a new client into the `Clients` table.
- **Implementation:** Uses input data (`company_client_id`, `sdc_id`, `client_name`) to construct and execute an `INSERT` SQL query.
- **Enhancement:** Encapsulates insertion logic, ensuring data integrity and reducing SQL injection risks.

*Procedure: **UpdateClient***

```
@app.route('/update/<table>', methods=['POST'])
def process_update(table):
    data = request.form
    if table == 'Clients':
        id = data["company_client_id"]
        sdc_id = data['sdc_id']
        client_name = data['client_name']
        try:
            query = f"UPDATE Clients SET SDC_ID = {sdc_id}, Client_Name =
'{client_name}'  WHERE CompanyClient_ID  = {id};"
            cursor.execute(query)
            dataBase.commit()
            result = "Data Updated Successfully."
        except Error as e:
            result = f"Error occurred: {e}"
            result = f"Error occured, {e}. "
    else:
        result = "Table not found"
    flash(result)
    return render_template(f'update_forms/{table.lower()}.html')
```

Explanation:

- **Purpose:** Updates client details in the `Clients` table.
- **Implementation:** Constructs and executes an `UPDATE` SQL query based on input data (`id`, `sdc_id`, `client_name`).
- **Enhancement:** Simplifies update operations, ensuring consistency and data accuracy.

*Procedure: **DeleteClient***

```
@app.route('/delete/<table>', methods=['POST'])
def process_delete(table):
    data = request.form
    if table == 'Clients':
        id = data["company_client_id"]
        try:
            query = f"DELETE FROM Clients WHERE CompanyClient_ID = {id};"
            cursor.execute(query)
            dataBase.commit()
            result = "Data Deleted Successfully."
        except Error as e:
            result = f"Error occurred: {e}"
            result = f"Error occured, {e}. "
    else:
        result = "Table not found"
    flash(result)
    return render_template(f'delete_forms/{table.lower()}.html')
```

Explanation:

- **Purpose:** Deletes a client from the `Clients` table.
- **Implementation:** Executes a `DELETE` SQL query based on the `company_client_id`.
- **Enhancement:** Ensures secure deletion and maintains data consistency.

Function: process_search

```
@app.route('/process_search/<table>', methods=['POST'])
def process_search(table):
    data = request.form
    id = data["client_id"]
    if table == 'Clients':
        query = f"SELECT * FROM clients Where CompanyClient_ID = {id};"
        cursor.execute(query)
        rows = cursor.fetchall()
        col_names = [desc[0] for desc in cursor.description]
    # Other table checks and queries omitted for brevity
    return render_template(f'search/AllTables.html', table = table,
rows=rows, col_names=col_names)
```

Explanation:

- **Purpose:** Retrieves client data from the `Clients` table based on the client ID.
- **Implementation:** Constructs and executes a `SELECT` SQL query.
- **Enhancement:** Facilitates searching and displaying client information within the GUI client.

InsertFreelancerCompanyAssignment Procedure

```
@app.route('/insert/<table>', methods=['POST'])
def process_insert(table):
    data = request.form
    if table == 'FreelancerCompanyAssignment':
        fc_assignment_id = data['fc_assignment_id']
        company_id = data['company_id']
        freelancer_id = data['freelancer_id']
        payment = data['payment']
        try:
            query = f"INSERT INTO FreelancerCompanyAssignment
(FreelancerCompany_ID, Company_ID, Freelancer_ID, Payment) VALUES
({fc_assignment_id}, {company_id}, {freelancer_id}, {payment});"
            cursor.execute(query)
            dataBase.commit()
            result = "Data Inserted Successfully."
        except Error as e:
            result = f"Error occurred: {e}"
            result = f"Error occurred, {e}. "
    else:
        result = "Table not found"
    flash(result)
    return render_template(f'insert_forms/{table.lower()}.html')
```

Explanation:

- **Purpose:** Inserts a new assignment record into the `FreelancerCompanyAssignment` table.
- **Implementation:** Constructs and executes an `INSERT` SQL query with input data (`fc_assignment_id`, `company_id`, `freelancer_id`, `payment`).
- **Enhancement:** Provides a structured way to add assignments, ensuring accurate record keeping and data integrity.

InsertScientist Procedure

```
@app.route('/insert/<table>', methods=['POST'])
def process_insert(table):
    data = request.form
    if table == 'Scientist':
        scientist_id = data['scientist_id']
        name = data['name']
        discipline = data['discipline']
        qualification = data['qualification']
        affiliation = data['affiliation']
        tech_id = data['tech_id']
        try:
            query = f"INSERT INTO Scientist (ScientistID, Name, Discipline,
Qualification, Affiliation, TechID) VALUES ({scientist_id}, '{name}',
'{discipline}', '{qualification}', '{affiliation}', {tech_id});"
```

```
            cursor.execute(query)
            dataBase.commit()
            result = "Data Inserted Successfully."
        except Error as e:
            result = f"Error occurred: {e}"
            result = f"Error occurred, {e}. "
    else:
        result = "Table not found"
    flash(result)
    return render_template(f'insert_forms/{table.lower()}.html')
```

Explanation:

- **Purpose:** Inserts a new scientist record into the `Scientist` table.
- **Implementation:** Constructs and executes an `INSERT` SQL query with input data (`scientist_id`, `name`, `discipline`, `qualification`, `affiliation`, `tech_id`).
- **Enhancement:** Facilitates adding new scientists to the database, supporting the application's functionality in managing scientific personnel.

DeleteFreelancerCompanyAssignment Procedure

```
@app.route('/delete/<table>', methods=['POST'])
def process_delete(table):
    data = request.form
    if table == 'FreelancerCompanyAssignment':
        fc_assignment_id = data['fc_assignment_id']
        try:
            query = f"DELETE FROM FreelancerCompanyAssignment WHERE 
FreelancerCompany_ID = {fc_assignment_id};"
            cursor.execute(query)
            dataBase.commit()
            result = "Data Deleted Successfully."
        except Error as e:
            result = f"Error occurred: {e}"
            result = f"Error occurred, {e}. "
    else:
        result = "Table not found"
    flash(result)
    return render_template(f'delete_forms/{table.lower()}.html')
```

Explanation:

- **Purpose:** Deletes an assignment record from the `FreelancerCompanyAssignment` table.
- **Implementation:** Constructs and executes a `DELETE` SQL query based on the `fc_assignment_id`.
- **Enhancement:** Provides a controlled way to remove assignments, ensuring data integrity and application consistency.

