جامعة الامير سلطان
PRINCE SULTAN UNIVERSITY

Maher Development System✔️

Prince Sultan University

Department of Computer & Information Sciences

Introduction to Database Systems Project

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Phase 1

Describing the Information System to be Developed

Introduction:

Welcome to the Maher Development System, a transformative platform designed to elevate professional training at Prince Sultan University (PSU). This document serves as your gateway into the Maher system, offering a comprehensive view of its background, motivation, organizational context, and its defined purpose and scope. We will delve into its data requirements, functional/non-functional system aspects, and ethical considerations drawn from the IEEE and ACM codes of ethics, essential in the realm of database analysis. Furthermore, this document will illustrate different phases of designing the database required for this system. As for phase one, description of the organization, purpose and scope is identified. Additionally, data, functional, and nonfunctional requirements are stated. For phase two, an ER/EER model will be shown describing the entities, attributes, and relationships within this system specifying cardinalities, participation, generalization, and further details based on user-scenarios. Moving on to phase three, a relational schema will be drawn as the first step in implementing the database so that queries in SQL are written according to it. Also, a data dictionary will be provided to give a detailed description of the entities. As for phase four, tables will be created using Oracle, it will contain all required integrity & column constraints. Eventually for phase five, we meet the specification by writing basic & advanced SQL queries, and a presentation to showcase our work. At each phase, IEEE and ACM Professional Code of Ethics will be used and specified. To emphasize, the “Maher " system embodies PSU's commitment to nurturing excellence among faculty members.

Background:

Prince Sultan University (PSU) has consistently upheld high standards of education, facilitating the successful careers of its graduates. Many PSU students secure positions at prominent companies immediately after completing their CO-OP training. The continuous development of PSU's faculty members has played a pivotal role in maintaining this high-quality education. Each academic department at PSU conducts professional level training activities, offering faculty members the opportunity to accumulate points by participating. These points are recorded in each faculty member's profile. The primary aim of these training activities is to enhance faculty members' knowledge and professional skills, ultimately ensuring the delivery of efficient education to students. Furthermore, these activities serve to recognize faculty excellence, potentially leading to salary raises and certificates. A dedicated system is necessary to manage this integral process effectively.

Description of the Organization:

The term "Maher" is derived from the Arabic word meaning skillful, reflecting the essence of the Maher Development System. This system is designed to benefit both academic departments and faculty members, ensuring an adept and streamlined process. Through this system, departments can showcase their professional training activities on a designated web page, providing comprehensive information such as duration, purpose, education term, and the number of hours involved. Faculty members can seamlessly register for these activities and, at the same time, their participation and achievements are tracked.

Purpose and Scope of the Information System (IS):

The Maher Development System's core purpose is to enable PSU faculty members to register for a variety of professional training activities. The system meticulously records each faculty member's points and the skills they acquire through their participation. It also identifies faculty members who excel professionally, either as attendees or presenters. The system's scope is restricted to PSU users, which includes faculty members and department employees. Diverse interfaces are designed to cater to the unique needs of each user group.

User View:

- Log-in Page: Allows users to sign in.
- Search Page: Facilitates users in searching for professional training activities by department, time, date, or activity name.
- Department Page: Provides a comprehensive list of all professional training activities.
- Evaluation Survey Page: Permits users to provide feedback on activities and presenter skills.

- Issue-Ticketing Page: Allows users to raise complaints and make recommendations for improvement.

Faculty Member View:

- Profile Page: Displays faculty members' skills, certificates, points acquired, and bibliographic information.
- Presenter Profile Page: Highlights presenter skills, points, certificates, and bibliographic information.
- Activity Details Page: Offers in-depth information about each activity.

Department Employees View:

- **Chairperson View**
- Dashboard: Provides access to event information, including attendance, the number of events offered per month, duration, and a general satisfaction chart of attendees.
- Table Page: Lists the most outstanding faculty members based on their contribution as presenters, points, certificates, and new skills acquired.
- **Department Administrators View**
- Evaluation Surveys Page: Displays recorded surveys for activities and presenters.
- Issue-Ticketing Page: Allows the filing of complaints and recommendations for improvement.
- Activity Information Page: Provides a form to announce professional training activities.
- Manual Registration Page: Enables manual registration for activities.
- User Profile Management Page: Allows administrators to access and modify user profiles.

Requirement Elicitation Method:

To establish the primary requirements for this system, we conducted interviews with two employees from the Teaching and Learning Center (TLC) at PSU, department employees, and three lecturers. These interviews helped us gain valuable insights into how the system can best serve the purpose of professional training. The bibliographic information for the stakeholders remains anonymous to ensure confidentiality upon their request.

Key legend: (entities attributes comments/relationships/participation & cardinality)

Scenario:

1. Users can be faculty members of different ranks , or can be administrative employees.
2. Users are identified by their Iqama Number/SSN, PSU_ID, and PSU_mail. Users will have Name (first and last), password, LinkedIn Username, and phone number.
3. All users listed above will inherit these attributes and each user will have additional specific attributes depending on their role.
4. Faculty is also described by rank.
5. Administrative employees are described by their job_position, administrative employees work in Admin Offices that are described by its office number.
6. Faculty members can manage one AC Department. An AC department must be managed by one faculty member.
7. Faculty members must work in one department. An AC department can have many faculty members working for them.
8. Academic Department will have two attributes, Dep Number, Dep name.
9. An AC department must have one college. A college must have many departments. A college is described by its name, campus which can be female or male.
10. Professional-training activities are described by activity id, activity title, activity type, start date, end date, learning outcome(s).

11. PT activities must be conducted in one or more locations. A location must conduct one PT Activity. A location is described by loc_id, loc_type, building number, room number, floor number.
12. A PT activity must also be presented by an external organization, which is described by a presenter_Name. The external organization is described by org_name, Address, email, and phone.
13. Users must participate in many PT activities. A PT activity is attended by many users. Their role as presenter, organizer, and participants is recorded. The Ticket number is issued for every participant. The points are also recorded for the activity they participated in according to their roles in the activity. A certificate is issued to the users based on the role they have in the PT activity.
14. A role is described by role_name, points.
15. The users must fill out questions that have a satisfaction score for many PT activities and a PT activity must receive many satisfaction scores.
16. A question has questions and answers, and each question is a part of an Evaluation survey. An evaluation survey consists of questions. A question *cannot exist* without the evaluation survey. An evaluation survey is identified by survey_no and date.
17. A PT contains many resources. Resources *cannot exist* without PT Activity. A resource is described by handouts and links.

Data Requirements:

Entity Definition Table:

Entity	Description	Identifier	Attribute
User	User is a general entity which allows access to the system.Can either be faculty members or administrative employees	SSN/Iqama number	-SSN/Iqama number -PSU_ID -Name (first and last). -Password. -PSU_mail -LinkedIn username. -Phone_Number

Faculty Member	Inherits User's attributes in addition to role-specific attributes	Inherited key attribute from superclass	-Rank
College	An entity that has information about each college's name and campus	College_name	-College name -Campus
Administrative Employee	Inherits User's attributes in addition to role specific attributes	Inherited key attribute from superclass	-Job_position
Admin Offices	An Entity identified by Office_Number	Office_Number	-Office_Number - Office_Name
Professional-Training Activity	An entity that has information about activity id, activity title, type, start date, end date, and learning outcome(s).	Activity id	-Activity_id -Activity title -Type -Start date -End date -Learning outcome(s)
AC Department AC= Academic	An attribute identified by Dep name, Dep Number	Dep_Number	-Dep_Number -Dep Name
Location	An entity that is described by loc_id, loc_type, building number, room number, floor number.	Loc_id	-Loc_id -Loc_type -Building number -Room number -Floor number
Role	An entity that is described by role name, and points.	Role name	-Role_name -Role points
External Organization	An entity that is described by organization Name, Address, email, and phone.	Org_Name	-Organization Name -Address -Email -Phone
Resources	A weak entity dependent on Professional Training Activity, defined by Handouts and Links	Activity id	-Handouts -Links

Relation Definition Table:

Relationship Name	Type (cardinality/ participation)	Attributes if found	Entities	Description
Managed	Binary, 1:1, TP:PP		AC Department and Faculty Member	A Faculty member manages an AC Department
Works	Binary, 1:N, TP:TP		AC Department and Faculty Member	A Faculty member works in an AC Department
Has	Binary, 1:N, TP:TP		College and AC Department	A College has many AC Departments.
Conducted_in	Binary, 1:N, TP:PP		Professional-training Activity and Location.	Professional-training Activities are conducted in one or many Locations.
Presents	Binary, 1:N, PP:PP	-Presenter_Name -Gender	External Organization and Professional-training Activity.	An External Organization presents Professional-training Activities.
Participates In	Ternary, 1:N:N, TP:TP:TP	-Ticket_no -Certificate (based on role) -Points_earned (depending on role)	Role, User and Professional -training Activity	Users participate in many Professional-training Activities, each participant has a Role.
Fills	Ternary, N:N:N,	-Answers	User , Question	Users fill the Question of

	PP:TP:TP		and Professional-training Activity	many Professional-training Activities.
Contains	Binary, 1:N, PP:TP *weak*		Professional training activity and Resources	Professional training activity has many Resources.
Consists	Binary, 1:N, TP:TP *weak*		Evaluation Survey and Question	An Evaluation Survey consists of many Questions.
Works In	Binary, N:1, TP:PP		Administrative Employee and Admin Offices	An Administrative Employee works in Admin Offices.

Attribute Definition Table:

Entity Name	**Attribute**	**Type**	**Description**
User	SSN/Iqama number	Simple Key attribute	Unique user identifier
	Name	Composite attribute (first and last)	User's full name
	Password	Simple attribute	User's preferred choice to log in
	PSU_mail	Simple attribute	Email assigned to user
	PSU_ID	Simple attribute	PSU ID of each user
	LinkedIn username	Simple attribute	LinkedIn username
	Phone Number	Simple attribute	User's phone number
Faculty Member	Rank	Simple attribute	Faculty member's Rank
External Organization	Org_Name	Simple key attribute	External organization's name identifier
	Address	Simple attribute	External organization's Address

	Phone	Simple attribute	External organization's phone number
	Email	Simple attribute	External organization’s email
College	College_name	Simple key attribute	Identifier of each college
	Campus	Composite attribute	Male / Female
Administrative Employee	Job_position	Simple attribute	Identifies each employee’s job
Admin Offices	Office_Number	Simple key attribute	Identifier of each admin’s office
	Office_name	Simple attribute	Specifies the name of each office
Professional-Training Activity	Activity_id	Simple key attribute	Activity identifier
	Activity title	Simple attribute	Specifies the title of activity
	Type	Simple attribute	Specifies the type of the activity
	Start date	Simple attribute	Specifies the start date of the activity
	End date	Simple attribute	Specifies the end date of the activity
	Learning outcome(s)	Multivalued attribute	Specifies the learning outcome(s)
AC Department	Dep_Number	Simple key attribute	Identifies each departments’ number
	Dep Name	Simple attribute	Specifies the name of department
Location	Loc_id	Simple key attribute	Identifier of location
	Loc_type	Simple attribute	Specifies location type
	Buildingno	Simple attribute	Specifies building number
	Roomno	Simple attribute	Specifies room number
	Floorno	Simple attribute	Specifies floor number
Role	Role_name	Simple key attribute	Role identifier
	Points	Simple attribute	Specifies the amount of points according to the role in

			professional training activity
Evaluation Survey	Survey_No	Simple key attribute	Unique Identifier for each Survey done on professional training activity
	Survey Date	Simple attribute	Determines the date on which the survey is completed
	Score	Derived attribute	Determines the score acquired
Question	Qno ……..	Partial key attribute	Part of composite key (Survey No, Questions)
	Q_statement	Simple attribute	Contains statement of each question
Resources	Handouts ……	Partial key attribute	Part of composite key (Activity_id)
	Links	Simple attribute	Contains Links for each professional training activity that could be useful
Relationship between User, Question and Professional-Training Activity (FILLS)	Answers	Simple attribute	Contains Answers of Question
Relationship between User, Professional Training Activity, and Role (PARTICIPATES IN)	Ticket_no	Simple attribute	Determines number of Ticket
	Certificate	Simple attribute	Determines the certificate earned
	Points_earned (depending on role)	Derived attribute	Determines the points that an activity can add to faculty member's profile
Relationship between Professional Training Activity and External Organization (PRESENTS)	Presenter_Name	Simple attribute	Determines the name of each presenter when a professional training activity is being presented by an external organization
	-Gender	Simple attribute	Determines the gender of each presenter from the External Organization.

Functional System Requirements:

User:

- The system must register new users.
- The system must allow registered users to sign in using either the SSN/Iqama Number or PSU_mail.
- The system must allow users to verify their accounts using their phone number.
- The system shall redirect users to Search Page after verification.
- The system must allow users in the Search Page to search activity, either by name, department or time and date (search filters).
- The system must allow the user to view search results.
- The system shall redirect users to the Department Page.
- The system must display the data.
- The system must allow users to explore further information about a specific search result.
- The system shall redirect users to the Evaluation Survey Page.
- The system must allow the user to fill an evaluation survey.
- The system shall redirect users to the Help Page.
- The system must provide a mechanism for users to file complaints or submit tickets, recording all complaints.

Chairperson:

- The system shall allow chairpersons to access the activity' dashboard.
- The system shall display the events' information.
- The system shall allow chairpersons to view the activity's information.
- The system shall provide a Table Page for viewing.
- The system must allow the chairpersons to access the Table Page.

Department administrator:

- The system shall display the recorded surveys in the Evaluation Survey Page.
- The system must allow department administrators to view the surveys.
- The system must allow the user to file a complaint or issue a ticket by selecting the domain.
- The system must record the complaint.
- The system shall redirect department administrators to the Activity Information Page.
- The system must allow department administrators to fill-in information about activities.
- The system must record the information.
- The system must announce the recorded information on the dashboard, Search Page, and the relevant Department Page.
- The system must enable department administrators to manually register activities.
- The system must record the registered activities,
- The system must allow department administrators to access each user's profile.
- The system must allow department administrators to modify each user's profile.

Non-Functional Requirements:

1. **Usability:**
    - The system should have an intuitive and user-friendly interface for all user roles.
    - Response times for user interactions should be minimal, ensuring a smooth and efficient user experience.
    - The system should provide helpful error messages to guide users in case of data input errors.
2. **Performance:**
    - The system should be capable of handling a large number of concurrent users without significant degradation in performance.

- Response times for common user interactions, such as activity searches and profile updates, should be within acceptable limits (ex: under 2 seconds).
- The system should be optimized for efficient database queries and data retrieval.

3. **Scalability:**
   - The system should be designed to scale both vertically and horizontally to accommodate potential increases in user numbers and data volume.
   - The architecture should support future expansion and the addition of new features without requiring a complete system overhaul.
4. **Security:**
   - Data security is a paramount concern. The system must implement robust security measures to protect user data and privacy.
   - User authentication and authorization must be secure and reliable to prevent unauthorized access.
   - Sensitive data, such as user passwords, should be securely hashed and stored.
   - The system should regularly undergo security audits and vulnerability assessments.
5. **Reliability:**
   - The system must be available and operational 24/7 to accommodate users from different time zones.
   - Regular system backups and data redundancy should be in place to prevent data loss in case of system failures.
   - The system should provide error handling and logging to track and resolve issues promptly.
6. **Compatibility:**
   - The system should be compatible with a wide range of web browsers and devices to ensure accessibility for all users.
   - Cross-browser compatibility testing should be conducted regularly.
7. **Data Integrity:**
   - Data integrity and consistency are crucial. The system should implement database constraints and validation rules to ensure data accuracy.

- Data backups should be regularly performed to safeguard against data corruption or loss.

8. **Data Privacy and Compliance:**
    - The system should adhere to relevant data protection laws and regulations, ensuring the privacy of user data.
    - User consent for data processing and storage should be obtained and recorded.
    - Data access and modification should be logged and monitored for compliance and auditing purposes.
9. **Documentation:**
    - Comprehensive system documentation should be maintained to aid in system maintenance, troubleshooting, and future development.

