

# Final Project Report

## Real Estate Management Database

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## Phase 1 documentation

### Step 1 Project ID:-

Team-12

### Step 2 Problem Definition:-

Our Project/Database System aims at providing a simple and lucid solution to the problem of Real Estate Searching. There is a huge gap between buyers and sellers in the real estate market. A mediator such as a **real estate agent** helps in bridging the gap by a little but it is still a hassle for the real estate agent to find potential buyers with sufficient funds, having specific requirements, ready to live in a certain region. Also, the real estate agent has to find the respective buyer who is ready to negotiate and sell the property at a reasonable price, having specific attributes for his property, having certain prerequisites such as repairs, facilities to be reminded of. It is also a hassle for the seller and buyer to find each other online let alone the way of going to a stranger's door and asking if he is selling or if he/she knows someone who is. **Company XYZ** has a titanic dataset that is very detailed but is spread out, unorganized and is more of an esoteric ocean of text. Now, our database system has its major use in this very domain, for organizing the dataset of Company XYZ into a easy to understand dataset which can find the specific seller, buyer, agent, house, just from usage of keywords, Thus speeding up the procedure for finding favorable properties from older dataset or updating or adding new instances in a well organized and well defined manner so that future retrieval causes no hassle and time is saved. In the database, the **buyer searches** for the **apartment** using keywords or he/she **contacts** the **headquarters** for allotting an **estate agent**. The **estate agent wires** this message to the **seller** that a buyer is interested in the property. The seller, in turn, replies to the agent if he is ready to talk in person to the buyer via the agent as the middleman. The buyer and seller can then negotiate with each other if a negotiable cost range is provided by the seller beforehand. Both parties talk only to the agent until the final agreement is reached. Agents work for the Company XYZ and each **Agent** is **allotted to a single** region or **headquarters** under his jurisdiction by the Main headquarters. A **headquarter** is **managed by a manager** who manages all the allotment of all the agents under his headquarters. Multiple agents can work at the same headquarters. If in doubt about how the process of buying and selling works online or questions regarding a certain property or the loan eligibility for the buyer, the buyer or seller can contact the **customer service officer**. Every **customer service officer** is allotted to a single **headquarter**. There can be **multiple customer service officers for a single headquarter**.

Our database system will include various parameters such as a **type of the architecture of the building/bungalow, Rent of the property/Cost of the property, locality, grocery stores nearby, public transport availability, Are Pets allowed, Age of the building, playschools nearby, availability of water, solar heater and produced electricity, monuments or places to visit nearby, Availability of catering services nearby, banks nearby, capacity of the flat/bungalow, number of bedrooms, floor plan type, Area in Square feet ,Lighting style, Lease Duration Available,False ceiling, Air conditioning, Parking space available, height of the ceiling, Availability of public facilities such as a clubhouse, gym, pool** and many more. Details of the agent, Details of the seller, Details of Buyer, Address of the property. The Application that will be connected to the dataset will include functions such as a search bar for putting in the keywords some query options for filtering out certain specific needs that the user has. The application will provide the user may it be seller, buyer, an

agent with information about the properties, and its respective seller, buyer, an agent in charge. The application will also provide an option for adding a new instance of the dataset and will take into account all the parameters that the user can put in while filling in the information for the new instance.

The application will take in the information such as:-

- **Details of the Buyer**(Name, ID, specific requirements for the property..)
- **Details of the Seller**(Name, ID, Cost range, Floor plan, architecture type, Nearby places, facilities provided..)
- **Details of the Agent**(Name, Headquarter ID, Starting Date, Number of assignments.. )