DeleteSoftwareDevelopmentCompanies Procedure

```
@app.route('/delete/<table>', methods=['POST'])
def process_delete(table):
    data = request.form
    if table == 'Software_Development_Companies':
        sdc_id = data['company_id']
        try:
            query = f"DELETE FROM SoftwareDevelopmentCompanies WHERE SDC_ID = 
{sdc_id};"
            cursor.execute(query)
            dataBase.commit()
            result = "Data Deleted Successfully."
        except Error as e:
            result = f"Error occurred: {e}"
            result = f"Error occurred, {e}. "
    else:
        result = "Table not found"
    flash(result)
    return render_template(f'delete_forms/{table.lower()}.html')
```

Explanation:

- **Purpose:** Deletes a software development company record from the `SoftwareDevelopmentCompanies` table.
- **Implementation:** Constructs and executes a `DELETE` SQL query based on the `sdc_id`.
- **Enhancement:** Supports management of software development companies within the application, allowing for removal of outdated or unnecessary records.

These stored procedures enhance the functionality of the GUI client by providing encapsulated and optimized routines for inserting data into specific database tables. They streamline the process of adding new records by encapsulating complex SQL queries into reusable procedures, which are invoked directly from the GUI client. This approach improves application efficiency and reduces redundancy by centralizing database interaction logic. Additionally, these procedures ensure data integrity and consistency by implementing error handling and validation checks within the database itself, thereby enhancing the overall reliability of the GUI client's data management capabilities.

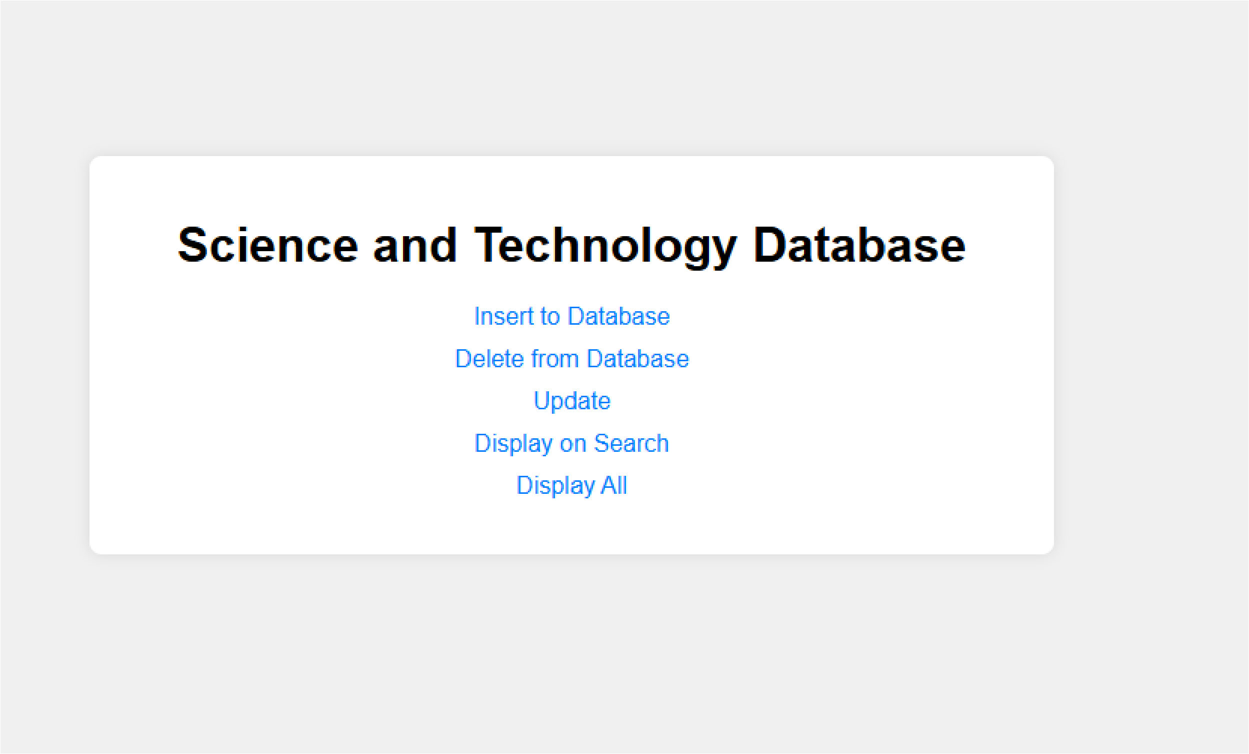
Note:

There are to many procedures in our database so we add a few above in this section.

5.4. INTERFACES:

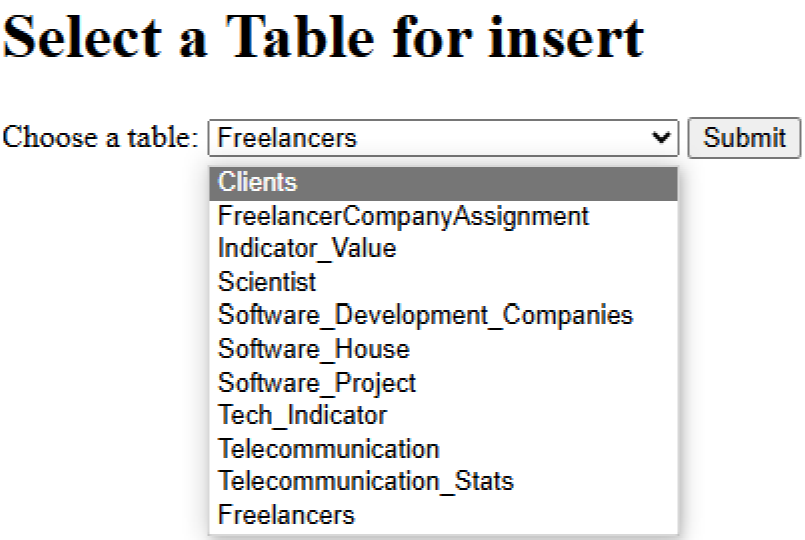
Here are some screenshots providing visual documentation of the GUI.