These non-functional requirements are essential to ensure that the Maher Development System not only functions as intended but also delivers a high-quality user experience while maintaining data security and integrity.

Relevant clauses from the IEEE & ACM Professional Code of Ethics:

IEEE Code of Ethics:

A. To maintain public safety, health, and welfare.

B. To not discriminate based on gender, race, disability or any other characteristics.

C. To treat people fairly and with respect.

D. To not engage in any form of bullying or harassment.

E. To avoid physical and verbal injuries to people and their properties.

F. To secure other's privacy.

G. To support colleagues and co-workers in following the code of ethics.

ACM Code of Ethics:

1. GENERAL ETHICAL PRINCIPLES.

1.1 Contribute to society and to human well-being, acknowledging that all people are stakeholders in computing.

1.2 Avoid harm.

1.3 Be honest and trustworthy.

1.4 Be fair and take action not to discriminate.

1.5 Respect the work required to produce new ideas, inventions, creative works, and computing artifacts.

1.6 Respect privacy.

1.7 Honor confidentiality.

2. PROFESSIONAL RESPONSIBILITIES.

2.2 Maintain high standards of professional competence, conduct, and ethical practice.

2.3 Know and respect existing rules pertaining to professional work.

2.4 Accept and provide appropriate professional review.

2.6 Perform work only in areas of competence.

2.8 Access computing and communication resources only when authorized or when compelled by the public good.

2.9 Design and implement systems that are robustly and usably secure.

3. PROFESSIONAL LEADERSHIP PRINCIPLES.

3.1 Ensure that the public good is the central concern during all professional computing work.

3.2 Articulate, encourage acceptance of, and evaluate fulfillment of social responsibilities by members of the organization or group.

3.5 Create opportunities for members of the organization or group to grow as professionals.

3.6 Use care when modifying or retiring systems.

4. COMPLIANCE WITH THE CODE.

4.1 Uphold, promote, and respect the principles of the Code.

4.2 Treat violations of the Code as inconsistent with membership in the ACM.

Teamwork Distribution & Strategy:

Name	Task Assigned
Haifa	Introducing the System, background, purpose and scope of the IS. Description of the organization. Requirement Elicitation and Data Requiremnt.Final Review.
Jana	Requirement Elicitation Method, Data requirement, Scenario, Functional System Requirements, Relationship Table Review other team members work with feedback.

Raghad	Data Requirement, Non-Functional Requirements, reviewed thoroughly over all other parts of the document with slight modifications
Fouz	IEEE and ACM Codes of Ethics and thoroughly done review, Suggestions of ideas, formatting the document.

Strategy:

1. **Idea Brainstorming**: We initiated the project with a brainstorming session, during which we discussed various concepts and eventually decided on the Maher system.
2. **Team Collaboration**: Roles and tasks were distributed among team members, and we commenced work on our respective assignments.
3. **Team Review**: After completing tasks, each team member reviewed the work and offered their comments and suggestions for improvement.

Phase 2

ER/EER Modelling

IEEE Code of Ethics:

- A. To maintain public safety, health, and welfare.

We implemented this clause by designing the EER diagram in a way that protects the privacy and confidentiality of user data. We also implemented data auditing to track who has accessed and modified user data. This can help to deter and detect unauthorized access and misuse of data.

- B. To not discriminate based on gender, race, disability, or any other characteristics.

We implemented this clause by designing the EER diagram in a way that does not promote or facilitate any form of discrimination. For example, we did not include any attributes in the EER diagram that could be used to discriminate against users, such as race, religion, or sexual orientation.

- C. To treat people fairly and with respect.

We implemented this clause by designing the EER diagram in a way that is accessible to users with disabilities and in a way that is easy to understand and navigate.

- F. To secure other's privacy.

We implemented this clause by using anonymization and pseudonymization to protect user privacy. For example, we stored usernames instead of real names. We also used access control lists to restrict access to sensitive data. For example, we restricted access to faculty member profiles to faculty members only.

ACM Code of Ethics:

- 1.1 Contribute to society and to human well-being, acknowledging that all people are stakeholders in computing.

We implemented this principle by designing the EER diagram in a way that benefits all users of the Maher Development System, including faculty members, department employees, and students. For example, the EER diagram will make it easier for faculty members to find and register for professional training activities. It will also make it easier for department employees to manage professional training activities and to track faculty member participation.

- 1.2 Avoid harm.

We implemented this principle by designing the EER diagram in a way that avoids causing any harm to users or to the system itself. For example, we implemented data auditing to track who has accessed and modified user data. This can help to deter and detect unauthorized access and misuse of data. We also designed the system in a way that is accessible to users with disabilities.

- 1.3 Be honest and trustworthy.

We implemented this principle by accurately and truthfully documenting the EER diagram. This will help users and developers to understand how the system works and how their data is being used.

- 1.4 Be fair and take action not to discriminate.

We implemented this principle by designing the EER diagram in a way that is fair and equitable for all users, regardless of their gender, race, disability, or any other characteristics. For example, we did not include any attributes in the EER diagram that could be used to discriminate against users.

- 1.5 Respect the work required to produce new ideas, inventions, creative works, and computing artifacts.

We implemented this principle by respecting the work of other developers and by not infringing on their intellectual property rights. For example, we did not copy any existing EER diagrams without permission.

- 1.6 Respect privacy.

We implemented this principle by designing the EER diagram in a way that respects the privacy of users and by protecting their data from unauthorized access. For example, we used anonymization and pseudonymization to protect user privacy, and we used access control lists to restrict access to sensitive data.

- 1.7 Honor confidentiality.

We implemented this principle by designing the EER diagram to protect the confidentiality of any sensitive data that it stores

We believe that these ethical considerations are essential for designing database systems that are secure, privacy-preserving, and accessible to all users.

Business Rules (Credentiality and Participation):

-Registration Requirement (Participation - Mandatory): Every PSU faculty member must register for the Maher Development System to access professional training activities.

-Activity Enrollment (Cardinality - Many-to-Many): Faculty members can enroll in multiple professional training activities, and each activity can have multiple faculty members.

-Points Tracking (Participation - Mandatory): The system must track points earned by every faculty member participating in professional training activities.

-Skills Acquisition (Cardinality - One-to-Many): Each faculty member can acquire multiple skills through their participation in various activities.

-Professional Excellence Recognition (Cardinality - One-to-One): The system can recognize one faculty member as excelling professionally in a particular activity.

-Presenter Participation (Participation - Optional): Faculty members can choose to participate as presenters in professional training activities, but it is not mandatory.
-User Access Control (Participation - Mandatory): The system should ensure that only PSU users (faculty members and department employees) can access the system.

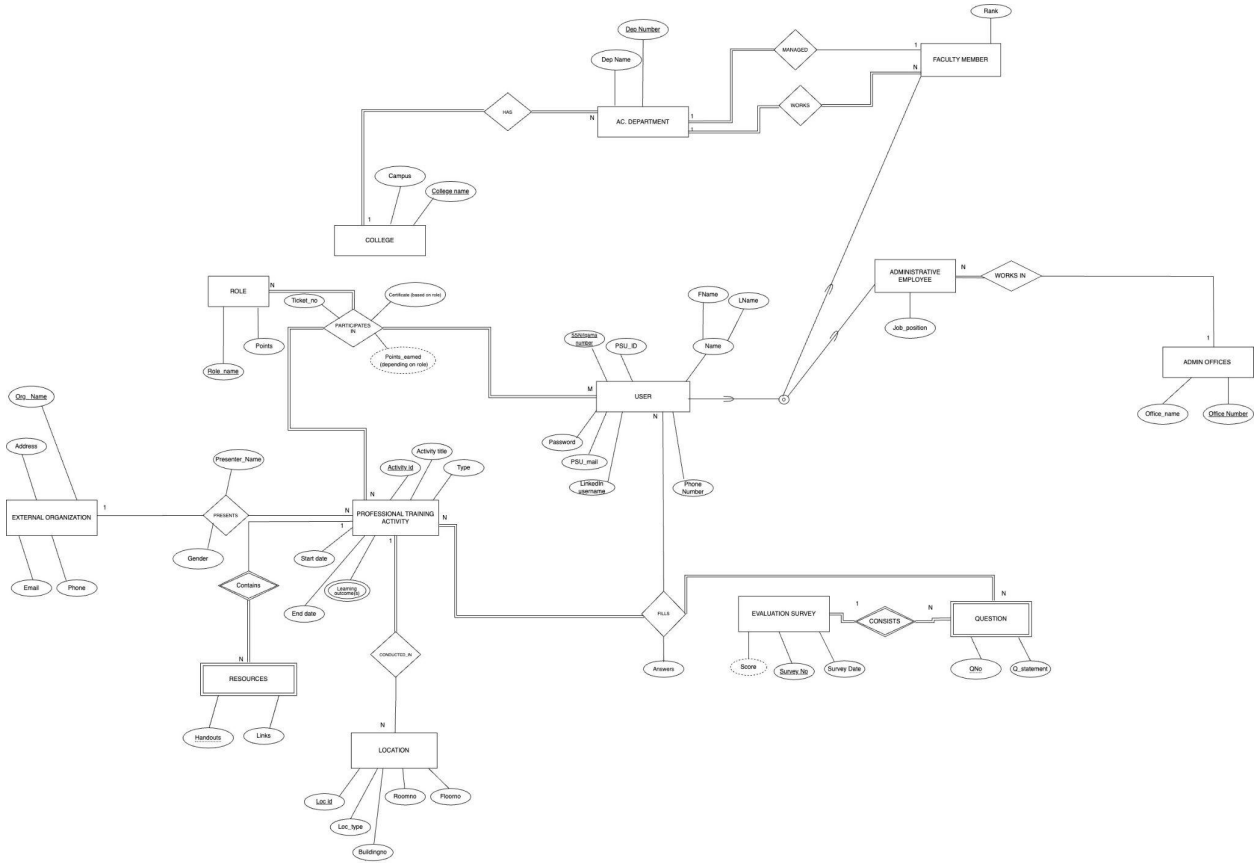
-User Interfaces (Cardinality - One-to-Many): The system provides multiple interfaces tailored to the unique needs of faculty members and department employees.

-Activity Evaluation (Cardinality - One-to-Many): Each professional training activity can have multiple evaluations or reviews from participating faculty members.

- Activity History (Cardinality - One-to-Many): The system maintains a history of all past professional training activities, allowing faculty members to refer to their previous participation.

- EER Model:

  Note: provided an extra landscape orientation for a clearer/more defined view.



[EER draw.io link]

Teamwork Distribution & Strategy:

Name	Task Assigned

Haifa	EER modeling, Entities and Attributes, modifications of phase 1 (Scenario, Entity Definition Table, Attribute Table, Relationship Table) alongside Jana. Final Review over the document and proofreading.
Jana	EER modeling, Relationships between entities, modifications of Phase I (Scenario, Entity Table, Relationship Table, Attribute Table) alongside Haifa to ensure data consistency. Review other teamworks work and final review. Overall format.
Raghad	IEEE and ACM Code of Ethics. Final document review.
Fouz	Business Rules (Credentiality and Participation) and final review of the document.

Strategy:

1. **Idea Brainstorming**: We initiated the phase with a brainstorming session, during which we discussed various conceptual representations and eventually decided on the final EER Model shown above.
2. **Team Collaboration**: Roles and tasks were distributed among team members, and we commenced work on our respective assignments.
3. **Team Review**: After completing tasks, each team member reviewed the work and offered their comments and suggestions for improvement.

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Phase 3

Designing Database and Normalization

Data dictionary:

PUSER

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
SSN/Iqama number	PK				CHAR	9
PSU_ID		Not null, unique			Varchar	9
Fname		Not null			Varchar	20
Lname		Not null			Varchar	20
Password		Not null			Varchar	45
PSU_mail		Not null, unique			Varchar	70
LinkedIn_username					Varchar	30
Phone_Number		Not null, unique			Char	10

FACULTY_MEMBER

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
SSN/Iqama number	PK, FK		USER	SSN/Iqama number	CHAR	9
Rank		Not null			Varchar	30
Dep_Number	FK	Not null	AC DEPARTMENT	Dep_Number	CHAR	10

COLLEGE

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
College_name	PK				Varchar	50
Campus					Varchar	6

ADMIN_EMPLOYEE

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
SSN/Iqama number	PK, FK		USER	SSN/Iqama number	CHAR	9
Job_position		Not null			Varchar	35
Office_number	FK	Not null	ADMIN OFFICES	Office_number	CHAR	4

ADMIN_OFFICES

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Office_Number	PK				CHAR	4
Office_name		Not Null			Varchar	20

PD_ACTIVITY

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Activity_id	PK				CHAR	10
Activity title					Varchar	50
Type					Varchar	50
Start date					Date	
End date					Date	
Loc_id	FK		LOCATION	Loc_id	Varchar	10

PDACTIVITY_LO

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Activity_id	PK,FK (composite)		Professional Training Activity		CHAR	10
Learning outcome(s) Learning_outcome	PK (composite)				Varchar	200

AC_DEPARTMENT

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Dep_Number	PK				CHAR	10
Dep Name		Not null			Varchar	100
Manager_SSN	FK		FACULTY MEMBER	SSN/Iqama number	CHAR	9
College Name		Not null			Varchar	50

LOCATION

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Loc_id	PK				Varchar	10
Loc_type					Varchar	20
Buildingno					CHAR	5
Roomno					CHAR	5
Floorno					CHAR	5

ROLE

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Role_name	PK				Varchar	50
Points					Number	(3,0)

EXTERNAL_ORG

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Org_Name	PK				Varchar	50
Address					Varchar	100
Email					Varchar	100
Phone					Char	10

RESOURCES

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Activity_id	PK,FK		PROFESSIONAL TRAINING ACTIVITY	Activity id	CHAR	10
Handouts	PK				Varchar	200
Links					Varchar	200

EVALUATION_SURVEY

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Survey_No	PK				Varchar	50
Survey_ Date					Date	
Score		Not null			Number	2

QUESTION

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Qno	PK				Varchar	200
Survey_No	PK, FK		EVALUATION SURVEY	Survey_No	Varchar	50
Q_Statement					Varchar	200

PRESENTS

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
Activity_id	PK,FK		Pofessional Training Activity		CHAR	10
Org_Name	PK, FK		External Organization		Varchar	50
Presenter					Varchar	50
Gender					Varchar	1

FILLS

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
SSN/Iqama number	PK,FK		USER	SSN/Iqama number	CHAR	9
Activity_id	PK,FK		PROFESSIONAL TRAINING ACTIVITY	Activity_id	CHAR	10
Questions	PK,FK		QUESTION	Questions	Varchar	200
Answers		Not null			NUMBER	(3, 0) Accepts about 100

Survey_No	PK, FK		QUESTION	Survey_No	Varchar	50

PARTICIPATE_IN

Column name	Key Type	Constraints	FK Table	FK Column	Data Type	Length
SSN/Iqama number	PK,FK		USER	SSN/Iqama number	CHAR	9
Role_ name	PK,FK		ROLE	Role_name	Varchar	50
Activity_id	PK,FK		PROFESSIONAL TRAINING ACTIVITY	Activity_id	char	10
Ticket_no		Not null			Number	(20,0)
Certificate					Varchar	50
Points_earned		Not null			Number	(3,0)

Relevant IEEE clauses and ACM Professional Code of Ethics in database design:

- **Privacy and Confidentiality (IEEE Code 3.2, ACM Code 1.3):**

  Database designers must ensure the protection of users' personal information, such as Iqama Numbers, SSNs, PSU_IDs, and PSU_mail. It is essential to implement strict access controls and encryption to safeguard sensitive data.

- **Data Accuracy and Integrity (IEEE Code 4.1, ACM Code 2.7):**

  Designers are responsible for maintaining the accuracy and integrity of data stored in the database. This includes ensuring that user information, academic records, and survey data are reliable and up-to-date.