### Step 3 Queries:-

- Show the apartments in Arlington, TX with is located near a grocery store?
- Show an apartment be found in Dallas, TX that costs under 100000\$ and has a playschool nearby.
- Show all the apartments in New York with an architectural style that is french and has a floor plan of B2.
- Show the capacity for an apartment with area 1000Square feet?
- Show the localities in Dallas, TX that have the least cost per square feet area and have facilities such as gym and clubhouse included within it.
- Show the contact number of the top 5 agents who have the highest number of successfully completed transactions.
- Show the apartment available in Dallas with abundant soft water, and pets are allowed with a maximum rent of 2000\$ per month.
- Show the top 5 agents with the highest amount of experience.
- Show a Seller who is ready to negotiate with the widest range of costs and has an architecture type of Japanese. With a closeness and a nice view of any monument of history or nature, the view should be great if the floor was higher than 5
- Show the apartments that are in close proximity to catering services? Also, I wanted to specify that I am looking for an apartment that is cheaper than 100k\$ while still having a bank nearby.
- Show the Contact number of the Company XYZ headquarters for Arlington, Texas.
- Show a Seller who has a fixed price for his property as that projects to me that the property is premium and it deserves the price.
- Show bungalow which has a parking space alongside a nearby park
- Show apartments that are close to any stadium and have a number of bedrooms to be a maximum of 2, also with a lease duration of 12months with a rent no more than 3000\$. With a height of ceiling no greater than 8 feet as I also wanted a false ceiling
- Show all the apartments in Arlington, TX with centralized Air conditioning and no repairs required?
- Show the information about the top 5 most expensive bungalows in all of your databases with a filter for the oldest age of the building, no pets allowed, a pool, Roman architecture, Catering services available, and the cost of the bungalow being fixed giving it a premium standard.