Home page of our database/GUI which gives the option to insert delete update data from the database.



Science and Technology Database

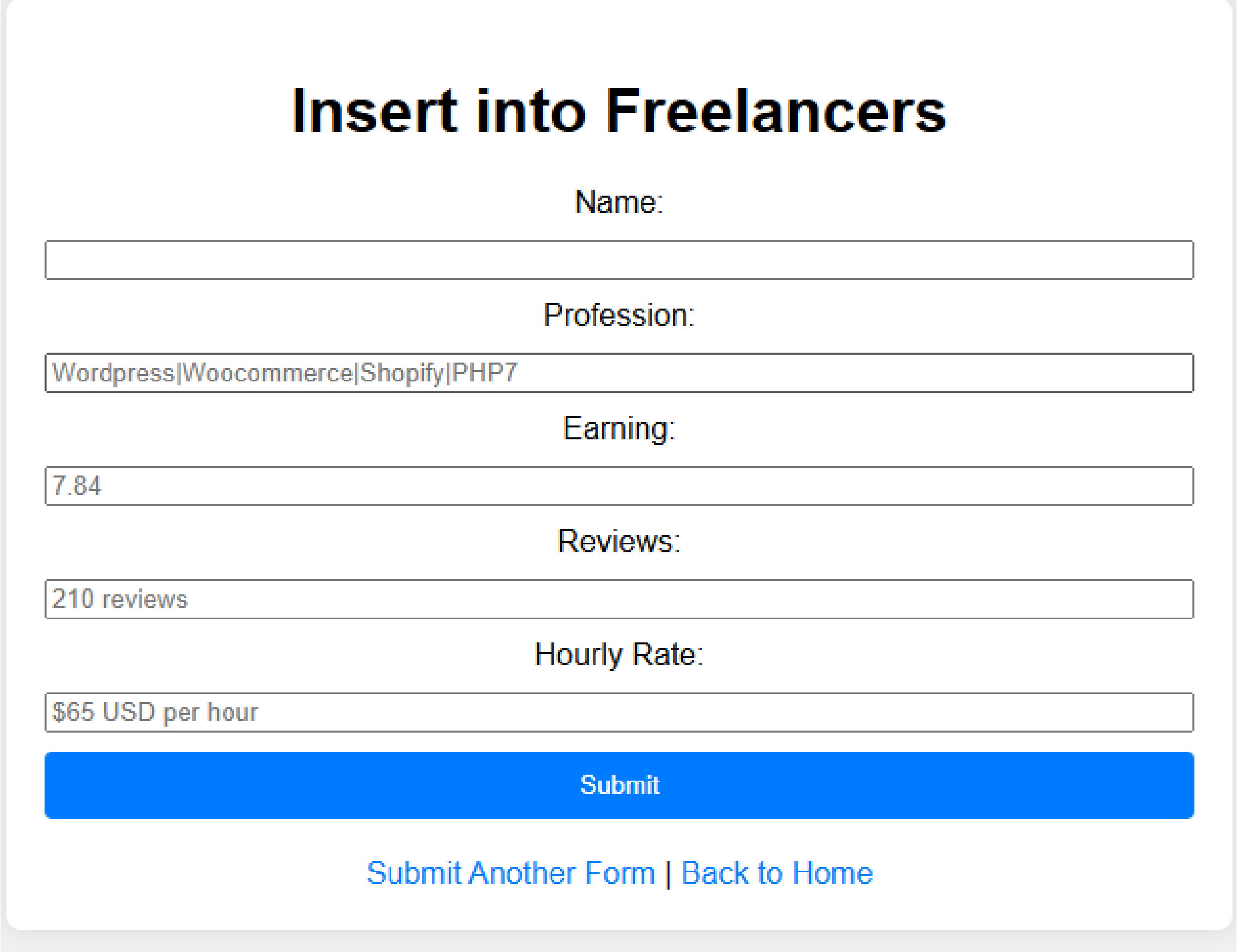
For inserting the data into the database. Here is the list of the tables to be selected to insert data to it.



Select a Table for insert

Choose a table: Freelancers

To add a new freelancer, all required details must be provided



Insert into Freelancers

Name:

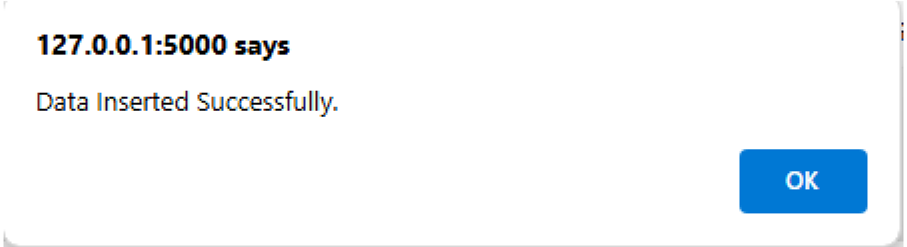
Profession: Wordpress|Woocommerce|Shopify|PHP7

Earning: 7.84

Reviews: 210 reviews

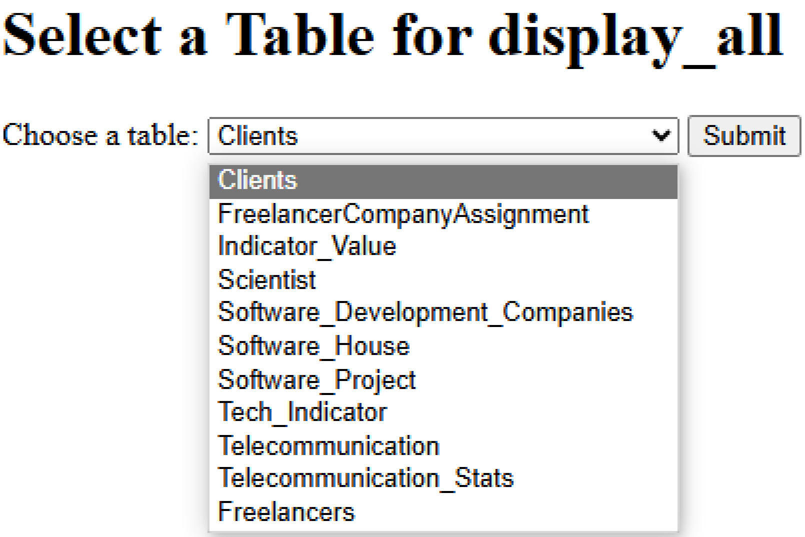
Hourly Rate: $65 USD per hour

Successfully inserted the freelancer.

