# DMSD DELIVERABLE 3: RESEARCH LAB MANAGER

**Course:** CS 631 - Data Management Systems Design

**Team**: Shaury Pratap Singh (ss5423) ,Abhiram Panuganti(ap3364), Rithvik Reddy(rb898).

**Date:** December 12, 2025

**Link for all files** : All files are uploaded here

## 1) Description of Implementation

In this final phase, we transitioned from the logical design to a fully functional database application.

- **Database Instance:** The database was created using **MySQL 9.5**. We executed a structured SQL script to define the tables, primary keys, and foreign key constraints to ensure referential integrity.
- **Application Environment:** The application was developed using **Python**. We utilized the *MySQL-connector-python* library to bridge the gap between the user interface and the database server.
- **User Interface:** Per the project requirements to provide a practical and efficient interface, we developed a **Menu-Driven Command Line Interface (CLI)**. This allows administrators to manage members, track equipment, and generate reports through a series of structured inputs.

## 2) Revisions and Challenges

**Revisions to Relational Schema:** During implementation, we made a minor revision to the *USES* table. We included *SDATE* in the primary key to allow the same member to use the same equipment on different dates, which was a limitation in our initial Deliverable 2 draft.

**Challenges Encountered:**

1. **Constraint Enforcement:** The requirement that *"Equipment cannot be used by more than three members simultaneously"* cannot be enforced by standard SQL keys alone.
    - **Solution:** We implemented "Application-Level Validation." Before allowing a "Checkout" action, the Python code runs a *SELECT COUNT (*)* query. If the count is 3 or more, the application blocks the transaction and displays an error.
2. **Recursive Relationships:** Implementing the Mentorship hierarchy required careful handling of the *MENTOR* foreign key within the *LAB_MEMBER* table to avoid circular references.
3. **Complex Reporting:** Calculating averages across majors required using *LEFT JOINs* to ensure that majors with zero publications were still represented correctly in the statistics.

## 3) Database Setup (schema.sql)

**Software:** MySQL Workbench

SQL:

```
DROP DATABASE IF EXISTS ResearchLabManager;
CREATE DATABASE ResearchLabManager;
USE ResearchLabManager;

-- 1. LAB_MEMBER (Parent table for all people)
CREATE TABLE LAB_MEMBER (
    MID INT PRIMARY KEY,
    NAME VARCHAR(100) NOT NULL,
    JOINDATE DATE,
    MTYPE VARCHAR(20),
    MENTOR INT,
    FOREIGN KEY (MENTOR) REFERENCES LAB_MEMBER(MID)
);

-- 2. Subtypes (Faculty, Student, Collaborator)
CREATE TABLE FACULTY (
    MID INT PRIMARY KEY,
    DEPARTMENT VARCHAR(100),
    FOREIGN KEY (MID) REFERENCES LAB_MEMBER(MID) ON DELETE
CASCADE
);

CREATE TABLE STUDENT (
    MID INT PRIMARY KEY,
    SID VARCHAR(20) UNIQUE,
    LEVEL VARCHAR(20),
    MAJOR VARCHAR(50),
    FOREIGN KEY (MID) REFERENCES LAB_MEMBER(MID) ON DELETE
CASCADE
);

CREATE TABLE COLLABORATOR (
    MID INT PRIMARY KEY,
    AFFILIATION VARCHAR(100),
    BIOGRAPHY TEXT,
    FOREIGN KEY (MID) REFERENCES LAB_MEMBER(MID) ON DELETE
CASCADE
);
```

```sql
-- 3. GRANT & PROJECT
CREATE TABLE `GRANT` (
    GID INT PRIMARY KEY,
    SOURCE VARCHAR(100),
    BUDGET DECIMAL(15, 2),
    STARTDATE DATE,
    DURATION INT
);

CREATE TABLE PROJECT (
    PID INT PRIMARY KEY,
    TITLE VARCHAR(200),
    SDATE DATE,
    EDATE DATE,
    EDURATION INT,
    LEADER INT NOT NULL,
    FOREIGN KEY (LEADER) REFERENCES FACULTY(MID)
);

-- 4. Many-to-Many Relationships
CREATE TABLE FUNDS (
    GID INT,
    PID INT,
    PRIMARY KEY (GID, PID),
    FOREIGN KEY (GID) REFERENCES `GRANT`(GID),
    FOREIGN KEY (PID) REFERENCES PROJECT(PID)
);

CREATE TABLE WORKS (
    PID INT,
    MID INT,
    ROLE VARCHAR(50),
    HOURS DECIMAL(5, 2),
    PRIMARY KEY (PID, MID),
    FOREIGN KEY (PID) REFERENCES PROJECT(PID),
    FOREIGN KEY (MID) REFERENCES LAB_MEMBER(MID)
);

-- 5. EQUIPMENT & USAGE
CREATE TABLE EQUIPMENT (
    EID INT PRIMARY KEY,
    ETYPE VARCHAR(50),
    ENAME VARCHAR(100),
    STATUS VARCHAR(50),
    PDATE DATE
);
```

```
CREATE TABLE USES (
    MID INT,
    EID INT,
    SDATE DATE,
    EDATE DATE,
    PURPOSE VARCHAR(255),
    PRIMARY KEY (MID, EID, SDATE),
    FOREIGN KEY (MID) REFERENCES LAB_MEMBER(MID),
    FOREIGN KEY (EID) REFERENCES EQUIPMENT(EID)
);

-- 6. PUBLICATIONS
CREATE TABLE PUBLICATION (
    PID INT PRIMARY KEY,
    TITLE VARCHAR(255),
    VENUE VARCHAR(100),
    DATE DATE,
    DOI VARCHAR(100)
);

CREATE TABLE PUBLISHES (
    MID INT,
    PID INT,
    SDATE DATE,
    EDATE DATE,
    PURPOSE VARCHAR(100),
    PRIMARY KEY (MID, PID),
    FOREIGN KEY (MID) REFERENCES LAB_MEMBER(MID),
    FOREIGN KEY (PID) REFERENCES PUBLICATION(PID)
);
```