## Updated Queries:-

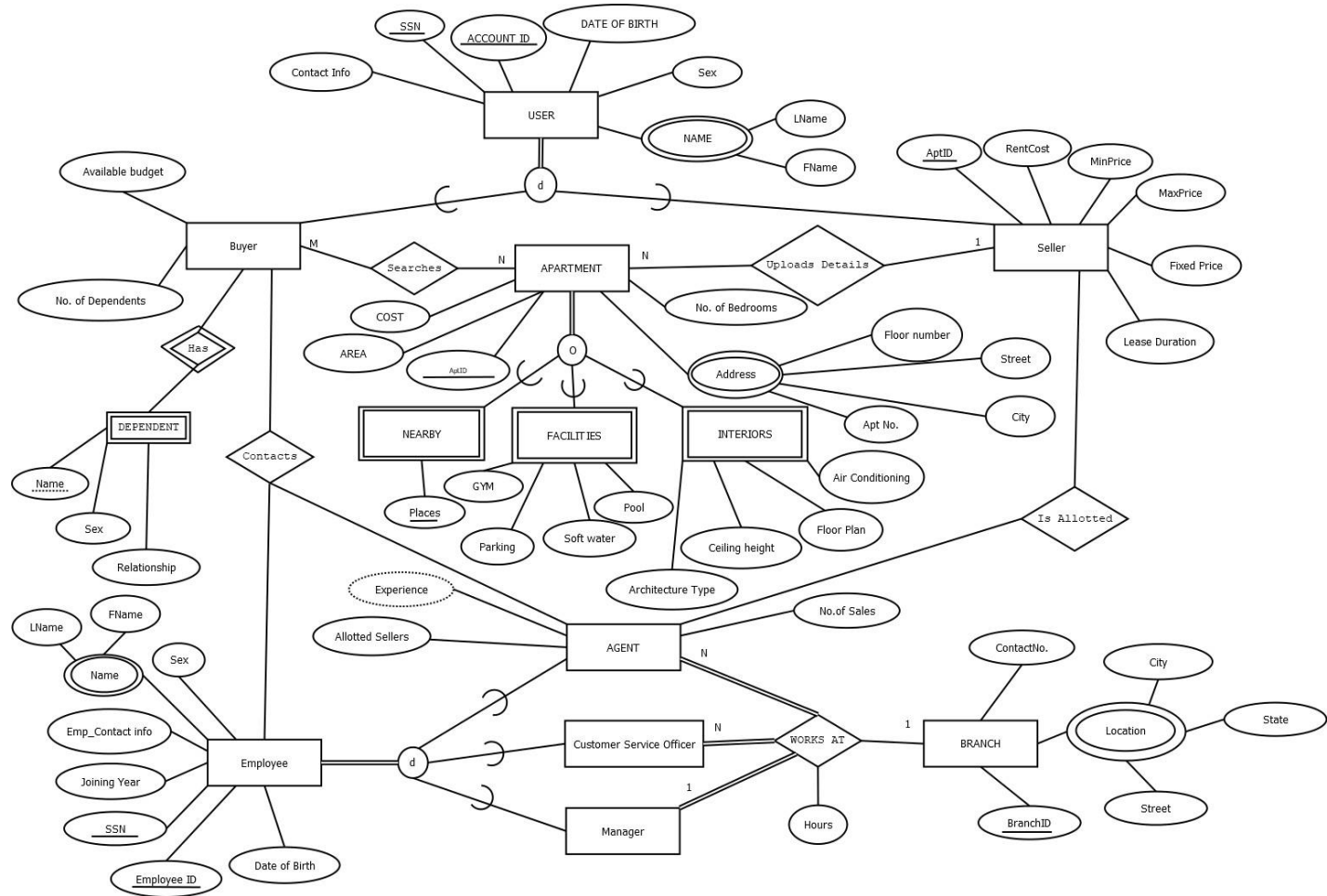
- Show the apartments in Arlington, TX which are located near a grocery store.
- Show an apartment be found in Dallas, TX that costs under 100000\$ and has a playschool nearby.
- Show all the apartments in New York with an architectural style that is French and has a floor plan of B2.
- Show the apartments with area 1000Square feet and nearby museum?
- Show the localities in Dallas, TX that have the cost less than 120k\$ and have facilities such as pool included within it.
- Show the apartment available in Dallas with abundant soft water.
- Show a Seller whose apartment has an architecture type of Japanese and facilities such as gym. Show the apartments that are in close proximity to public transport? Also, I wanted to specify that I am looking for an apartment that is cheaper than 100k\$.
- Show the Contact number of the Branch whose BranchID is 1000.
- Show a Seller who has a fixed price for his property and cost less than 50k\$.
- Show apartment which has a parking space alongside a nearby park.
- Show apartments with a height of ceiling of 8 feet.
- Show all the apartments with no Air conditioning.
- Show me the contact info of Employee with the First Name David.
- Show me the Names of All the Customer Service Officers that have joined the branch in year 1997.
- Show the apartment available in Dallas with abundant soft water with a maximum rent of 2000\$ per month.
- Show apartments that are close to any stadium and have a number of bedrooms to be a maximum of 2, also with a lease duration of 12months with a rent no more than 3000\$.
- Show the top 5 agents with the highest amount of experience.
- Show the total number of apartments near play school.
- Show all the branches where more than two employees work in ascending order of number of employees.
- Show Sellers whose apartment has an architecture type of Japanese and facilities such as gym.
- Show all the employees who have the same first names with respect to any other employee and display them in alphabetical order of their first names.