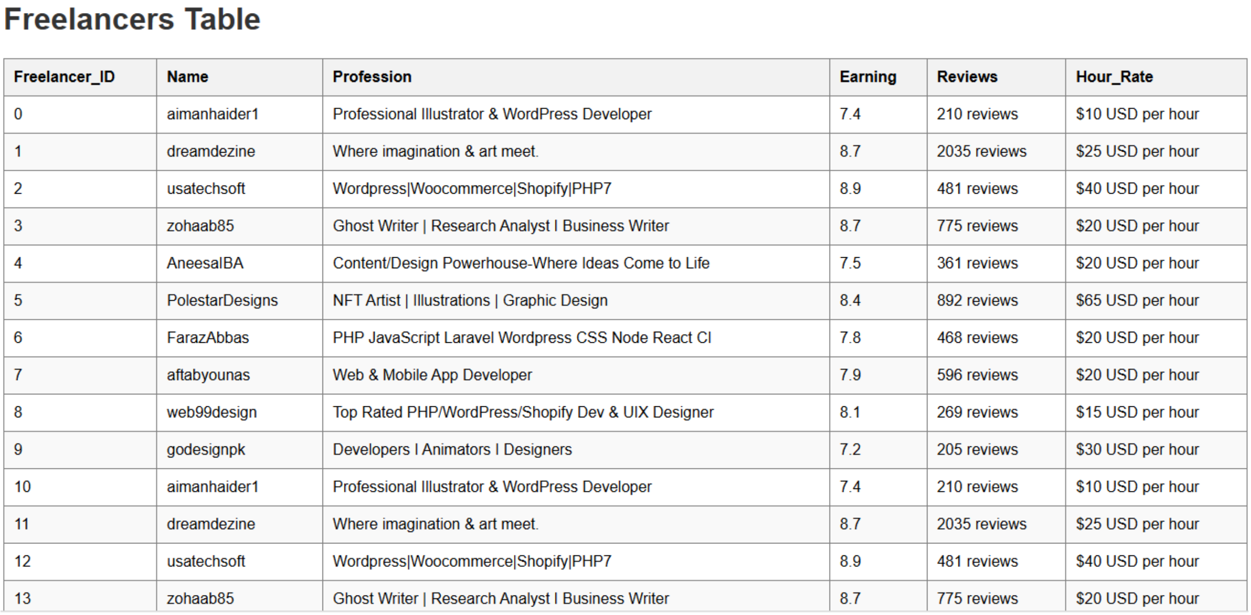


127.0.0.1:5000 says

Data Inserted Successfully.