- **Access Control (IEEE Code 3.7, ACM Code 2.5):**

  Access to the database should be restricted to authorized personnel only. User roles and permissions must be well-defined and enforced to prevent unauthorized access or data breaches.

- **Transparency (IEEE Code 1.3, ACM Code 2.6):**

  Database designers should provide clear documentation and explanations of the data collection and processing procedures, as well as any algorithms or models used in the system. This transparency promotes trust and accountability.

- **Data Ownership (IEEE Code 7.2, ACM Code 2.8):**

  Designers should establish policies for data ownership and use. Users' rights to their own data, as well as the organization's rights to the data collected, should be clearly defined.

- **Data Minimization (IEEE Code 4.3, ACM Code 2.4):**

  Collect and store only the data necessary for the system's purpose. Avoid unnecessary data collection to reduce privacy risks.

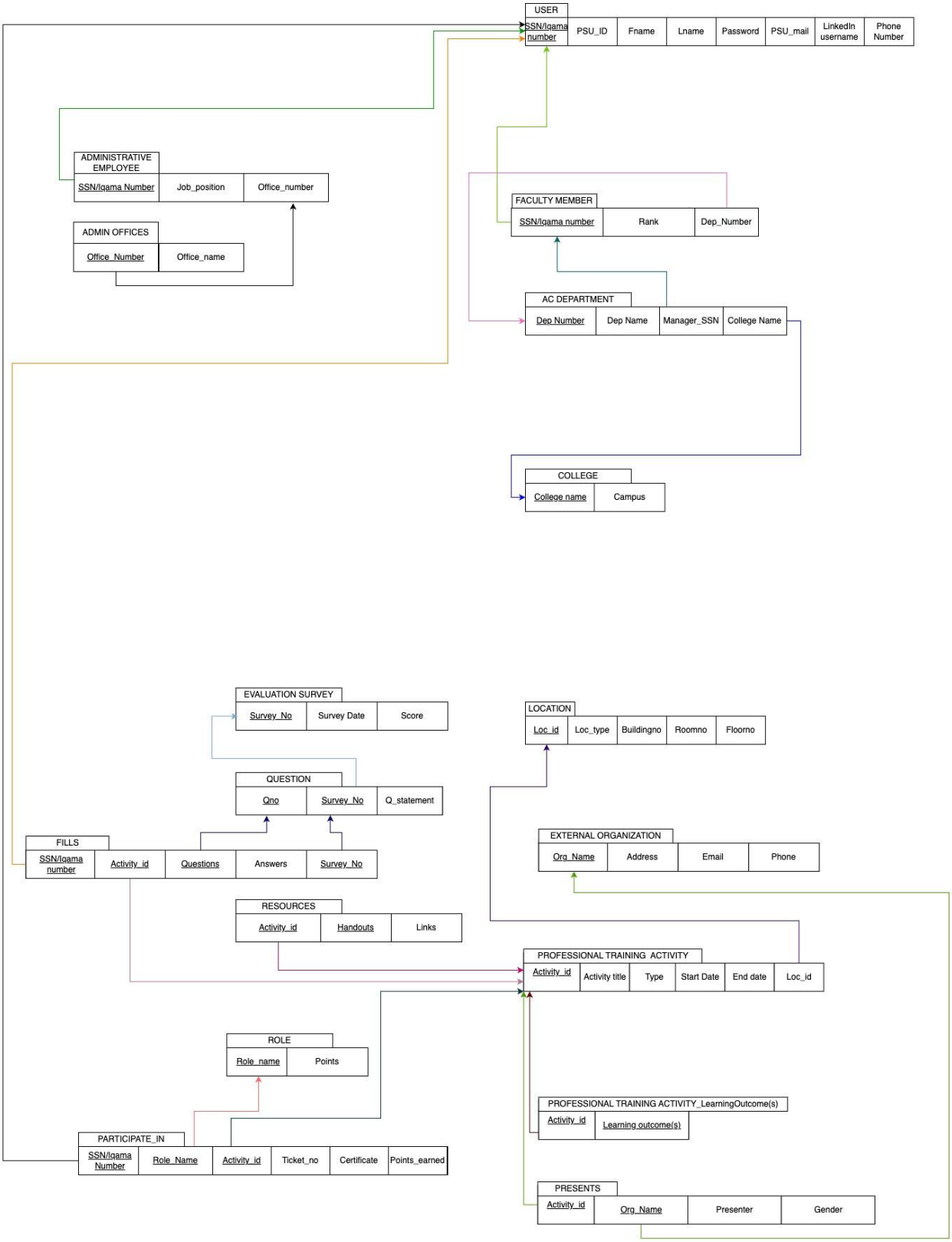
- **Ethical Decision-Making (IEEE Code 1.7, ACM Code 1.1):**

  Designers should consider the ethical implications of database design decisions, especially when handling personal information and sensitive data. They should be prepared to question and deal with all unethical practices.

- **Accountability (IEEE Code 6.1, ACM Code 1.4):**

  Database designers and administrators must be accountable for the security and ethical use of the data. They should report any irregularities, or ethical concerns promptly.

- **Normalized Relational Model / Schema:** Relational Schema draw.io link


USER
SSN/Iqama number
PSU_ID
Fname
Lname
Password
PSU_mail
LinkedIn username
Phone Number
ADMINISTRATIVE EMPLOYEE
SSN/Iqama Number
Job_position
Office_number
ADMIN OFFICES
Office_Number
Office_name
FACULTY MEMBER
SSN/Iqama number
Rank
Dep_Number
AC DEPARTMENT
Dep Number
Dep Name
Manager_SSN
College Name
COLLEGE
College name
Campus
EVALUATION SURVEY
Survey_No
Survey Date
Score
LOCATION
Loc_id
Loc_type
Buildingno
Roomno
Floorno
QUESTION
Qno
Survey_No
Q_statement
FILLS
SSN/Iqama number
Activity_id
Questions
Answers
Survey_No
EXTERNAL ORGANIZATION
Org_Name
Address
Email
Phone
RESOURCES
Activity_id
Handouts
Links
PROFESSIONAL TRAINING_ACTIVITY
Activity_id
Activity title
Type
Start Date
End date
Loc_id
ROLE
Role_name
Points
PROFESSIONAL TRAINING ACTIVITY_LearningOutcome(s)
Activity_id
Learning outcome(s)
PARTICIPATE_IN
SSN/Iqama Number
Role_Name
Activity_id
Ticket_no
Certificate
Points_earned
PRESENTS
Activity_id
Org_Name
Presenter
Gender

Teamwork Distribution & Strategy:

Name	Task Assigned
Haifa	Modified previous phases' according to the notes given (introduction, Tables, EER, etc). Worked alongside Jana on Relational Schema and mapping. Review of other teammates' work. Listed tasks for phase 3 and coordinated with the leader. Final Review.
Jana	Modified previous phases' according to the notes given (introduction, Tables, EER, etc). Worked alongside Haifa on Relational Schema and mapping. Review of other teammates' work. Coordination with the leader. Final Review.
Raghad	Creating all of the Data Dictionary tables and filling them in accordingly. Adjusting previous phases according to instructor's notes. Formatting and alignments + Full document review.
Fouz	Identifying the relevant clauses from the IEEE and ACM Professional Code of Ethics in database design according to the previous work. Final Review.

Strategy:

In Phase 3, our team continued to foster a collaborative and efficient work environment. We began by refining and expanding upon the ideas generated in the earlier phases. Team members assumed their designated roles and tasks, and work commenced on their respective assignments. Following task completion, we maintained our commitment to

collaboration by conducting iterative team reviews. During these sessions, each team member thoroughly assessed the work done by their Teammate, providing valuable feedback and suggestions for improvement. This strategy ensured that our project remains on track, upholding the highest standards of quality.

Phase 4

Creating Tables using Oracle

IEEE and ACM Code of Ethics:

1. **Privacy and Confidentiality (IEEE Code 3.2, ACM Code 1.3):**
    - Ensure that access to the Oracle APEX workspace is restricted to authorized personnel only.
    - Implement robust encryption mechanisms within Oracle APEX to safeguard sensitive data stored in the database, such as Iqama Numbers, SSNs, PSU_IDs, and PSU_mail.
    - Adhere to Oracle APEX's security features to protect users' personal information.
2. **Data Accuracy and Integrity (IEEE Code 4.1, ACM Code 2.7):**
    - Employ Oracle APEX's data integrity constraints to maintain accuracy in the stored data.
    - Regularly perform integrity checks and validation procedures within Oracle APEX to ensure that data in the tables remains reliable and up to date.
3. **Access Control (IEEE Code 3.7, ACM Code 2.5):**
    - Utilize Oracle APEX's role-based access control features to define and enforce user roles and permissions.
    - Implement strict access controls within Oracle APEX to prevent unauthorized access or data breaches.
4. **Transparency (IEEE Code 1.3, ACM Code 2.6):**
    - Provide comprehensive documentation for the Oracle APEX database design, including data collection and processing procedures.
    - Clearly explain any algorithms or models used in the Oracle APEX system to enhance transparency and promote trust.
5. **Data Ownership (IEEE Code 7.2, ACM Code 2.8):**
    - Establish and document clear policies within Oracle APEX for data ownership and use.

- Define users' rights to their own data and the organization's rights to the data collected.

6. **Data Minimization (IEEE Code 4.3, ACM Code 2.4):**
   - Employ data minimization principles when creating tables in Oracle APEX, collecting and storing only the data necessary for the system's purpose.
   - Avoid unnecessary data collection within Oracle APEX to reduce privacy risks.
7. **Ethical Decision-Making (IEEE Code 1.7, ACM Code 1.1):**
   - Consider ethical implications when making decisions related to table creation and data modeling in Oracle APEX.
   - Address and rectify any ethical concerns promptly.
8. **Accountability (IEEE Code 6.1, ACM Code 1.4):**
   - Oracle APEX database designers and administrators must be accountable for the security and ethical use of the data.
   - Report any irregularities or ethical concerns promptly.

Teamwork Distribution & Strategy:

Name	Task Assigned
Haifa	Tables creation + Debugging script+ Data insertion +Final review
Jana	Tables creation + Debugging script+ Data insertion +Final review
Raghad	Data insertion + Data dictionary + Updates on EER +Final Review
Fouz	Data insertion +Data dictionary review + Updates on schema+Final review

Strategy:

In Phase 4, the team adopted a strategy of collaborative development using Oracle APEX. We created individual accounts on Oracle APEX, ensuring a centralized and synchronized environment for table creation. Regular communication through virtual meetings facilitated the sharing of insights and addressing any challenges encountered during the process. A structured workflow was maintained, ensuring each team member's contributions were aligned with the project goals. The strategy emphasized the importance of timely feedback and support, reinforcing our commitment to delivering a high-quality database implementation.

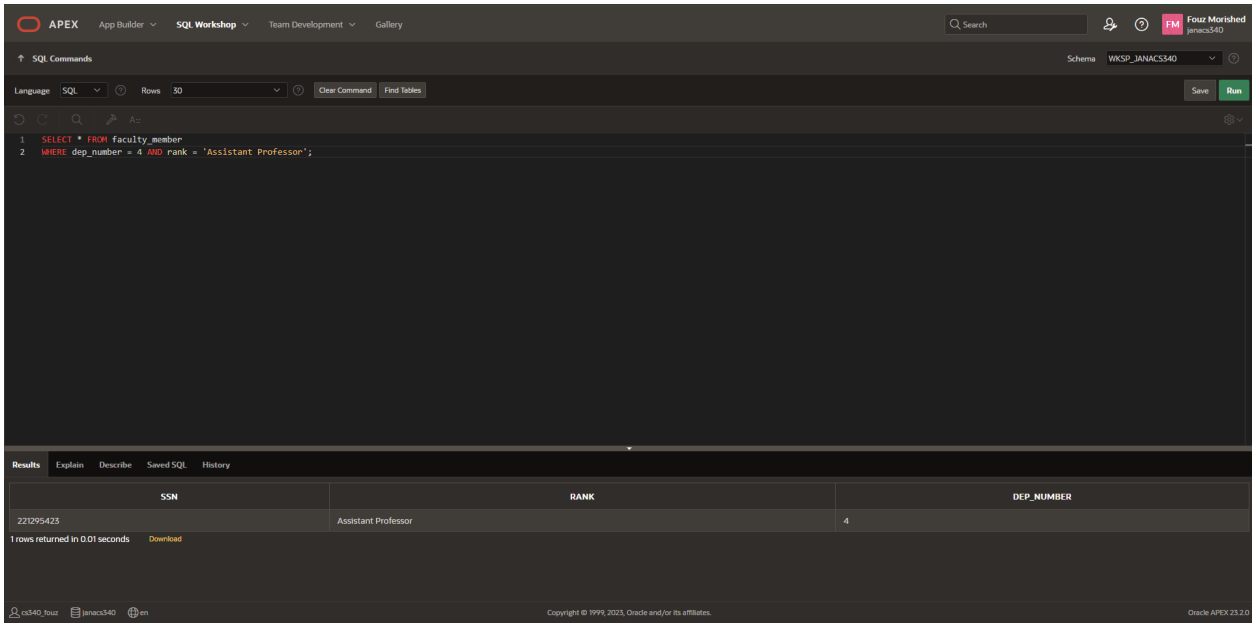
Phase 5

Simple & Advanced Queries

Simple queries:

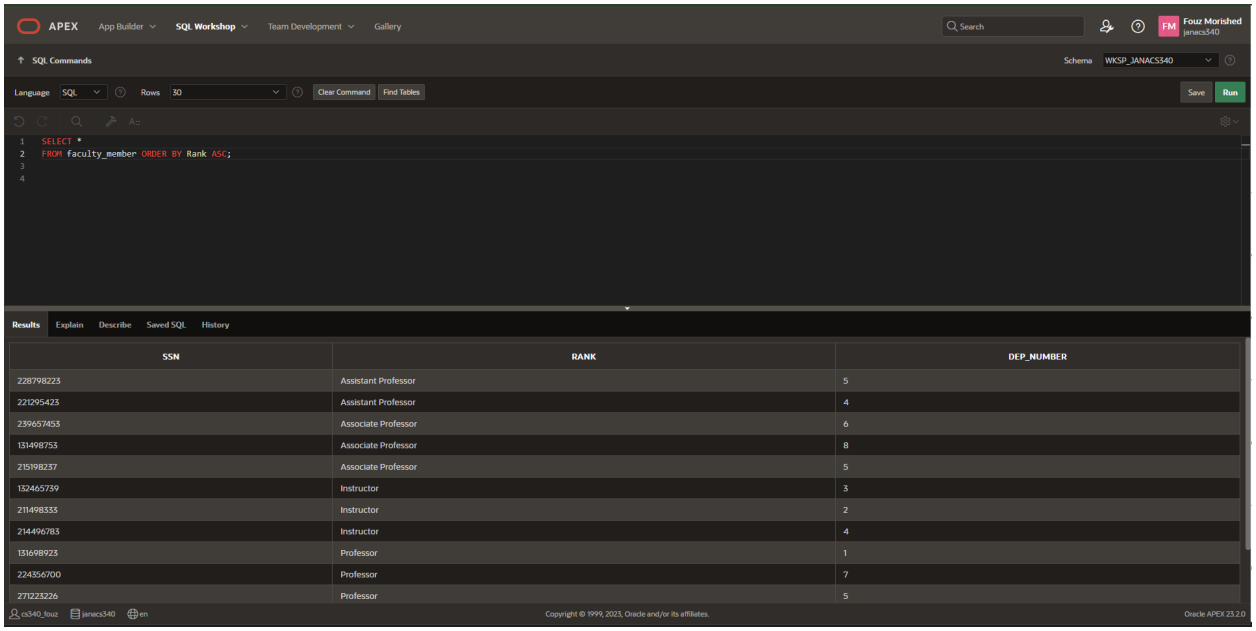
1. Display all the Assistant Professors who work in department 4

```
SELECT *

 FROM faculty_member

WHERE dep_number = 4 AND rank = 'Assistant Professor';
```