## **Step 4 Assumptions:-**

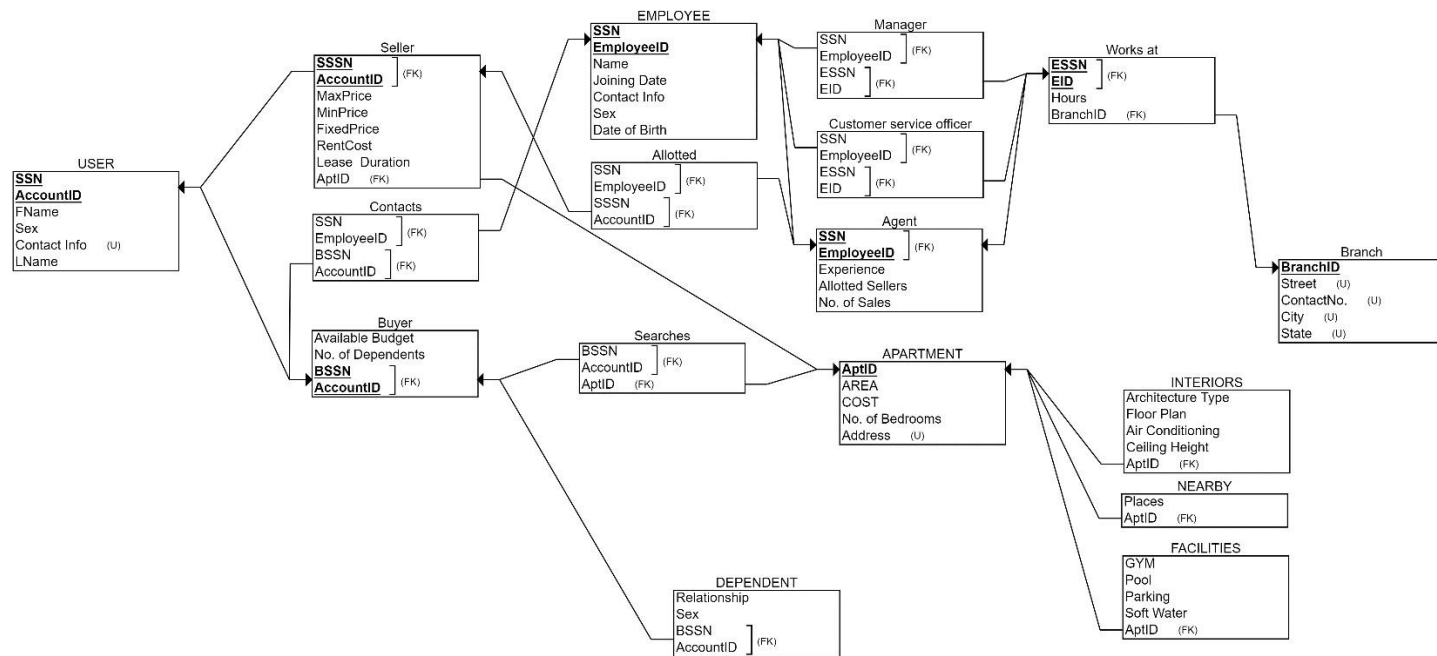
- Multiple agents can work at a company headquarter
- Direct Contact between Buyer and Seller is not possible.
- No apartment or bungalow is situated in a rural area(region).
- Every property is either one of the many architecture types and floor plans.
- The age of all the users is above the legal age for doing property transactions.
- One Seller can have multiple buyers.
- One Buyer can have only one seller.
- Multiple agents can work at the same headquarters.
- A headquarter is managed by a single manager.
- No seller is allotted more than one agent to contact to.

## Phase 2 Documentation

### Step 5 EER DIAGRAM (please zoom for clearer view):-



## Step 6 Relational Database Schema (please zoom for clearer view):-



User(SSN, AccountID, FName, LName, Sex, ContactInfo)

Contacts( SSN, EmployeeID, BSSN, AccountID)

Buyer(Available Budget, No. of Dependents, BSSN , AccountID )

Seller(SSSN, AccountID, MaxPrice, MinPrice, FixedPrice, RentCost, AptID,Lease Duration)

Agent(SSSN,EmployeeID,Name,Joining Date, Contact Info,Sex, Date of Birth)

Allotted(SSN,EmployeeID,SSSN,AccountID)

Apartment(AptID, AREA,COST,No.of Bedrooms, Address)

Dependent(Relationship,Sex,BSSN,AccountID)

INTERIORS(Architecture Type, Floor Plan, Air Conditioning, Ceiling Height,AptID)

FACILITIES(GYM,Pool,Parking,Soft Water, AptID)

NEARBY(Places,AptID)

Customer Service Officer(SSN,ESSN,EmployeeID,EID)



Manager(SSN,ESSN,EmployeeID,EID)

WorksAt(ESSN,EID,Hours,BranchID)

Branch(Street,ContactNo., City,State,BranchID)

Dependent(Relationship,BSSN,Sex,AccountID)

## Step 7 Relational Algebra expressions for the Queries:-

- 1) Show the apartments in Arlington, TX which are located near a grocery store?

$$\text{NEAR\_BY} \leftarrow \pi_{\text{Apt\_Id}} \left( \sigma_{\text{Places} = \text{"Grocery\_Store"}} (\text{NearBy}) \right)$$
$$\text{APTS} \leftarrow \pi_{\text{Apt\_Id}, \text{Area}, \text{Street}, \text{Apt\_No}, \text{City}} \left( \sigma_{\text{City} = \text{"Arlington"}} (\text{Apartment}) \right)$$
$$\text{APTS} \bowtie \text{NEAR\_BY}$$
$$\text{APTS.Apt\_Id} = \text{NEAR\_BY.Apt\_Id}$$

- 2) Show an apartment be found in Dallas, TX that costs under 10000\$ and has a playschool nearby.