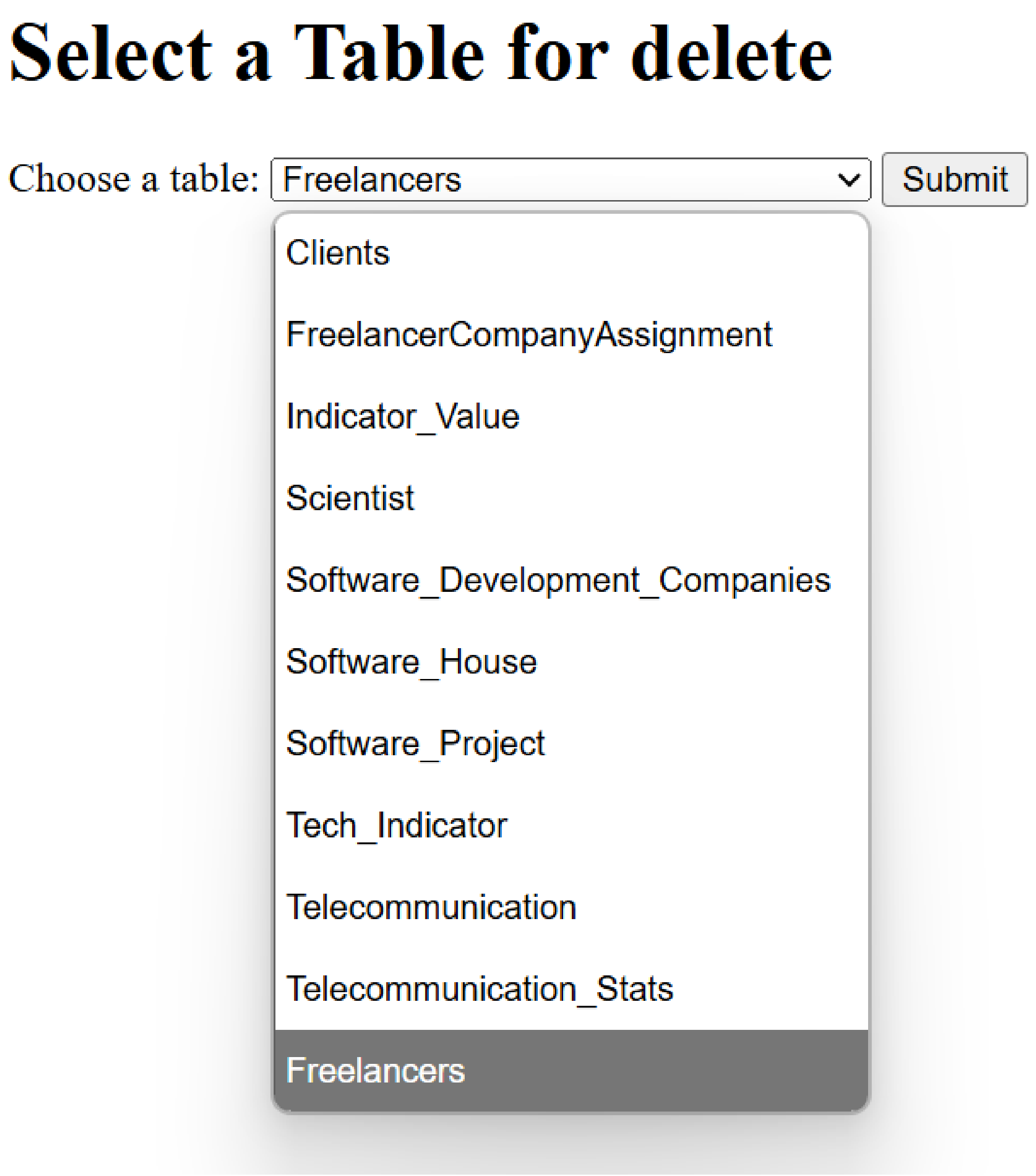
Select a Table for display_all



Freelancers Table

Freelancer_ID	Name	Profession	Earning	Reviews	Hour_Rate
0	aimanhaider1	Professional Illustrator & WordPress Developer	7.4	210 reviews	$10 USD per hour
1	dreamdezine	Where imagination & art meet.	8.7	2035 reviews	$25 USD per hour
2	usatechsoft	Wordpress|Woocommerce|Shopify|PHP7	8.9	481 reviews	$40 USD per hour
3	zohaab85	Ghost Writer | Research Analyst I Business Writer	8.7	775 reviews	$20 USD per hour
4	AneesalBA	Content/Design Powerhouse-Where Ideas Come to Life	7.5	361 reviews	$20 USD per hour
5	PolestarDesigns	NFT Artist | Illustrations | Graphic Design	8.4	892 reviews	$65 USD per hour
6	FarazAbbas	PHP JavaScript Laravel Wordpress CSS Node React CI	7.8	468 reviews	$20 USD per hour
7	aftabyounas	Web & Mobile App Developer	7.9	596 reviews	$20 USD per hour
8	web99design	Top Rated PHP/WordPress/Shopify Dev & UIX Designer	8.1	269 reviews	$15 USD per hour
9	godesignpk	Developers I Animators I Designers	7.2	205 reviews	$30 USD per hour
10	aimanhaider1	Professional Illustrator & WordPress Developer	7.4	210 reviews	$10 USD per hour
11	dreamdezine	Where imagination & art meet.	8.7	2035 reviews	$25 USD per hour
12	usatechsoft	Wordpress|Woocommerce|Shopify|PHP7	8.9	481 reviews	$40 USD per hour
13	zohaab85	Ghost Writer | Research Analyst I Business Writer	8.7	775 reviews	$20 USD per hour

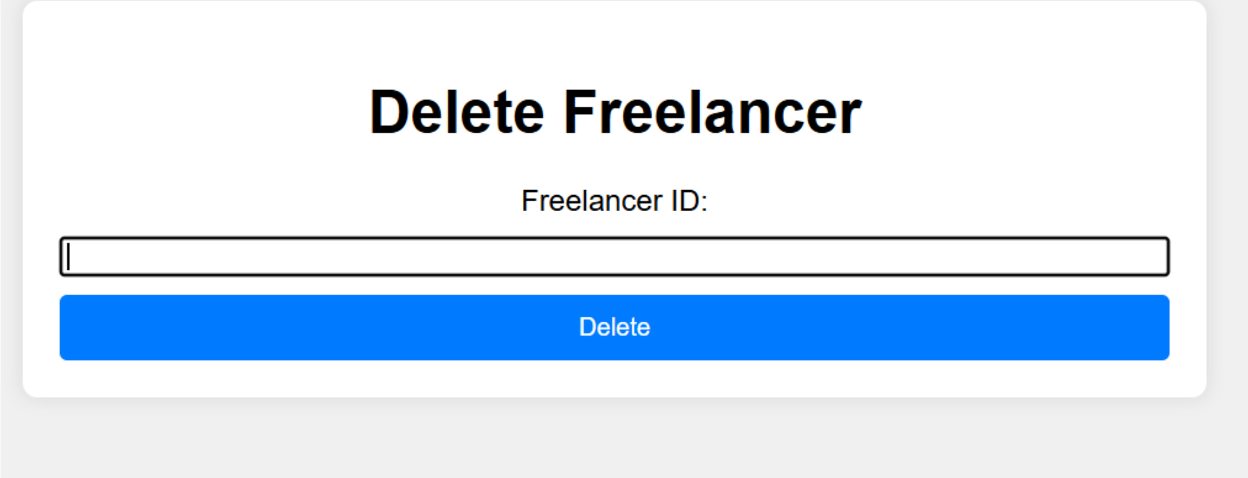
For Deleting the data into the database. Here is the list of the tables to be selected to delete data to it.



Select a Table for delete

Choose a table: Freelancers

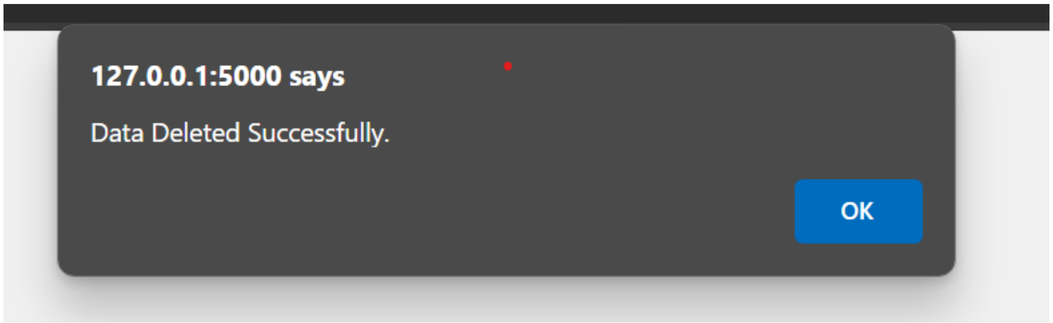
Deleting a new freelancer requires providing their Freelancer ID.