## 4) Sample Data (data.sql)

**Software:** MySQL Workbench

Have "Ample Sample Data".

**SQL**:

```
USE ResearchLabManager;
SET FOREIGN_KEY_CHECKS=0;

-- Wipe existing data
TRUNCATE TABLE PUBLISHES; TRUNCATE TABLE PUBLICATION; TRUNCATE
TABLE USES; TRUNCATE TABLE EQUIPMENT;
```

```
TRUNCATE TABLE WORKS; TRUNCATE TABLE FUNDS; TRUNCATE TABLE
PROJECT; TRUNCATE TABLE `GRANT`;
TRUNCATE TABLE COLLABORATOR; TRUNCATE TABLE STUDENT; TRUNCATE
TABLE FACULTY; TRUNCATE TABLE LAB_MEMBER;

-- Members
INSERT INTO LAB_MEMBER VALUES (1, 'Dr. Alice Smith', '2019-01-
01', 'Faculty', NULL),
(2, 'Dr. Bob Jones', '2020-05-15', 'Faculty', NULL),
(3, 'Charlie Lee', '2021-08-20', 'Student', 1),
(4, 'Diana Ross', '2022-01-10', 'Student', 1),
(5, 'Evan Wright', '2022-09-01', 'Student', 2),
(6, 'Frank Miller', '2023-01-15', 'Collaborator', NULL),
(7, 'Grace Hopp', '2023-02-01', 'Student', 2);

-- Subtypes
INSERT INTO FACULTY VALUES (1, 'Computer Science'), (2, 'Data
Science');
INSERT INTO STUDENT VALUES (3, 'S100', 'PhD', 'CS'), (4, 'S101',
'Masters', 'CS'), (5, 'S102', 'PhD', 'DataSci'), (7, 'S103',
'Masters', 'DataSci');
INSERT INTO COLLABORATOR VALUES (6, 'TechCorp', 'AI
Specialist');

-- Grants & Projects
INSERT INTO `GRANT` VALUES (101, 'NSF', 500000, '2021-01-01',
36), (102, 'NIH', 300000, '2022-06-01', 24);
INSERT INTO PROJECT VALUES (501, 'AI Health', '2021-02-01',
NULL, 36, 1), (502, 'Big Data Ops', '2022-07-01', '2023-07-01',
24, 2);
INSERT INTO FUNDS VALUES (101, 501), (102, 502);

-- Works & Usage
INSERT INTO WORKS VALUES (501, 3, 'Researcher', 20), (501, 4,
'Analyst', 15), (501, 1, 'PI', 10), (502, 5, 'Dev', 25);
INSERT INTO EQUIPMENT VALUES (10, 'Server', 'GPU Cluster',
'Available', '2020-10-10'), (11, 'Microscope', 'Electron Scope',
'In Use', '2021-03-15'), (12, 'Laptop', 'MacBook Pro Lab',
'Available', '2022-01-20');
INSERT INTO USES VALUES (4, 11, '2023-11-01', NULL, 'Lab Work');

-- Publications
INSERT INTO PUBLICATION VALUES (901, 'Deep Learning', 'Nature',
'2023-01-15', '10.1038/x'), (902, 'Data Mining', 'IEEE', '2022-
11-20', '10.1109/y'), (903, 'Quantum Basics', 'ACM', '2021-05-
10', '10.1145/z');
```

```
INSERT INTO PUBLISHES VALUES (1, 901, '2022-01-01', '2023-01-15', 'Author'), (3, 901, '2022-01-01', '2023-01-15', 'Co-Author'), (2, 902, '2022-06-01', '2022-11-20', 'Author'), (5, 902, '2022-06-01', '2022-11-20', 'Co-Author'), (1, 903, '2021-01-01', '2021-05-10', 'Author');

SET FOREIGN_KEY_CHECKS=1;
```