NEAR\_BY  $\leftarrow \pi_{\text{Apt\_Id, Places}} (\sigma_{\text{Places} = \text{"Play School"}} (\text{NearBy}))$

APTS  $\leftarrow \pi_{\text{Apt\_Id, Area, Street, Apt\_No, City, Cost}} (\sigma_{\text{City} = \text{"Dallas"} \text{ AND } \text{Cost} \leq 10000} (\text{Apartment}))$

APTS  $\bowtie$  APTS.Apt\_Id = NEAR\_BY.Apt\_Id

- 3) Show all the apartments in New York with an architectural style that is french and has a floor plan of B2.

3)

APTS  $\leftarrow \pi_{\text{Apt\_Id, Area, Street, Apt\_No, City}} (\sigma_{\text{City} = \text{"Chicago"}} (\text{Apartment}))$

INTERIOR  $\leftarrow \pi_{\text{Apt\_Id, Floor\_Plan, Architecture\_Type}} (\sigma_{\text{Architecture\_Type} = \text{"French"} \text{ AND } \text{Floor\_Plan} = \text{"B2"}} (\text{Interior}))$

APTS  $\bowtie$  INTERIOR  
APTS.Apt\_Id = INTERIOR.Apt\_Id

- 4) Show the apartments with area 1000 Square feet and nearby museum?

$NEAR\_BY \leftarrow \pi_{Apt\_Id, Places} (\sigma_{Places = "museum"})$   
 (Nearby))

$APTS \leftarrow \pi_{Apt\_Id, Street, Apt\_No, City, Area} (\sigma_{Area = 1000})$   
 (Apartment))

$APTS \bowtie NEAR\_BY$   
 $APTS.Apt\_Id = NEAR\_BY.Apt\_Id$

- 5) Show the localities in Dallas, TX that have the cost less than 120k\$ and have facilities such as pool included within it.

$FACILITIES \leftarrow \pi_{Apt\_Id, Soft\_Water} (\sigma_{Soft\_Water = "yes"})$   
 (Facilities))

$APT \leftarrow \pi_{Apt\_Id, Street, Apt\_No, City} (\sigma_{City = "Dallas"})$   
 (Apartment))

$APT \bowtie FACILITIES$   
 $APT.Apt\_Id = FACILITIES.Apt\_Id$

- 6) Show the apartment available in Dallas with abundant soft water.

$$\text{FACILITIES} \leftarrow \pi_{\text{Apt-Id, Soft-Water}} (\sigma_{\text{Soft-Water} = \text{"yes"}})$$
  
(Facilities))

$$\text{APT} \leftarrow \pi_{\text{Apt-Id, Street, Apt-No, City}} (\sigma_{\text{City} = \text{"Dallas"}})$$
  
(Apartment))

$$\text{APT} \bowtie \text{FACILITIES}$$

$$\text{APT.Apt-Id} = \text{FACILITIES.Apt-Id}$$

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- 7) Show a Seller whose apartment has an architecture type of Japanese and facilities such as gym.

FACILITIES  $\leftarrow \pi_{\text{Apt\_Id}, \text{Gym}} (\sigma_{\text{Gym} = \text{"yes"}} (\text{Facilities}))$

INTERIOR  $\leftarrow \pi_{\text{Apt\_Id}, \text{Architecture\_Type}} (\sigma_{\text{Architecture\_Type} = \text{"Japanese"}} (\text{Interiors}))$

FAC\_INTERIOR  $\leftarrow \text{FACILITIES} \bowtie \text{INTERIOR}$   
 $\text{FACILITIES.Apt\_Id} = \text{INTERIOR.Apt\_Id}$

APT  $\leftarrow \pi_{\text{cost}, \text{Apt\_Id}} (\text{Apartment})$

APT\_TO\_SELL  $\leftarrow (\text{FAC\_INTERIOR}) \bowtie \text{APT}$   
 $\text{FAC\_INTERIOR.Apt\_Id} = \text{APT.Apt\_Id}$

SELLER  $\leftarrow \pi_{\text{Pname}, \text{Lname}} (\text{Seller})$

SELLER  $\bowtie$  APT\_TO\_SELL

$\text{SELLER.MinPrice} < \text{APT\_TO\_SELL.cost}$   
 AND  
 $\text{SELLER.MaxPrice} > \text{APT\_TO\_SELL.cost}$

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- 8) Show the apartments that are in close proximity to public transport? Also, I wanted to specify that I am looking for an apartment that is cheaper than 100k\$.