Delete Freelancer

Freelancer ID:

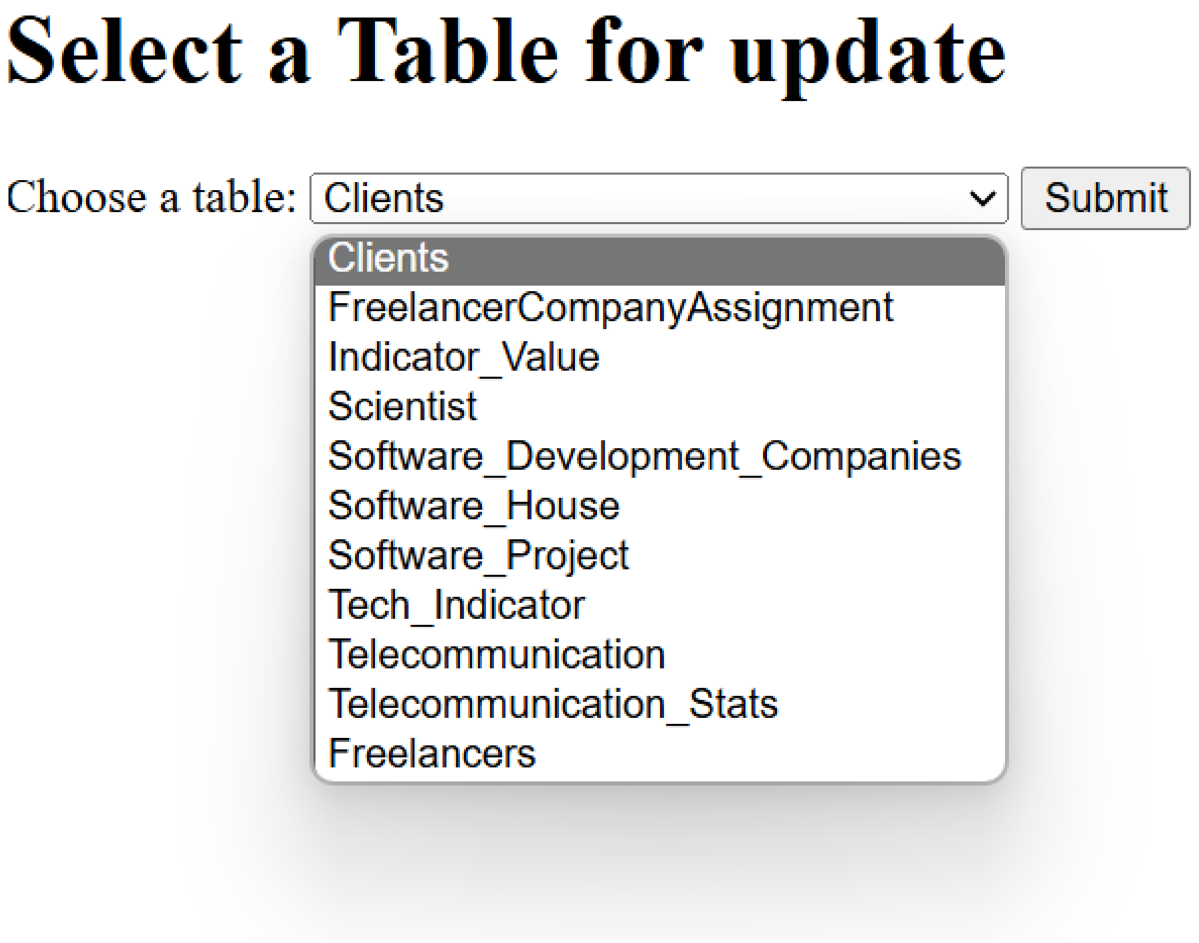
Data is deleted successfully



127.0.0.1:5000 says

Data Deleted Successfully.

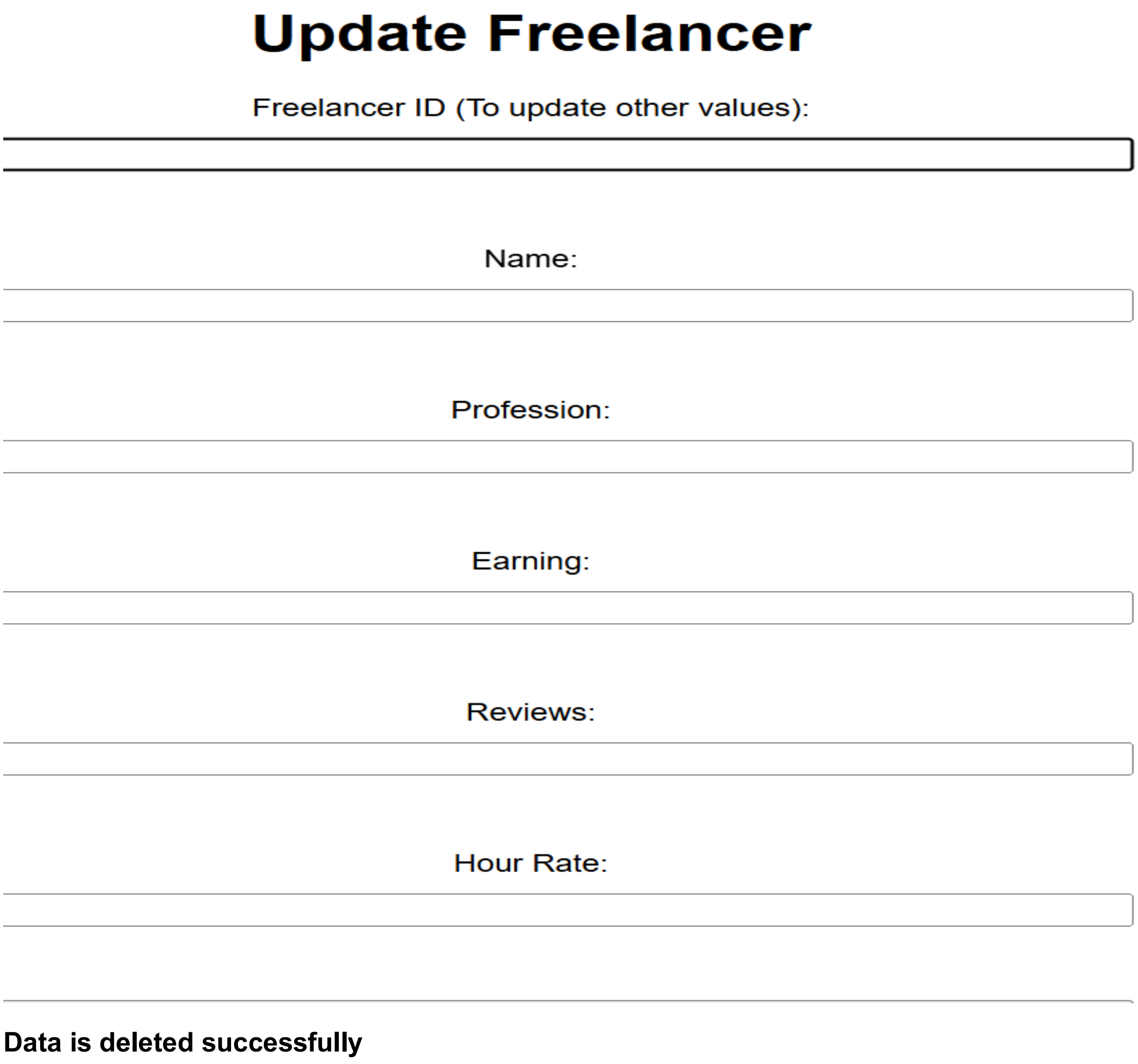
For Updating the data into the database. Here is the list of the tables to be selected to update data to it.