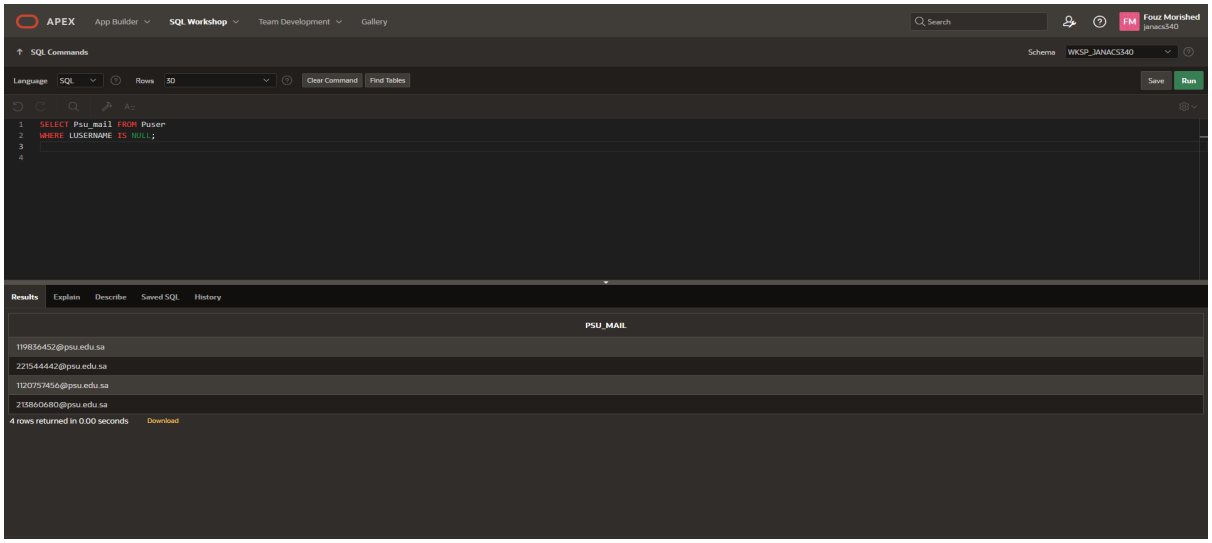
2. Display all faculty members and sort them based on their ranks in ascending order

```
SELECT *

FROM faculty_member

ORDER BY Rank ASC;
```



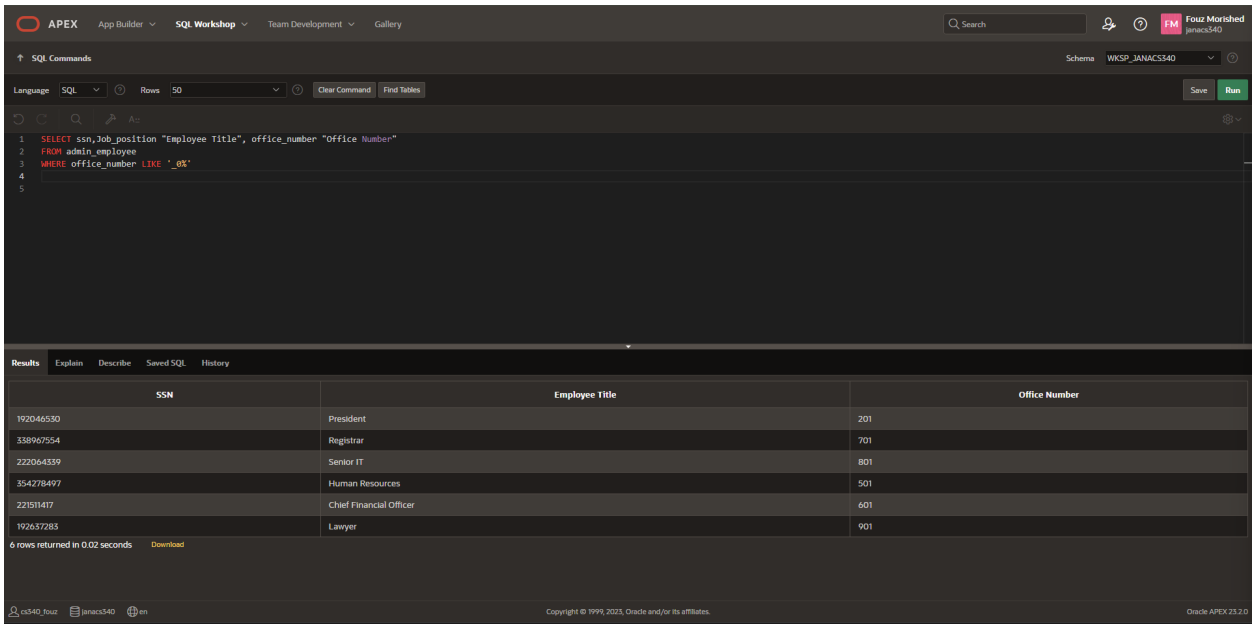
3. Display the emails of the users without LinkedIn accounts

```
SELECT Psu_mail

FROM Puser

WHERE LUSERNAME IS NULL;
```



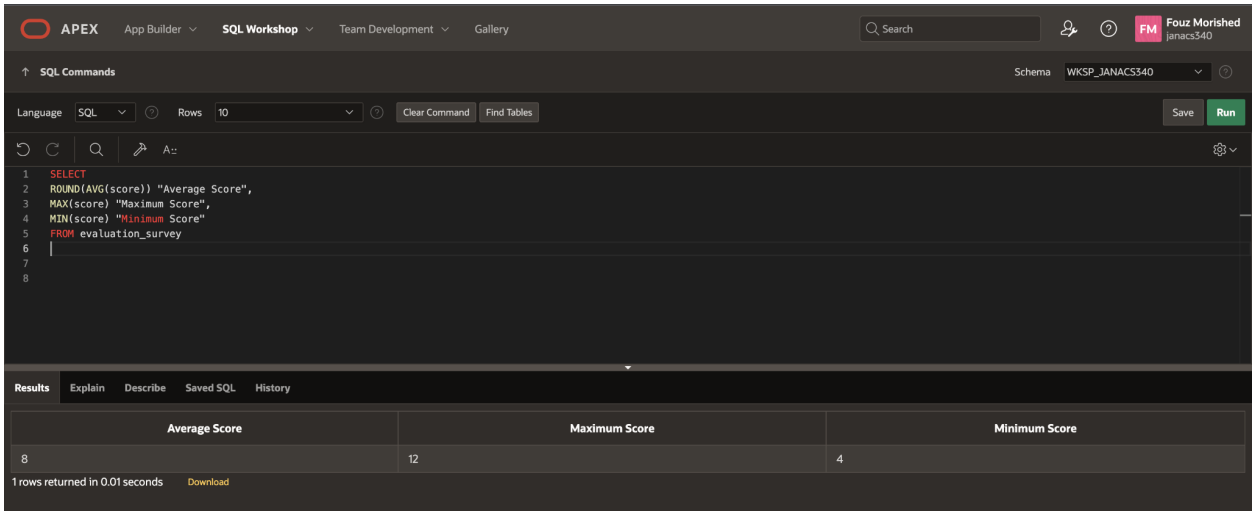
4. Display the employees whose first name has the second digit of their office is ‘0’

```
SELECT ssn, Job_position "Employee Title", office_number
"Office Number"

FROM admin_employee

WHERE office_number LIKE '_0%'
```



5. Display the average, minimum and maximum scores for the evaluation surveys

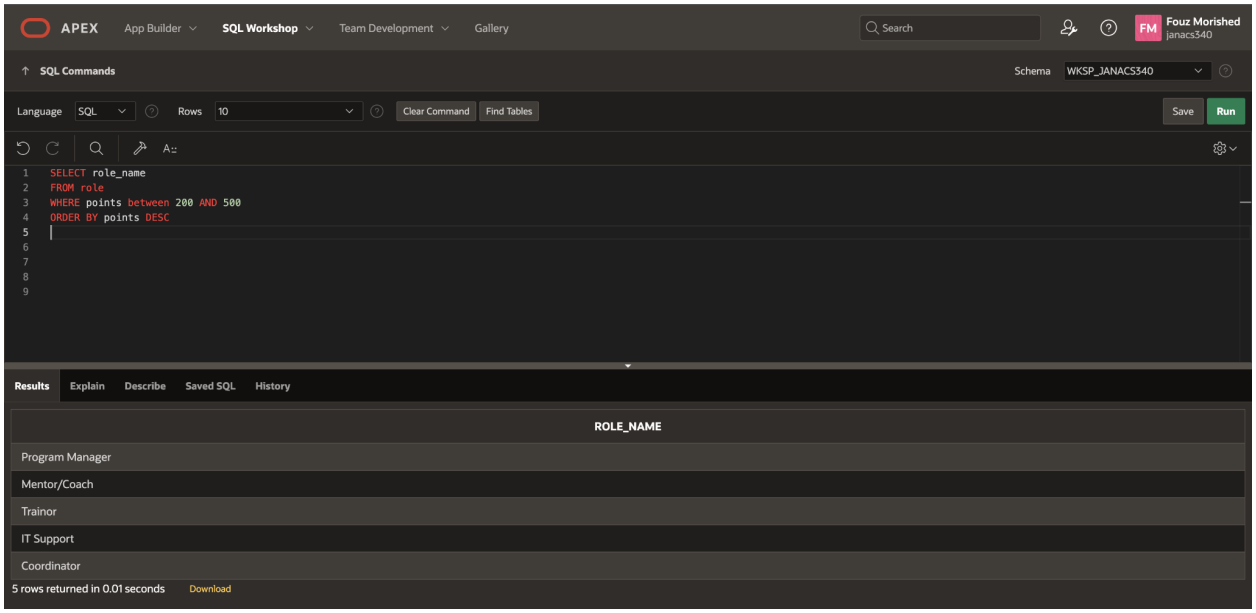
```
SELECT
ROUND(AVG(score)) "Average Score",
MAX(score) "Maximum Score",
MIN(score) "Minimum Score"
FROM evaluation_survey
```



6. Display the roles that have between 200 to 500 points starting from the one with the least points

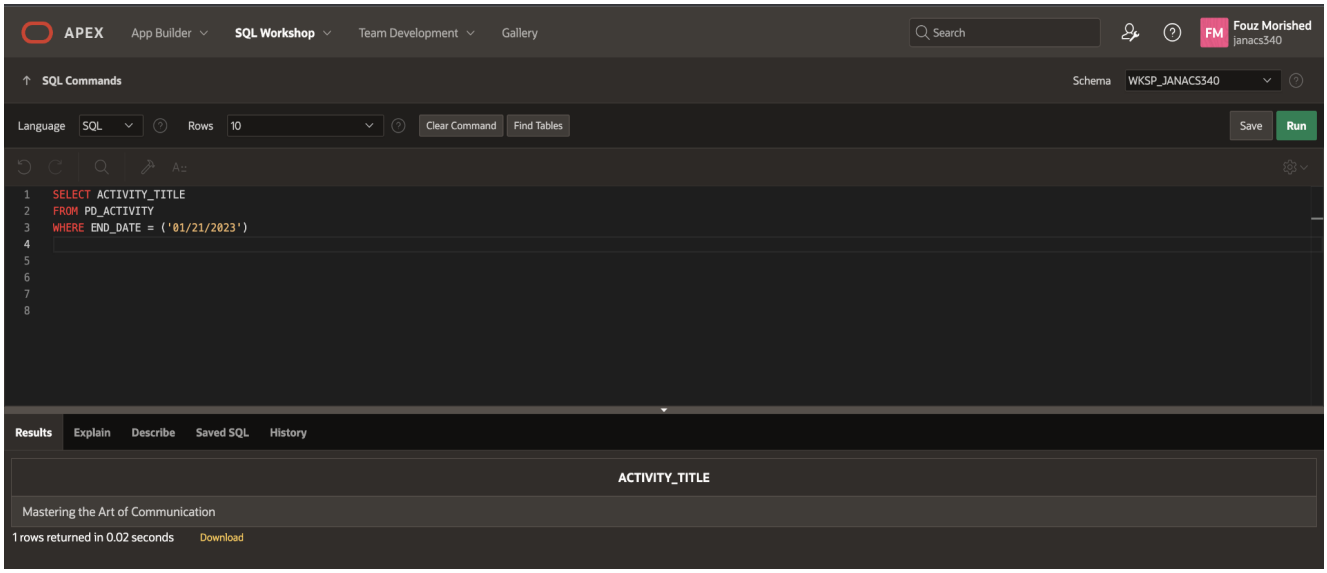
```
SELECT role_name
FROM role
WHERE points between 200 AND 500
```

```
ORDER BY points DESC
```



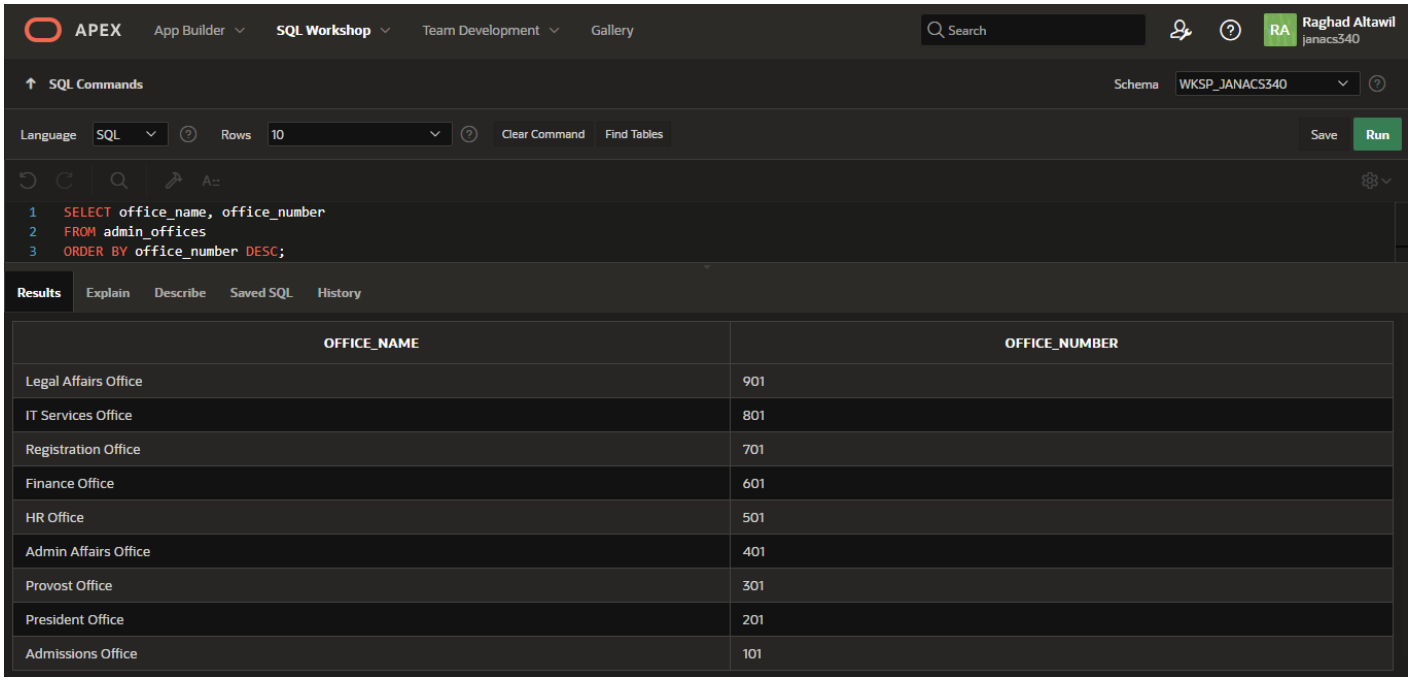
7. Display the activity that ends at January 21st 2023

```
SELECT ACTIVITY_TITLE

FROM PD_ACTIVITY

WHERE END_DATE = '01/21/2023'
```