NEAR\_BY  $\leftarrow \pi_{\text{Apt\_Id, Places}} (\sigma_{\text{Places} = \text{"Public transport"}} (\text{NearBy}))$

APTS  $\leftarrow \pi_{\text{Apt\_Id, Street, Apt\_No, City, Cost}} (\sigma_{\text{Cost} < 100000} (\text{Apartment}))$

APTS  $\bowtie$  NEAR\_BY  
APTS.Apt\_Id = NEAR\_BY.Apt\_Id

- 9) Show the Contact number of the Branch whose BranchID is 1000.

$\pi_{\text{Branch Id, Contact no.}} (\sigma_{\text{Branch Id} = \text{"1000"}} (\text{Branch}))$

- 10) Show a Seller who has a fixed price for his property and cost less than 50k\$.

SELLER  $\leftarrow \pi_{\text{Fixed-Price, SSN}} (\sigma_{\text{Fixed-Price} < 50000} (\text{Seller}))$

USER  $\leftarrow \pi_{\text{SSN, FName, LName}} (\text{User})$

USER  $\bowtie$  SELLER  
USER.SSN = SELLER.SSN

11) Show apartment which has a parking space alongside a nearby park.

NEAR\_BY  $\leftarrow \pi_{\text{Apt\_Id, Places}} (\sigma_{\text{Places} = \text{"Park (Near By)"}})$

APTS  $\leftarrow \pi_{\text{Apt\_Id, Street, Apt\_No., City}} (\text{Apartment})$

FACILITIES  $\leftarrow \pi_{\text{Apt\_Id, Parking}} (\sigma_{\text{Parking} = \text{"Yes"} (\text{Facilities}))$

APTS\_WITH\_PARKING  $\leftarrow$  APTS  $\bowtie$  FACILITIES  
APTS.Apt\_Id = FACILITIES.Apt\_Id

APTS\_WITH\_PARKING  $\bowtie$  NEAR\_BY  
APTS\_WITH\_PARKING.Apt\_Id = NEAR\_BY.Apt\_Id

12) Show apartments with a height of ceiling of 8 feet.

INTERIORS  $\leftarrow \pi_{\text{Apt\_Id, Ceiling\_height}} (\sigma_{\text{Ceiling\_height} = 8} (\text{Interiors}))$

APT  $\leftarrow \pi_{\text{Apt\_Id, Street, Apt\_No., City}} (\text{Apartment})$

APT  $\bowtie$  INTERIORS  
APT.Apt\_Id = INTERIORS.Apt\_Id



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13) Show all the apartments with no Air conditioning.

$NO\_AC \leftarrow \pi_{Apt\_Id, Air\_Conditioning}$   
 $(\sigma_{Air\_Conditioning = "No"})$   
 $(Interiors))$

$APT \leftarrow \pi_{Apt\_Id, Street, Apt\_No, City} (Apartment)$

$APT \bowtie NO\_AC$   
 $APT.Apt\_Id = NO\_AC.Apt\_Id$

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14) Show me the contact info of Employee with the First Name David.

$\pi_{FName, LName, Emp\_Contact\_Info} (\sigma_{FName = "David"})$   
 $(Employee))$

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15) Show me the Names of All the Customer Service Officers that have joined the branch in year 1997.

$CUST\_OFFER \leftarrow \pi_{SSN}(Customer\ Service\ Officer)$

$EMP \leftarrow \pi_{SSN, Employee\ Id, Joining\ Year, FName, LName}$

$(\sigma_{Joining\ Year = 1997}$   
 $(Employee))$

$CUST\_OFFER \bowtie EMP$

$CUST\_OFFER.SSN = EMP.SSN$

- 16) Show the apartment available in Dallas with abundant soft water with a maximum rent of 2000\$ per month.

$Softwater \leftarrow \Pi_{AptID, Softwater} (\sigma_{Softwater = "Yes"} (Facilities))$

$Cost \leftarrow \Pi_{AptID, Cost} (\sigma_{Cost \leq 2000} (Apartment))$

$Softwater \bowtie Cost$

$Softwater\_AptID = Apartment.AptID$

- 17) Show apartments that are close to any stadium and have a number of bedrooms to be a maximum of 2, also with a lease duration of 12 months with a rent no more than 3000\$.