Select a Table for update

Choose a table: Clients

To update a freelancer's profile, all necessary details must be provided.



Update Freelancer

Freelancer ID (To update other values):

Name:

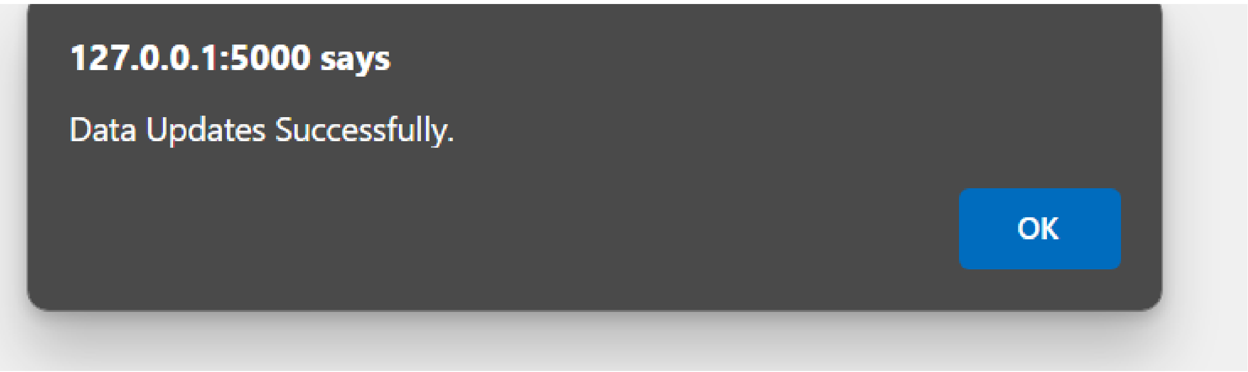
Profession:

Earning:

Reviews:

Hour Rate:

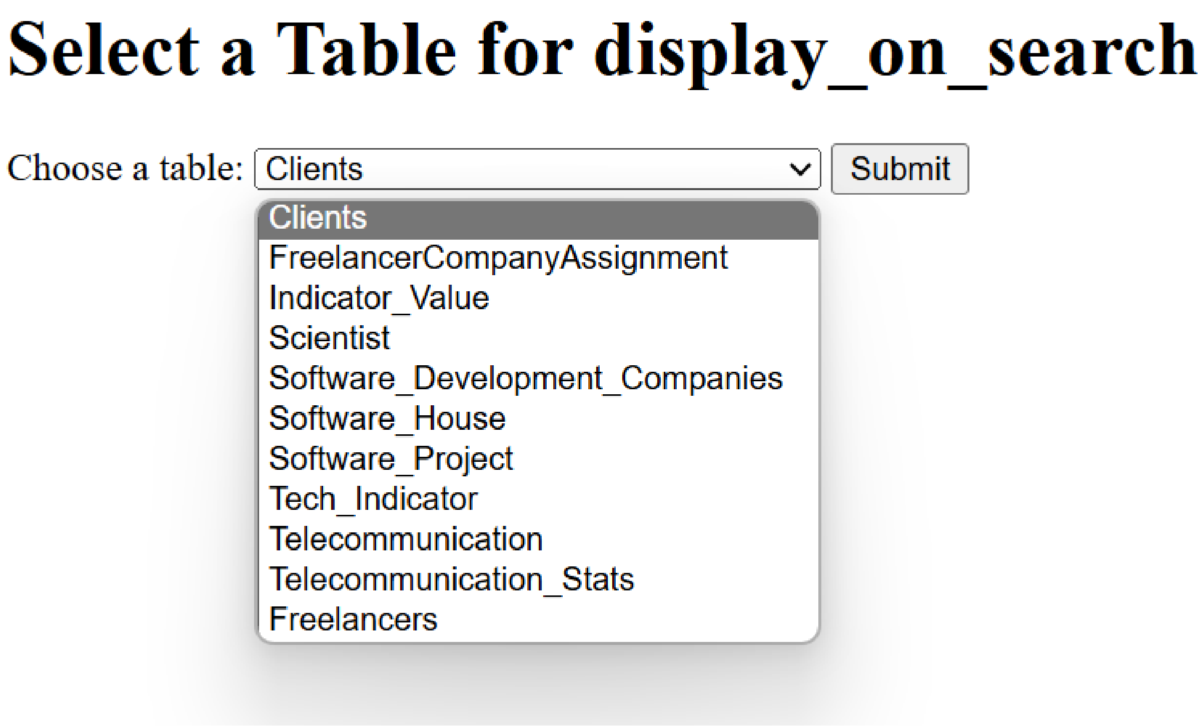
Data is deleted successfully



127.0.0.1:5000 says

Data Updates Successfully.