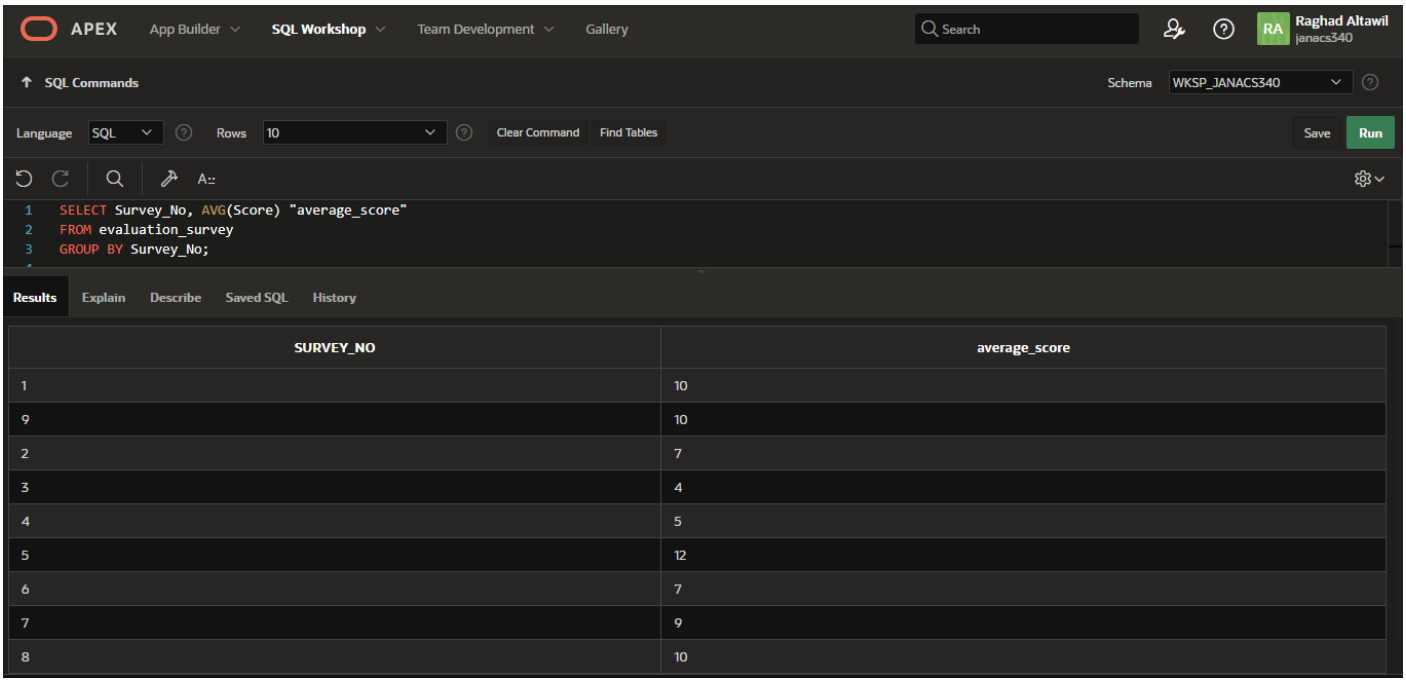
8. List the names and locations of admin offices in descending order based on office numbers:

```
SELECT office_name, office_number

FROM admin_offices

ORDER BY office_number DESC;
```



9. Retrieve the average score for each evaluation survey:

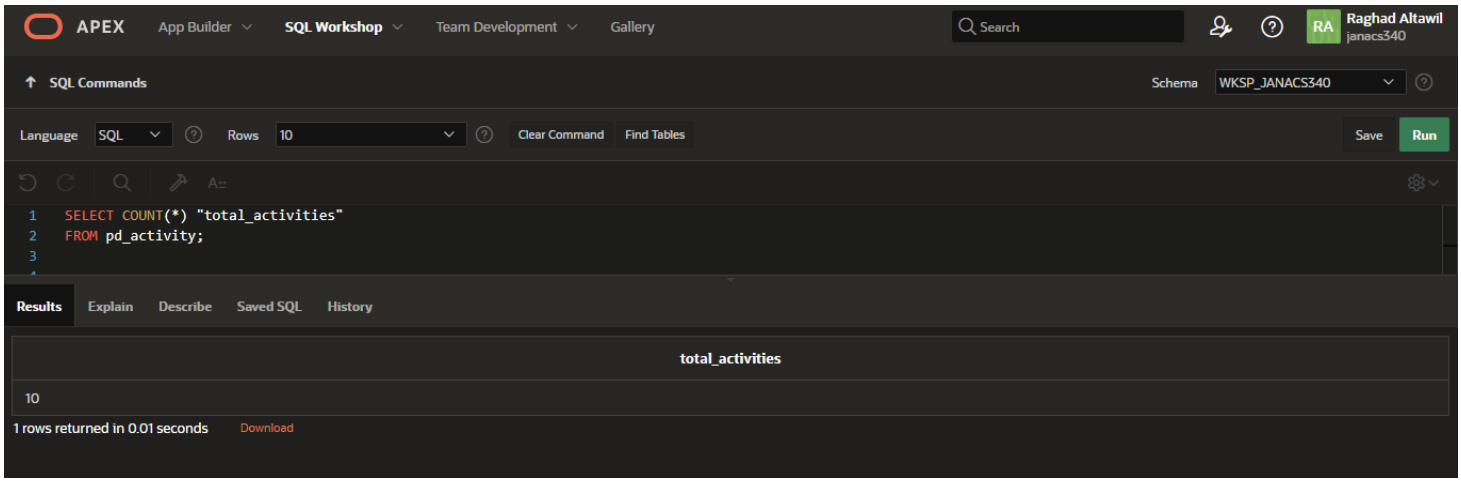
```
SELECT Survey_No, AVG(Score) "average_score"
FROM evaluation_survey
GROUP BY Survey_No;
```



SURVEY_NO	average_score
1	10
9	10
2	7
3	4
4	5
5	12
6	7
7	9
8	10

10. Display the total number of activities:

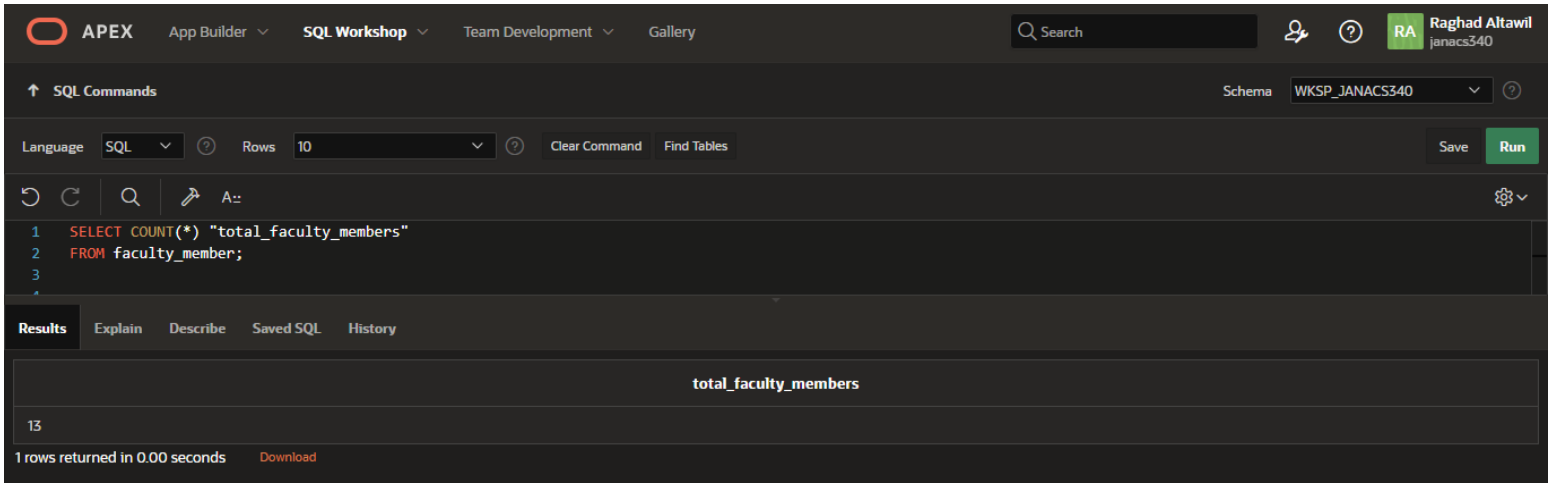
```
SELECT COUNT(*) "total_activities"
FROM pd_activity;
```



OR

Display the total number of faculty members:

```
SELECT COUNT(*) "total_faculty_members"
FROM faculty_member;
```

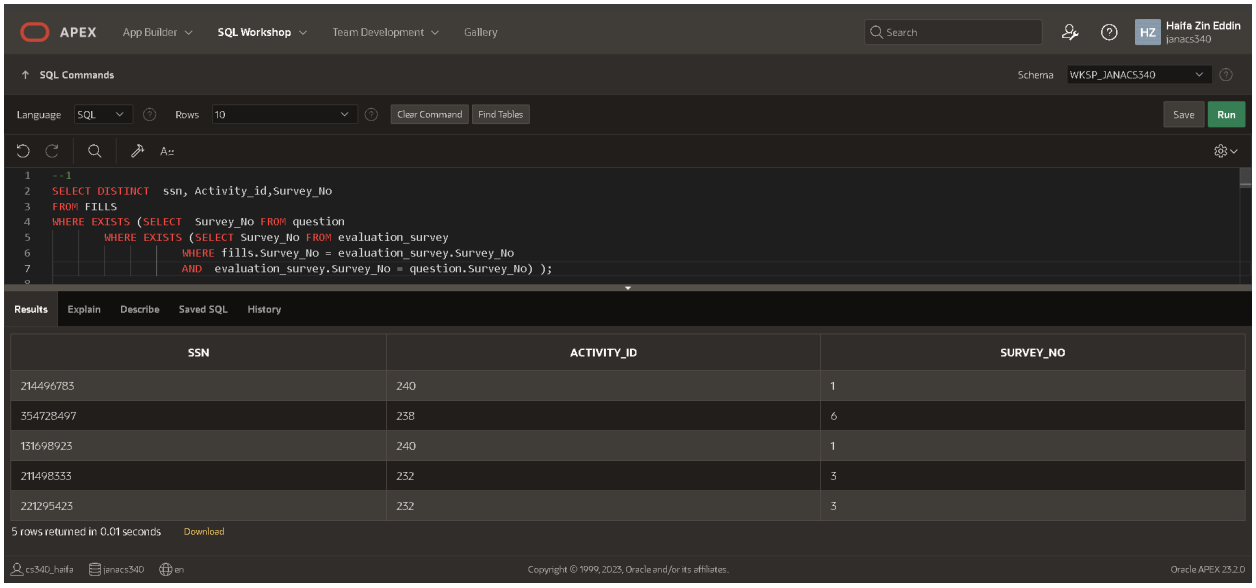


Advanced queries:

1. Write a query displays the ssn of those who filled the evaluation survey and the activity_id associated with the survey_no that was filled.

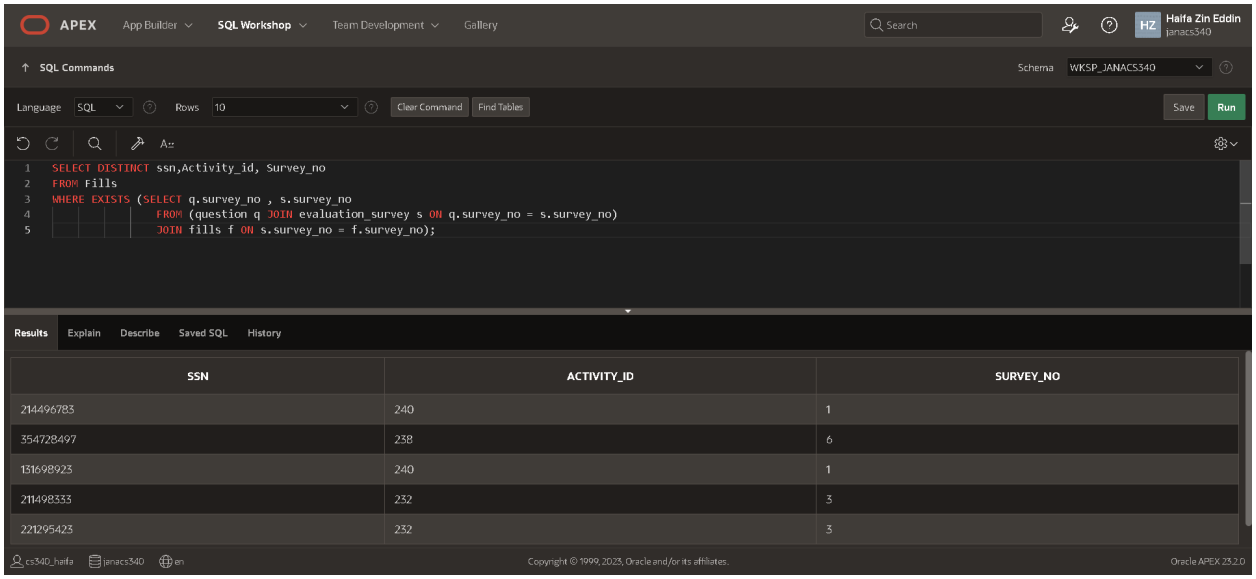
(using EXISTS Correlated Subquery)

```
 SELECT DISTINCT  ssn, Activity_id,Survey_No

FROM FILLS

WHERE EXISTS (SELECT  Survey_No FROM question

                              WHERE EXISTS (SELECT Survey_No
FROM evaluation_survey

                                                          WHERE
fills.Survey_No=evaluation_survey.Survey_No

                    AND  evaluation_survey.Survey_No =
question.Survey_No) );
```



Another Way (using JOIN ON Correlated Subquery)

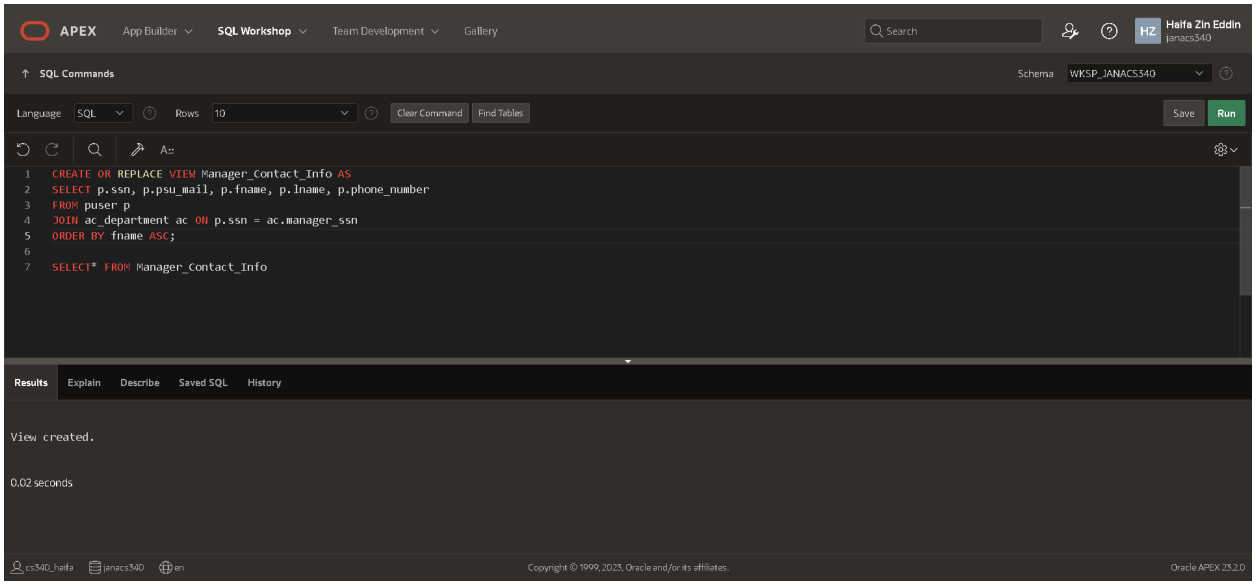
```
SELECT DISTINCT ssn,Activity_id, Survey_no

FROM Fills

WHERE EXISTS (SELECT q.survey_no , s.survey_no

                FROM (question q JOIN evaluation_survey s ON
q.survey_no = s.survey_no)

                JOIN fills f ON s.survey_no = f.survey_no);
```