$Nearby \leftarrow \Pi_{AptID, Nearby} (\sigma_{places = "stadium"} (Nearby))$

$Bedroom \leftarrow \Pi_{AptID, No. of bedroom} (\sigma_{No. of bedroom \leq 2} (Apartment))$

$Lease \leftarrow \Pi_{AptID, Lease duration} (\sigma_{Lease duration = 12} (Seller))$

$Rent \leftarrow \Pi_{AptID, Rent Cost} (\sigma_{Rent Cost \leq 3000} (Seller))$

$Nearby \bowtie Bedroom \bowtie Lease \bowtie Rent$

$Nearby.AptID = Bedroom.AptID = Lease.AptID = Rent.AptID$

**Conclusion(Phase II)**:- This phase of the project opened a new facet of possibilities toward the views from which the project can be viewed. The Enhanced Entity Relation Diagram(EER) helped in understanding the exact structure in which the entities and attributes are placed in the project which was not possible to know until this very point. The relational schema made the concepts of schema and different types of relationships that existed between the various entities such as cardinality ratios, specialization and generalization were made clear, also the various features used in it such as select , project , union, disjoint. The relation mapping helped in getting an overview of the system which we were working in and made the bookmarking of all the attributes and their dependencies on the various entities easier. The project is far from its best version but still a better version nonetheless than the previous one. The project output can be made better by making an actual database and comparing the results that we achieve when the operations we carried out in this phase are carried out on it. Moreover, the whole point of doing this phase was to learn the various ways of viewing the system and preparing the system for the more complex operations it will have to perform in the future.

## **System Configurations:-**

Hardware and Software specializations used to create the project:

Operating System: Ubuntu 18.04.2 LTS

Memory: 15.5 GiB

Processor: Intel® Core™ i7-7820HQ CPU @ 2.90GHz × 8

Graphics: Intel® HD Graphics 630 (Kaby Lake GT2)

OS type: 64-bit

Disk: 109.1 GB

Server: Apache Tomcat 9.0.27

MySQL version: Ver 14.14 Distrib 5.7.28

MySQL connector JAR: mysql-connector-java-8.0.15.jar

IDE: IntelliJ Idea 2019.02 Ultimate version

Project SDK: JDK 1.8

Languages Used: HTML, CSS, Bootstrap4, JSP

Java EE version: Java EE 8

Java version: 11.0.4

## **Final Conclusion:-**

We created a web application that incorporates all the functionalities of the database and the queries. The major takeaways from the project were the concepts of The Enhanced Entity Relation Diagram(EER) that helped in understanding the exact structure in which the entities and attributes are placed in the project. The relational schema made the concepts of schema and different types of relationships that existed between the various entities such as cardinality ratios, specialization and generalization were made clear, also the various features used in it such as select, project, union, disjoint. The relation mapping helped in getting an overview of the system which we were working in and made the bookmarking of all the attributes and their dependencies on the various entities easier. Some more things that the project taught us were Time Management, the project aspects to be considered during the setting up of a Project, Creation of a responsive Graphical User Interface using HTML, Bootstrap. Moreover, we also learned to fetch records dynamically according to the user input by using the java logic in our code. We learned the process of connecting the server to data in the Database.

We could have achieved a better output by incorporating a security checkup such as providing a Unique ID while also checking if the email the user input was valid. Another thing we could have done was incorporating a larger and more precise data instances, doing this could have helped in enriching the data and making it more viable for future users. We could have made a system for abstracting the data and hiding certain data from users that did not have the authorization to view it. We also could have implemented a recommendation system for recommending the user properties he might be interested in based on his search history, thus making the site more relevant time to time and more user-friendly. We could have included the operations such as Create, Update and Delete for easier addition of new data and removal of unwanted data thus making the database more dynamic and editable. Currently, we are at the 4th phase of our project which is the Final Phase, but even though it is Final it is not the best version of the project the highest potential is yet to be met, nonetheless it is still a better version than the before and in conclusion it taught us a lot of the possibilities and uses of database systems.