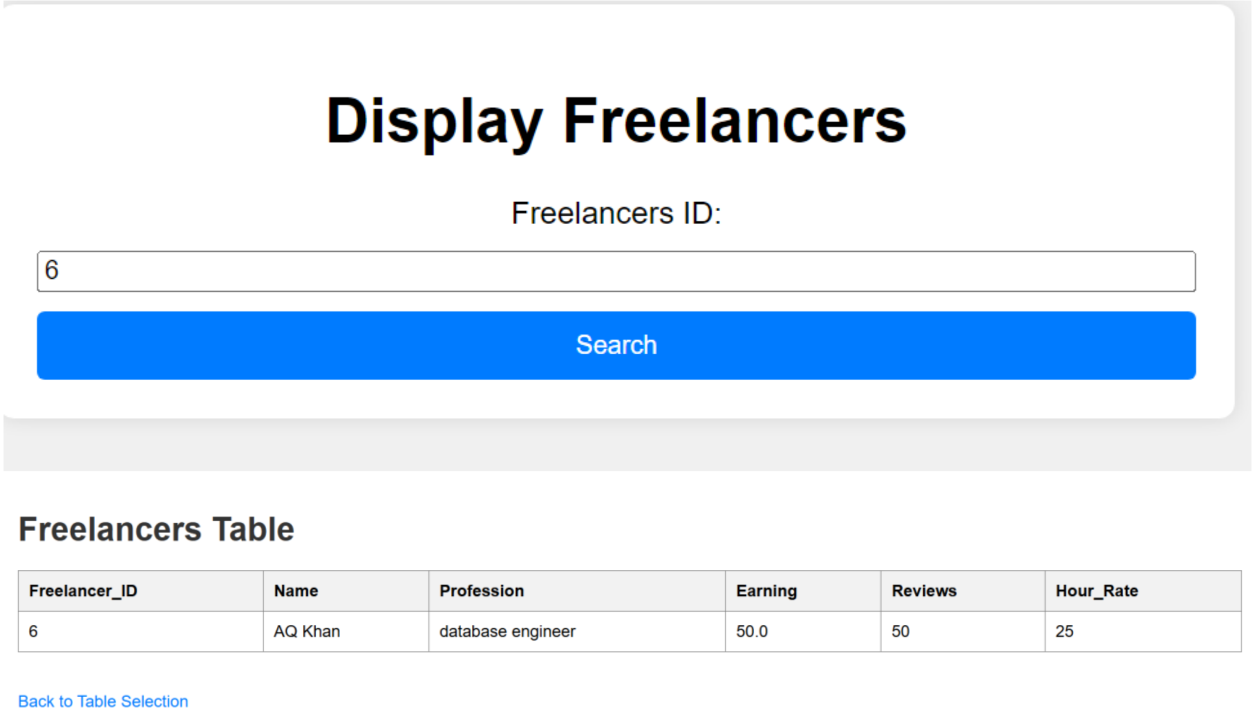
To display data from the database, the user can select a table from a provided list of available tables.



Select a Table for display_on_search

Choose a table: Clients

The system requires the Freelancer ID to display a new freelancer's information.



Display Freelancers

Freelancers ID: 6

Freelancers Table

Freelancer_ID	Name	Profession	Earning	Reviews	Hour_Rate
6	AQ Khan	database engineer	50.0	50	25

~~CHAPTER 5 : CONCLUSION~~

6.1. LESSONS LEARNED:

This project has been a valuable learning experience in the realm of database management and software development.

The process began with a detailed Entity-Relationship Diagram (ERD), highlighting the crucial role of thorough initial planning. We learned that a well-structured ERD is essential for building a robust database foundation. Applying normalization techniques to our database design emphasized the importance of balancing data redundancy and efficiency, optimizing both performance and integrity.

Integrating MySQL with Flask for the GUI demonstrated the critical nature of seamless backend/frontend communication, reliable database connections, and effective error handling. Throughout the project, we encountered various challenges that required us to develop robust debugging and error-handling skills, proving pivotal in maintaining system stability.

Iterative testing and feedback loops were instrumental in refining our database and GUI, underscoring the significance of user-centric design and continuous improvement. Furthermore, the project enhanced our teamwork and communication skills, teaching us how to leverage each member's strengths and coordinate effectively.

Overall, this project has deepened our understanding of database management, improved our technical abilities, and prepared us for more complex future projects.

6.2. CHALLENGES AND SOLUTIONS:

The project's development presented a series of challenges, which the team successfully addressed. Design complexities emerged during Entity-Relationship Diagram (ERD) development and normalization, necessitating iterative refinement to achieve an optimal schema that balanced data integrity and performance. Implementation challenges centered around fine-tuning SQL queries and ensuring robust error handling mechanisms, crucial for maintaining system reliability. Rigorous testing phases focused on validating data insertion, retrieval, and Graphical User Interface (GUI) functionality to meet user expectations. Solutions involved collaborative problem-solving, leveraging team expertise to effectively overcome design intricacies and technical hurdles.

FUTURE WORK AND IMPROVEMENTS:

Right now, our project helps us understand technology and science. We can make it even better by using special tools to predict future trends. We can also make the information easier to understand by showing it in a visually appealing way. To make sure everyone can use our project, we can move it to the cloud, so it's accessible anywhere. Lastly, we can use our project to figure out how technology will impact Pakistan's economy and society, which will benefit everyone.

6.3. FINAL THOUGHTS:

In the end, this project has been a testament to our team's dedication. Beyond developing a robust database-driven GUI application, it has underscored the importance of structured project management, agile methodologies, and continuous learning. Personally, this journey has deepened our understanding of database systems, software development lifecycles, and the transformative potential of integrating technology with real-world applications. As we look ahead, we are confident that the insights gained, and the collaborative spirit fostered will guide us towards future successes in leveraging technology for positive societal impact.

REFERENCES

[1] "Science and Technology," 09 2021. [Online]. Available: https://opendata.com.pk/dataset?category=Science+%26+Technology&page=1. [Accessed 13 3 2024].

[2] "world-bank-science-and-technology-indicators-for-pakistan," 28 02 2024. [Online]. Available: https://data.humdata.org/dataset/world-bank-science-and-technology-indicators-for-pakistan?. [Accessed 12 3 2024].