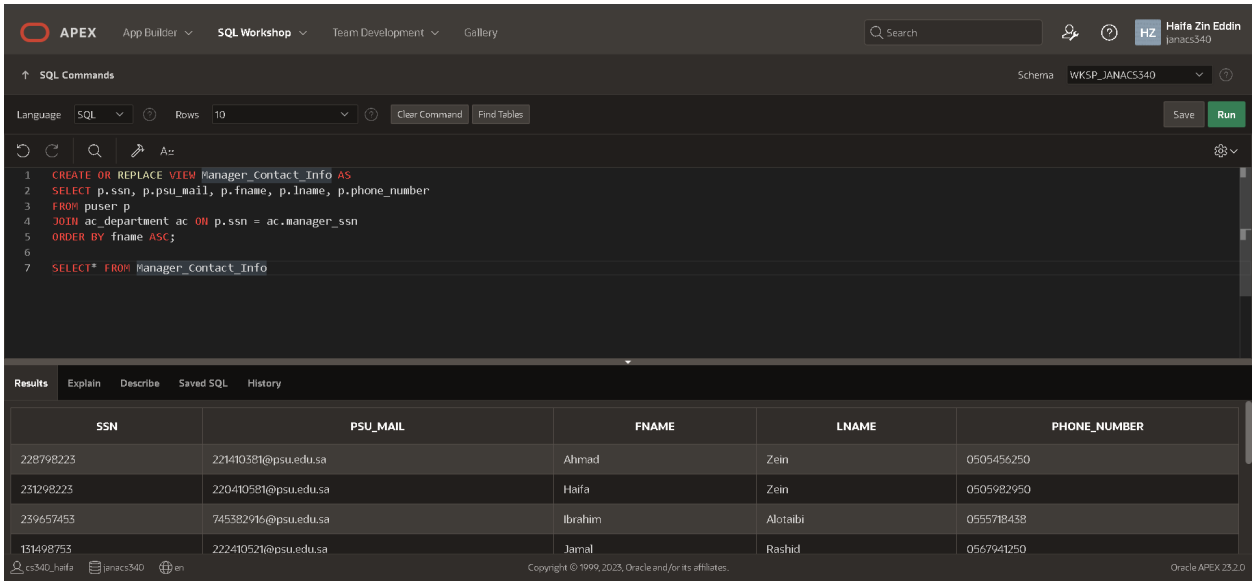
2. Write a query that displays the ssn,psu_email, fname,lname,phone_number of a manager.

(using JOIN Query) (Create a view and name it as Manager_Contact_Info)

```
CREATE OR REPLACE VIEW Manager_Contact_Info AS

SELECT p.ssn, p.psu_mail, p.fname, p.lname, p.phone_number

FROM puser p

JOIN ac_department ac ON p.ssn = ac.manager_ssn

ORDER BY fname ASC;
```



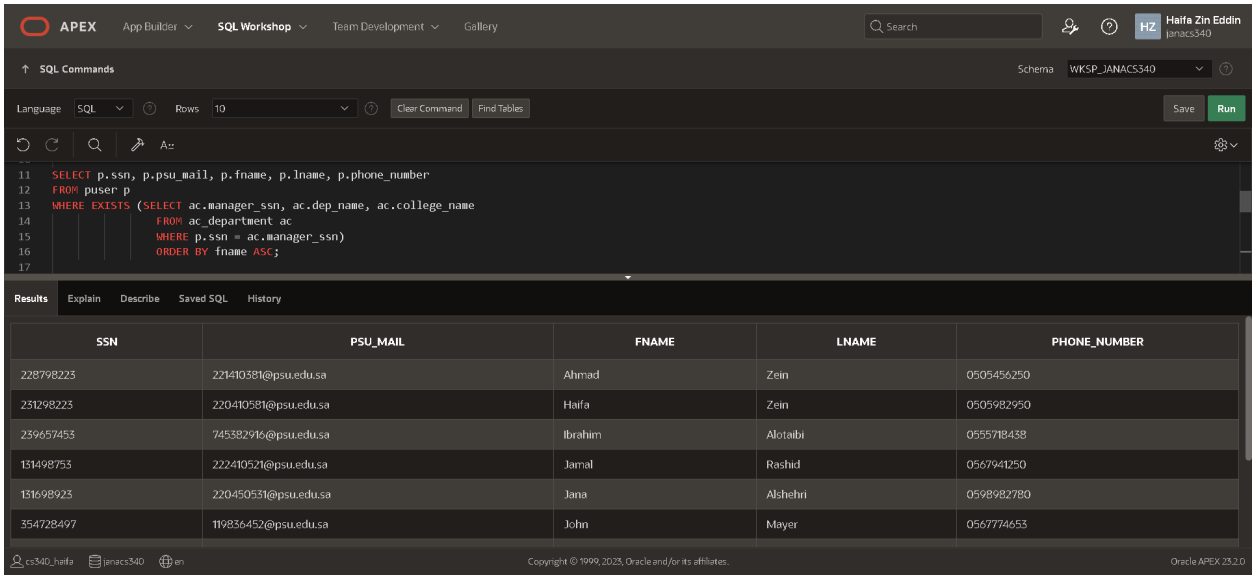
SELECT* FROM Manager_Contact_Info



Another way (using EXISTS , Correlated Subquery)

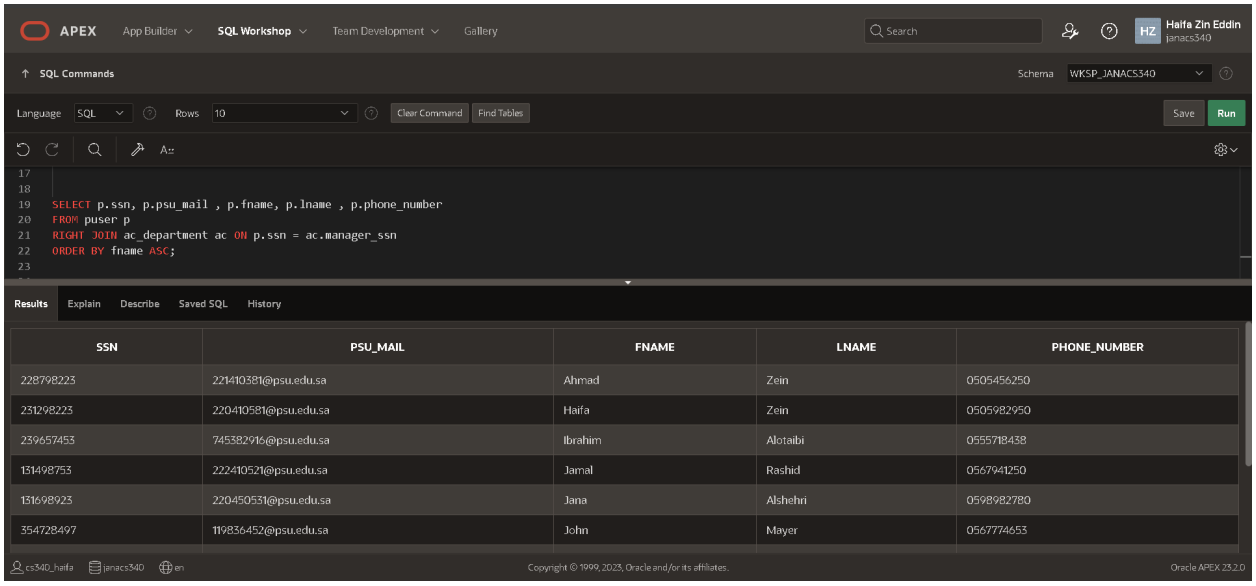
SELECT p.ssn, p.psu_mail, p.fname, p.lname, p.phone_number

```
FROM puser p

WHERE EXISTS (SELECT ac.manager_ssn, ac.dep_name,
ac.college_name

                FROM ac_department ac

                WHERE p.ssn = ac.manager_ssn)

                ORDER BY fname ASC;
```



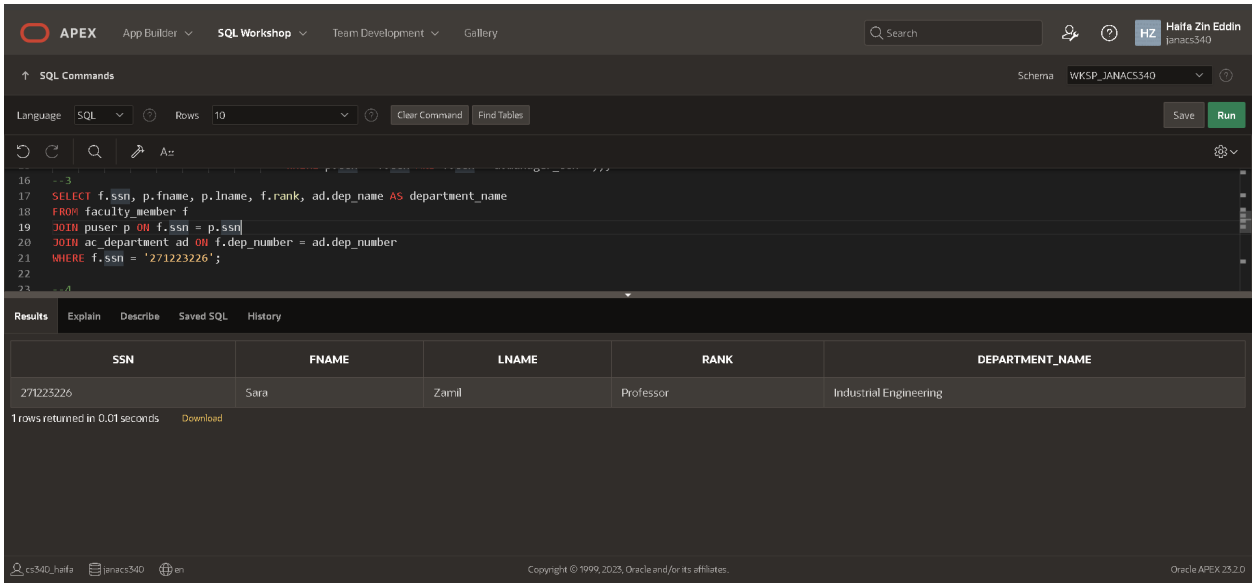
Another way(using RIGHT JOIN, Correlated Subquery)

```
SELECT p.ssn, p.psu_mail , p.fname, p.lname , p.phone_number

FROM puser p

RIGHT JOIN ac_department ac ON p.ssn = ac.manager_ssn

ORDER BY fname ASC;
```



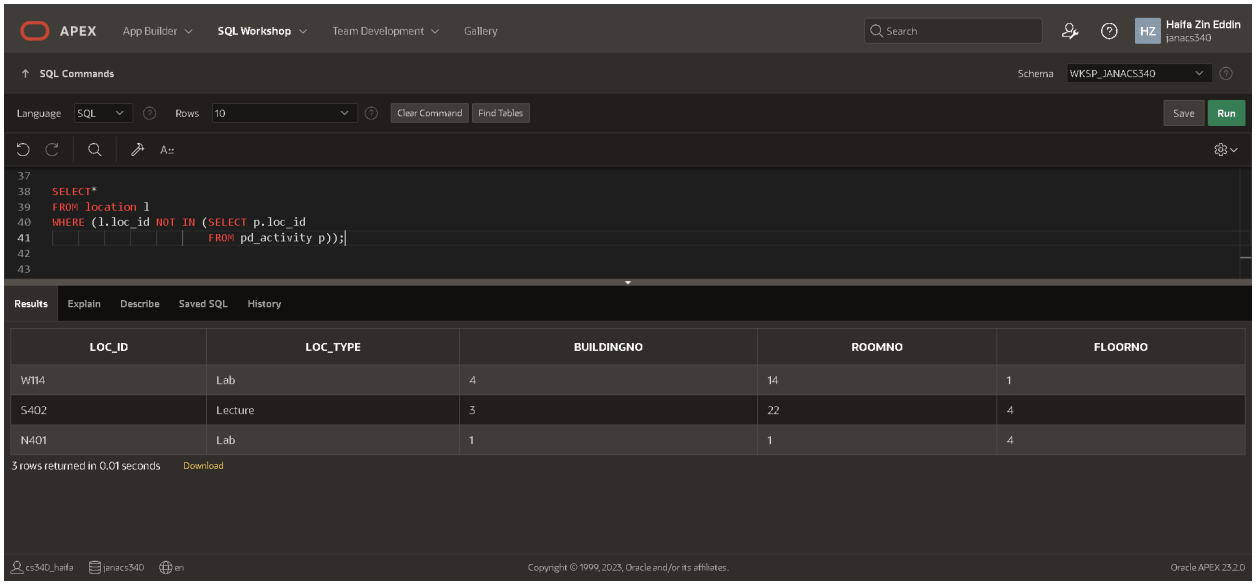
3. Write a query that displays the faculty member's name, rank, with ssn = 271223226 and which ac_department it belongs to.

```
 SELECT f.ssn, p.fname, p.lname, f.rank, ad.dep_name AS
department_name

FROM faculty_member f

JOIN puser p ON f.ssn = p.ssn

JOIN ac_department ad ON f.dep_number = ad.dep_number

WHERE f.ssn = '271223226';
```



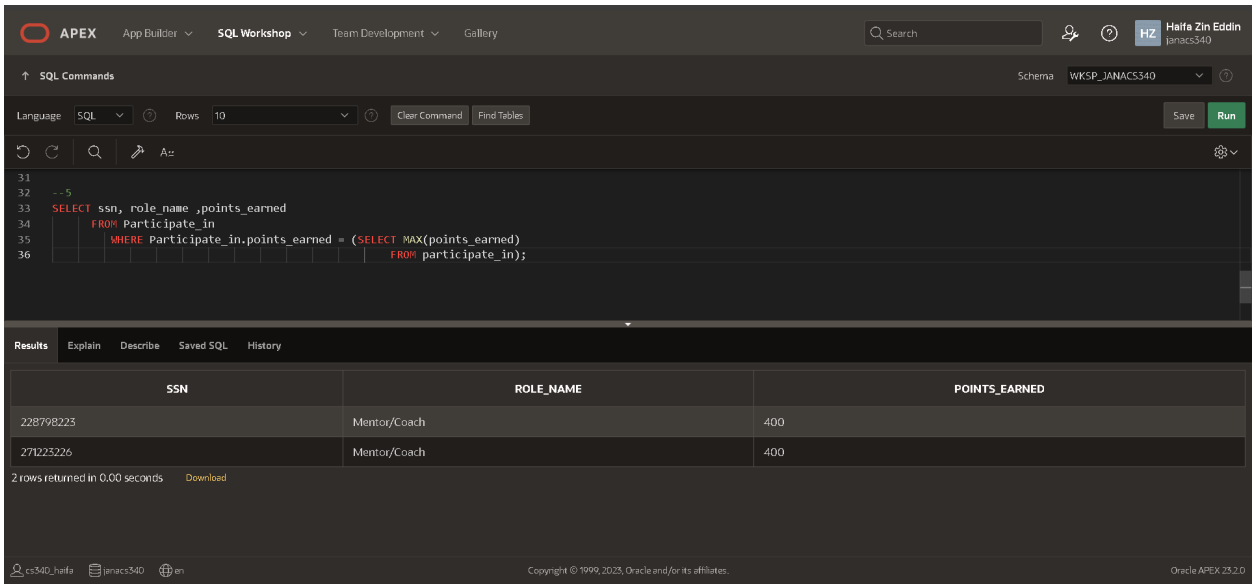
4. Write a query to find the location which hasn't been used by a pd_activity. (Non-Correlated Subquery).

```
SELECT*

FROM location l

WHERE (l.loc_id NOT IN (SELECT p.loc_id

                        FROM pd_activity p));
```



5. Write a query that displays the ssn, role, of those who earned the highest points from participating in a professional activity.(Non-Correlated Subquery containing Aggregate function).

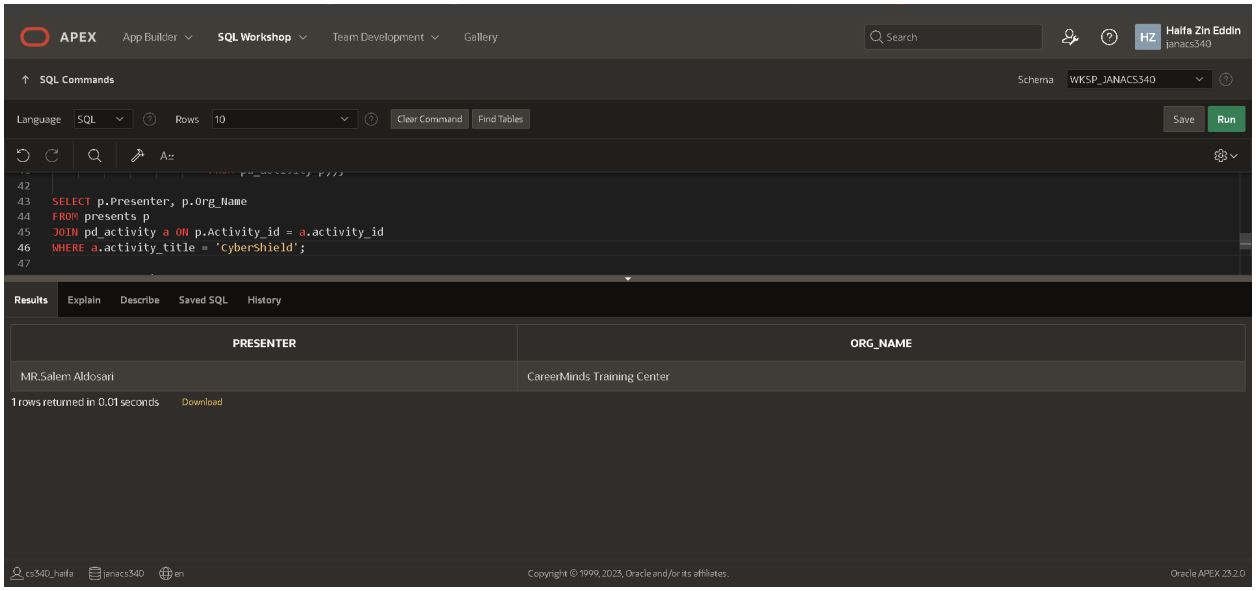
```
SELECT ssn, role_name ,points_earned

FROM Participate_in

WHERE Participate_in.points_earned = (SELECT
MAX(points_earned)

            FROM participate_in);
```



6. Find the Presenter of the professional development activity with the title 'CyberShield' and retrieve the external organization he/she belongs to.

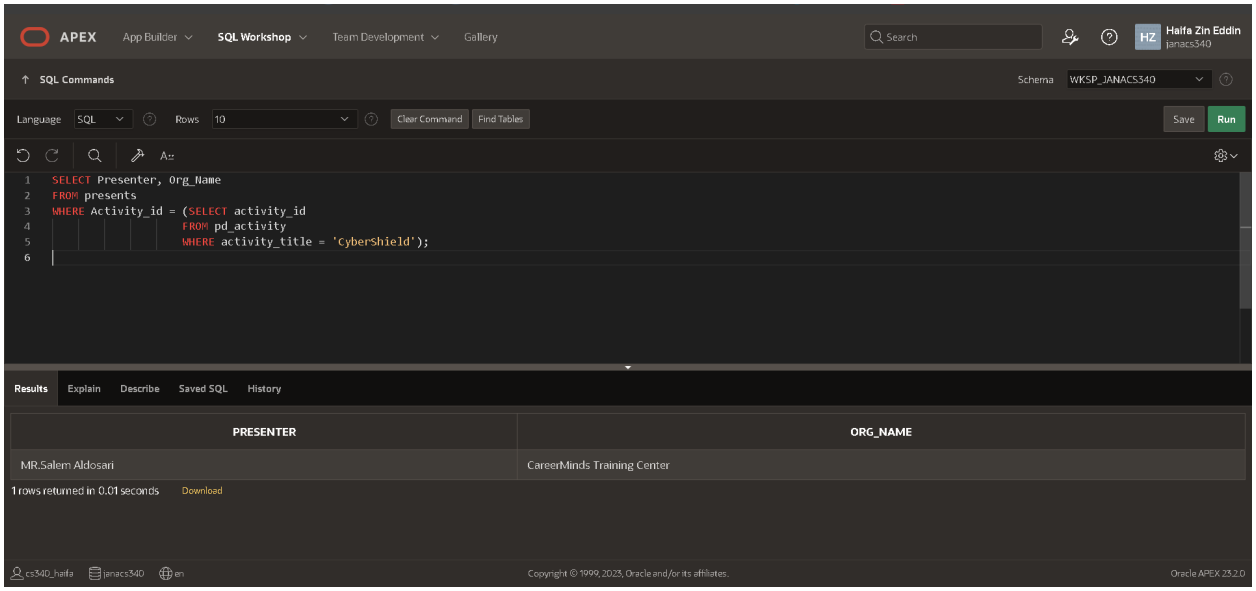
(Using JOIN Non-Correlated)

```
SELECT p.Presenter, p.Org_Name

FROM presents p

JOIN pd_activity a ON p.Activity_id = a.activity_id

WHERE a.activity_title = 'CyberShield';
```



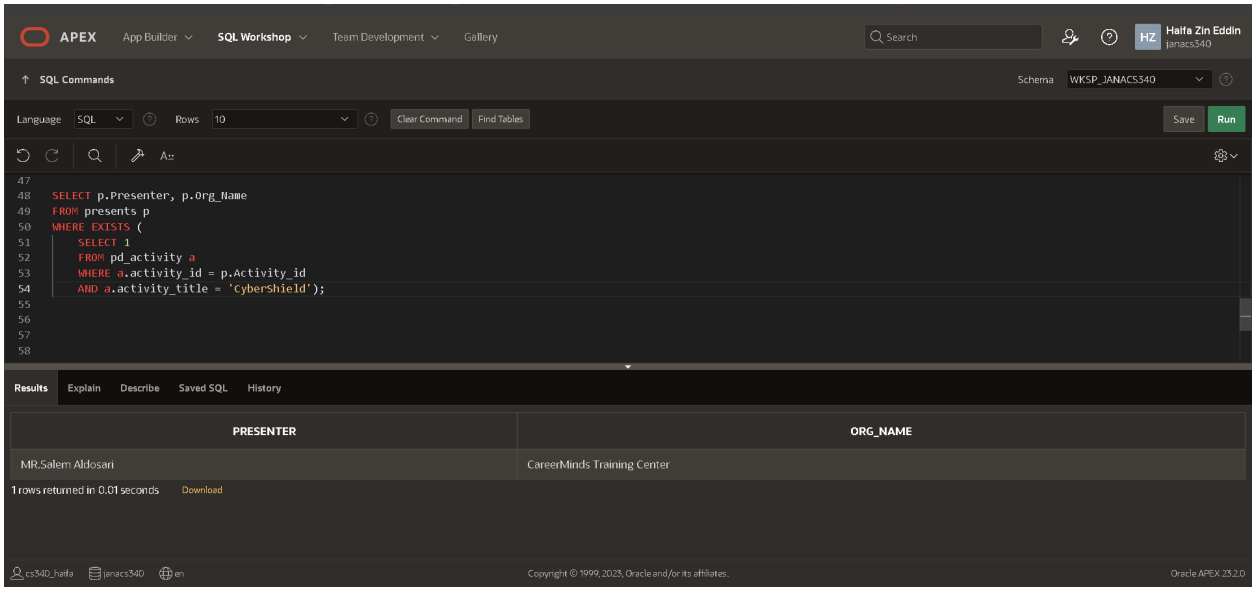
(Non-Correlated Subquery)

```
SELECT Presenter, Org_Name

FROM presents

WHERE Activity_id = (SELECT activity_id

                     FROM pd_activity

                     WHERE activity_title =
'CyberShield');
```



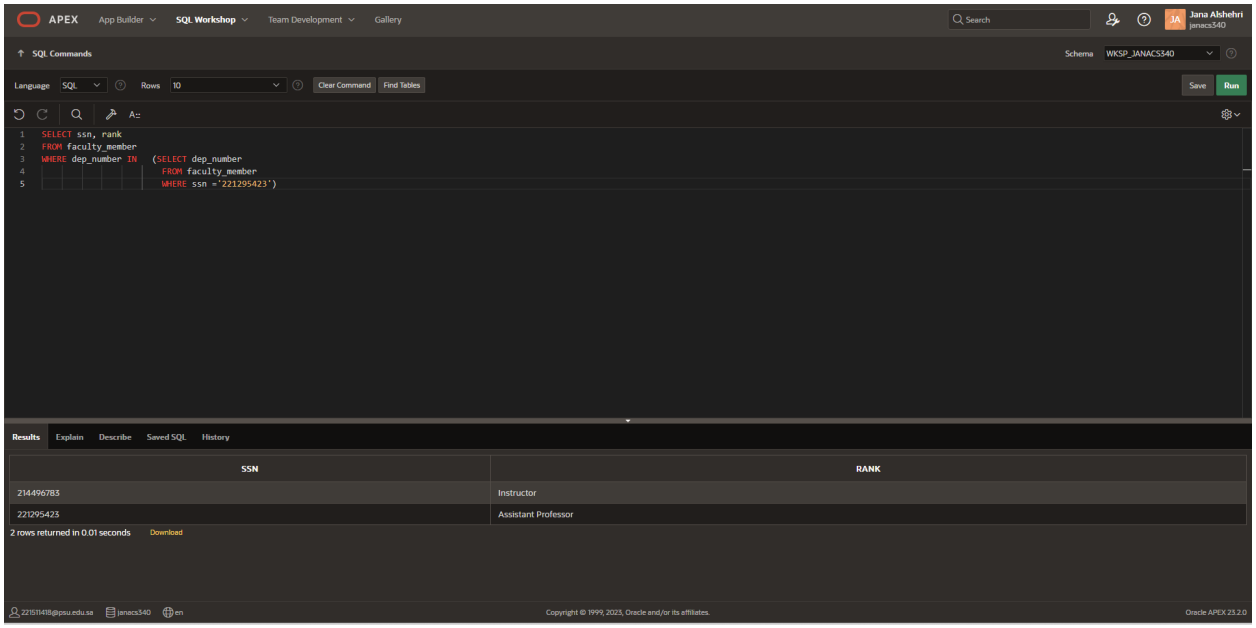
(Correlated SubQuery)

```
SELECT p.Presenter, p.Org_Name

FROM presents p

WHERE EXISTS (

    SELECT 1

    FROM pd_activity a

    WHERE a.activity_id = p.Activity_id

    AND a.activity_title = 'CyberShield');
```



7. Display the ssn and rank of the faculty members who are working in the same department as '221295423'. (Non-correlated Subquery)

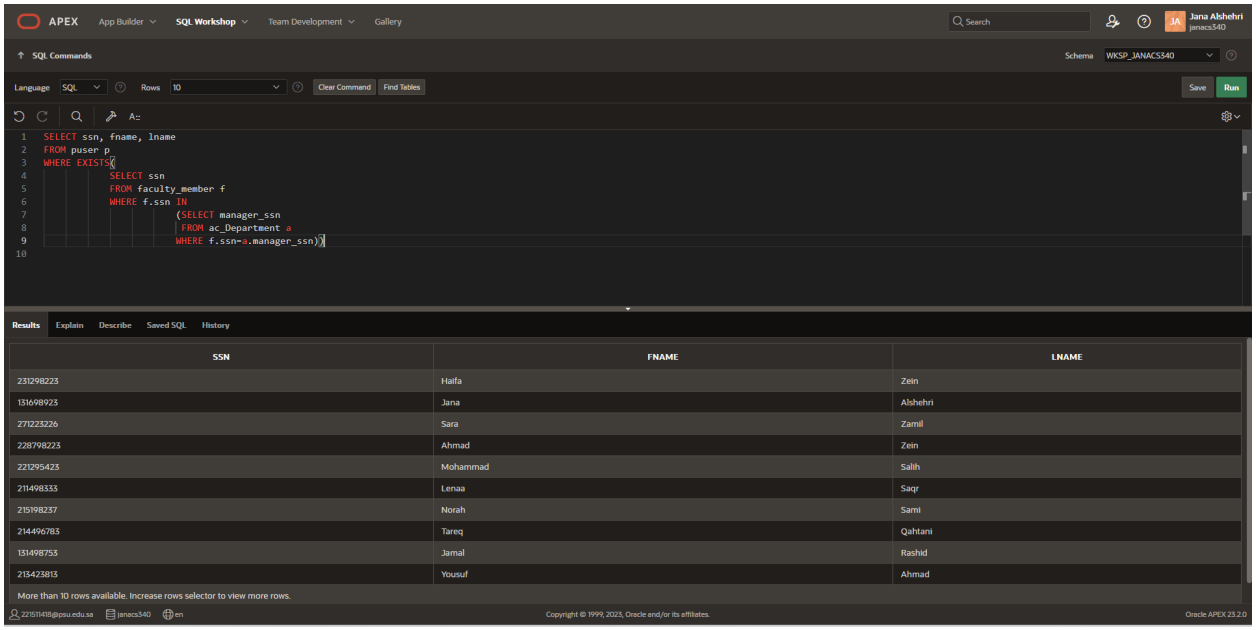
```
SELECT ssn, rank

FROM faculty_member

WHERE dep_number IN    (SELECT dep_number
                        FROM faculty_member
                        WHERE ssn ='221295423')
```



8. Retrieve the names of faculty members who are managing a department. (Correlated Subquery)

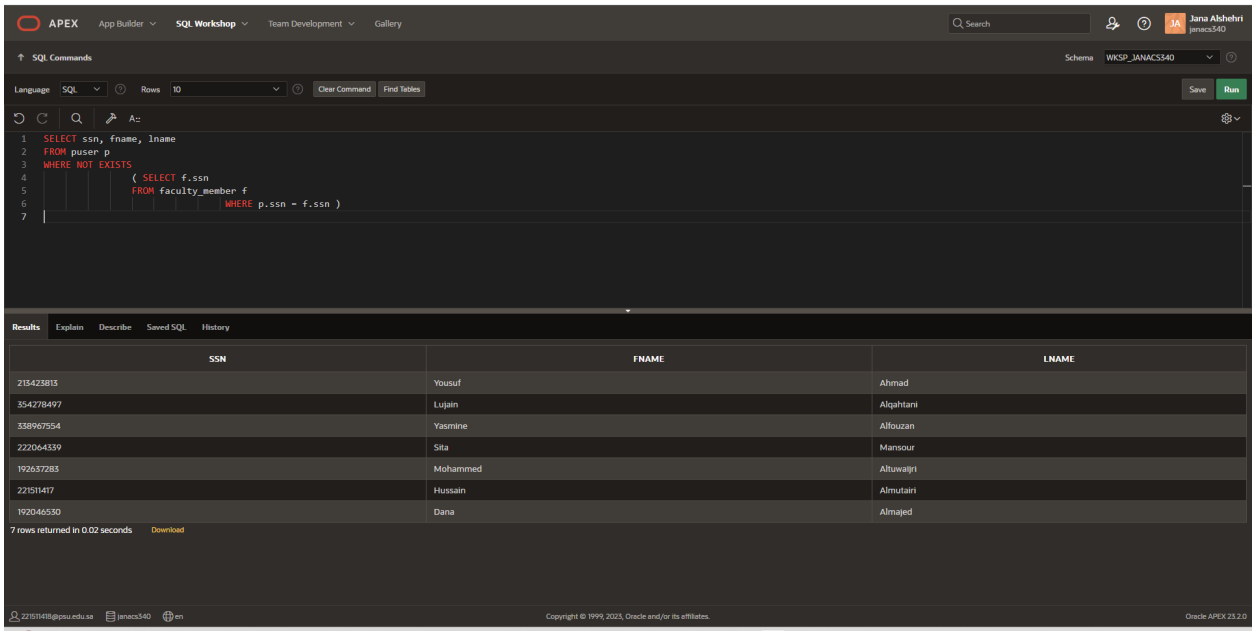
```
SELECT ssn, fname, lname

FROM puser p

WHERE EXISTS(

            SELECT ssn

            FROM faculty_member f

            WHERE f.ssn IN

                        (SELECT manager_ssn

                         FROM ac_Department a
```

```
                    WHERE f.ssn=a.manager_ssn))
```



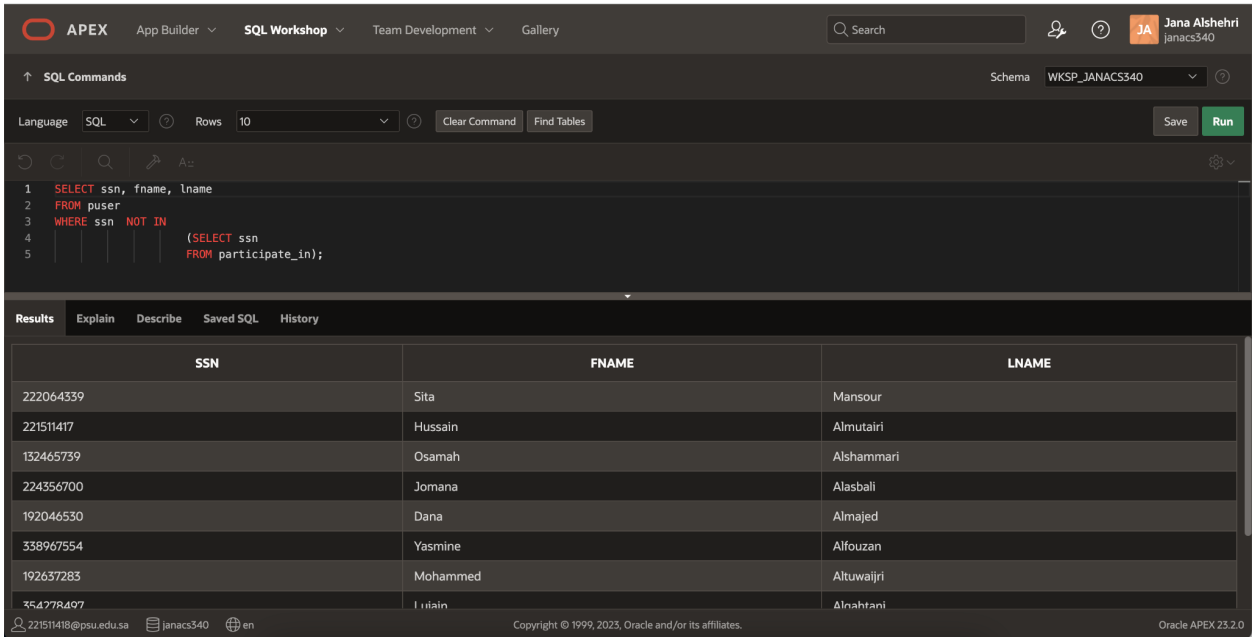
9. Retrieve the ssn, fname, and name of users who are NOT faculty members. (Correlated Subquery)

```
SELECT ssn, fname, lname

FROM puser p

WHERE NOT EXISTS

                    ( SELECT f.ssn

                    FROM faculty_member f

                                        WHERE p.ssn = f.ssn )
```



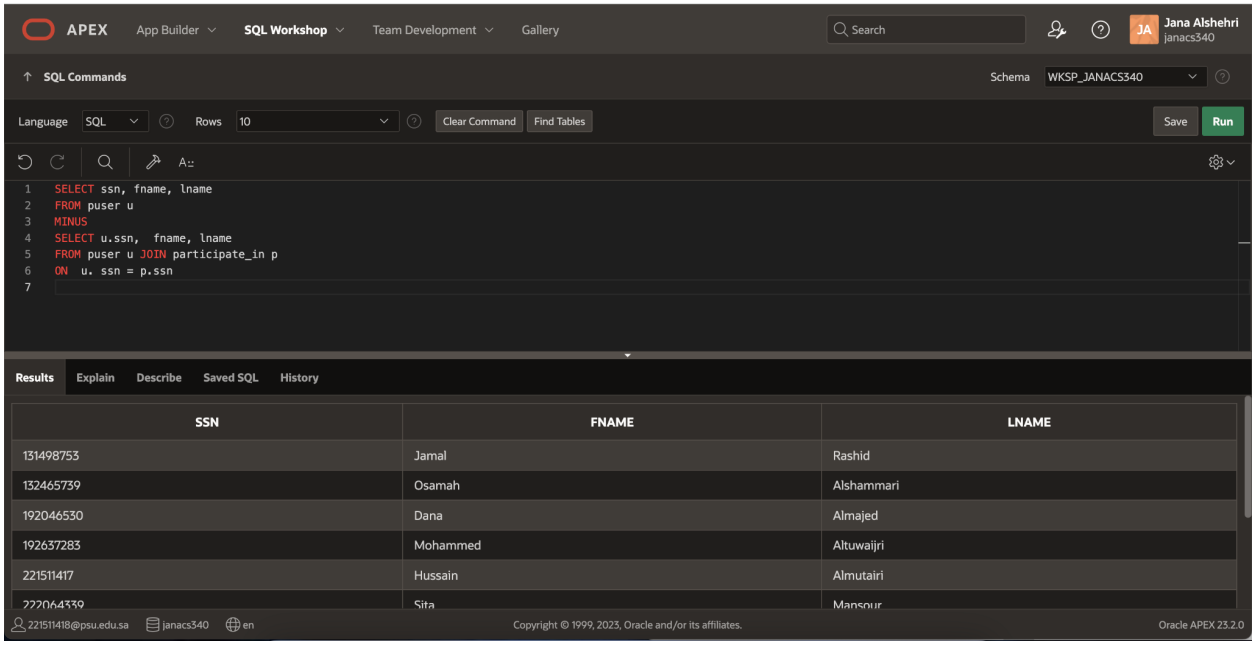
10. Find the ssn, first name and last name of the users who have not participated in any activity. Use NOTIN or NOT EXIST OR MINUS operators in different SQL queries. (Non-correlated Subquery)

```
SELECT ssn, Fname, Lname
FROM puser
WHERE ssn  NOT IN
                    (SELECT ssn
                   FROM participate_in);
```



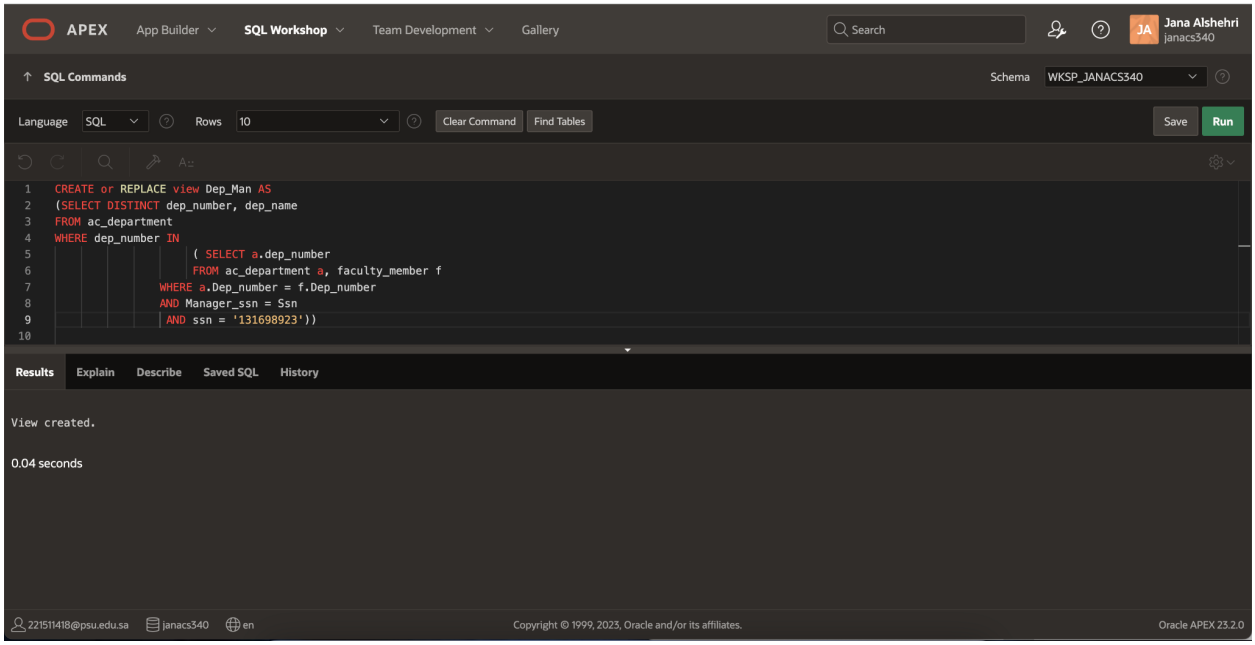
Using MINUS

```
SELECT ssn, fname, lname

FROM puser u

MINUS

SELECT u.ssn,  fname, lname

FROM puser u JOIN participate_in p

ON  u. ssn = p.ssn
```



11. Create a view for displaying the department number, name that have a faculty member with the ssn '131698923' involved as a manager.

```
CREATE or REPLACE view Dep_Man AS
(SELECT DISTINCT dep_number, dep_name
FROM ac_department
WHERE dep_number IN
                ( SELECT a.dep_number
                FROM ac_department a, faculty_member f
                    WHERE a.Dep_number = f.Dep_number
                    AND Manager_ssn = Ssn
                     AND ssn = '131698923'))
```


APEX
App Builder
SQL Workshop
Team Development
Gallery
Search
Jana Alshehri
janacs340
SQL Commands
Schema
WKSP_JANACS340
Language
SQL
Rows
10
Clear Command
Find Tables
Save
Run
CREATE or REPLACE view Dep_Man AS
(SELECT DISTINCT dep_number, dep_name
FROM ac_department
WHERE dep_number IN
(SELECT a.dep_number
FROM ac_department a, faculty_member f
WHERE a.Dep_number = f.Dep_number
AND Manager_ssn = Ssn
AND ssn = '131698923'))
Results
Explain
Describe
Saved SQL
History
View created.
0.04 seconds
221511418@psu.edu.sa
janacs340
en
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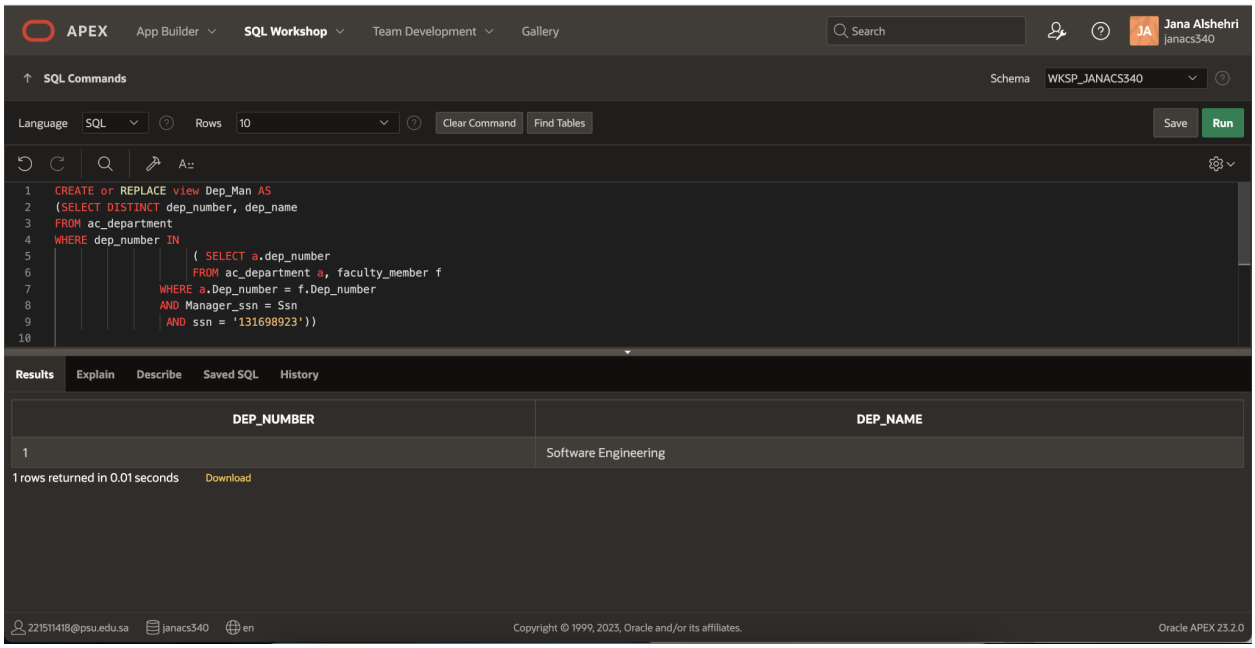
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SQL Commands
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WKSP_JANACS340
Language
SQL
Rows
10
Clear Command
Find Tables
Save
Run
CREATE or REPLACE view Dep_Man AS
(SELECT DISTINCT dep_number, dep_name
FROM ac_department
WHERE dep_number IN
(SELECT a.dep_number
FROM ac_department a, faculty_member f
WHERE a.Dep_number = f.Dep_number
AND Manager_ssn = Ssn
AND ssn = '131698923'))
Results
Explain
Describe
Saved SQL
History
DEP_NUMBER
DEP_NAME
1
Software Engineering
1 rows returned in 0.01 seconds
Download
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janacs340
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Teamwork Distribution & Strategy:

Name	Task Assigned
Haifa	-SQL Queries (10 Advanced) -Review of Simple Queries / Suggestions -Final Review over the document -Poster Preparation / Review
Jana	-SQL Queries (10 Advanced) -Review of Simple Queries / Suggestions -Final Review over the document -Poster Preparation / Review
Raghad	-SQL Queries (10 Simple) -Review of Advanced Queries / Suggestions -Poster Preparation / Modifications
Fouz	-SQL Queries (10 Advanced) -Review of Advanced Queries / Suggestions -Poster Review

Strategy:

In Phase 5, the team adopted a strategy of collaborative development using Oracle APEX. We wrote 20 query statements after brainstorming. 10 of them were simple queries and the other 10 were advanced queries that focused on more complex concepts. Then, through shared slides, members contributed in poster design and creation to present the final work. Regular communication through virtual meetings facilitated the sharing of insights and addressing any challenges encountered during the process. A structured workflow was maintained, ensuring each team member's contributions were aligned with the project goals. The strategy emphasized the importance of timely feedback and support, reinforcing our commitment to delivering a high-quality database implementation.

Summary and Learning Outcomes:

The process of designing and implementing this database was to complete the Maher development system as whole. Through this project, it was evident that this system's scope and purpose could definitely be enlarged to facilitate more requirements and could be enhanced. However, this project in its essence is a starting point for the Maher system that helped us gain a better understanding of database creation and design process by learning and applying consecutively. Receiving constructive feedback throughout the project helped in covering the practical aspects of application in which you can only grab a sense of in real-work environment.