## 5) Application Source Code

**Software:** VS Code

```python
import mysql.connector
import sys


db_config = {
    'user': 'root',
    'password': 'Devendra01#',
    'host': 'localhost',
    'database': 'ResearchLabManager'
}

def get_connection():
    try:
        return mysql.connector.connect(**db_config)
    except mysql.connector.Error as err:
        print(f"Error: {err}")
        sys.exit(1)

def execute_query(sql, params=None, fetch=False):
    conn = get_connection()
    cur = conn.cursor()
    try:
        cur.execute(sql, params)
        if fetch:
            result = cur.fetchall()
            return result
        else:
            conn.commit()
            print(">> Action Successful.")
    except mysql.connector.Error as err:
        print(f">> Error: {err}")
    finally:
        conn.close()
```

```python
# ==========================================
# MAIN MENU
# ==========================================
def main_menu():
    while True:
        print("\n" + "="*60)
        print("      RESEARCH LAB MANAGER SYSTEM")
        print("="*60)

        print("1. PROJECT AND MEMBER MANAGEMENT")
        print("2. EQUIPMENT USAGE TRACKING")
        print("3. GRANT AND PUBLICATION REPORTING")
        print("4. Exit")

        choice = input("\nEnter Selection: ")

        if choice == '1': menu_one_management()
        elif choice == '2': menu_two_equipment()
        elif choice == '3': menu_three_reporting()
        elif choice == '4': break

# ==========================================
# 1. PROJECT AND MEMBER MANAGEMENT
# ==========================================
def menu_one_management():
    while True:
        print("\n--- [1] PROJECT & MEMBER MANAGEMENT ---")
        print("MEMBERS:")
        print("  1. List Members")
        print("  2. Add Member")
        print("  3. Update Member Name")
        print("  4. Remove Member")
        print("PROJECTS:")
        print("  5. List Projects (Display Status)")
        print("  6. Add Project")
        print("  7. Update Project Title")
        print("  8. Remove Project")
        print("QUERIES:")
        print("  9. Show Members funded by a Grant")
        print("  10. Show Mentorships in a Project")
        print("  0. Back to Main Menu")

        sel = input("Select: ")

        # --- MEMBER CRUD ---
        if sel == '1':
            rows = execute_query("SELECT * FROM LAB_MEMBER", fetch=True)
            for r in rows: print(r)
```

```
        elif sel == '2':
            mid = input("ID: ")
            name = input("Name: ")
            mtype = input("Type (Faculty/Student/Collaborator): ")
            execute_query("INSERT INTO LAB_MEMBER (MID, NAME, JOINDATE, MTYPE) VALUES
(%s, %s, CURDATE(), %s)", (mid, name, mtype))

        elif sel == '3':
            mid = input("Member ID to Update: ")
            name = input("New Name: ")
            execute_query("UPDATE LAB_MEMBER SET NAME=%s WHERE MID=%s", (name, mid))

        elif sel == '4':
            mid = input("Member ID to Delete: ")
            execute_query("DELETE FROM LAB_MEMBER WHERE MID=%s", (mid,))

        # --- PROJECT CRUD ---
        elif sel == '5':
            # "Display the status of a project"
            rows = execute_query("SELECT PID, TITLE, SDATE, EDATE FROM PROJECT",
fetch=True)
            for r in rows:
                status = "Active" if r[3] is None else "Completed"
                print(f"ID: {r[0]} | Title: {r[1]} | Status: {status}")

        elif sel == '6':
            pid = input("ID: ")
            title = input("Title: ")
            leader = input("Leader ID (Faculty): ")
            execute_query("INSERT INTO PROJECT (PID, TITLE, SDATE, LEADER) VALUES (%s,
%s, CURDATE(), %s)", (pid, title, leader))

        elif sel == '7':
            pid = input("Project ID: ")
            title = input("New Title: ")
            execute_query("UPDATE PROJECT SET TITLE=%s WHERE PID=%s", (title, pid))

        elif sel == '8':
            pid = input("Project ID to Delete: ")
            execute_query("DELETE FROM PROJECT WHERE PID=%s", (pid,))

        # --- SPECIFIC QUERIES ---
        elif sel == '9':
            gid = input("Enter Grant ID: ")
            rows = execute_query("""SELECT DISTINCT M.NAME FROM LAB_MEMBER M
                                    JOIN WORKS W ON M.MID=W.MID
```

```
                                    JOIN FUNDS F ON W.PID=F.PID WHERE F.GID=%s""",
(gid,), fetch=True)
            for r in rows: print(f"- {r[0]}")

        elif sel == '10':
            pid = input("Enter Project ID: ")
            rows = execute_query("""SELECT Mentee.NAME, Mentor.NAME FROM LAB_MEMBER
Mentee
                                    JOIN LAB_MEMBER Mentor ON Mentee.MENTOR=Mentor.MID
                                    JOIN WORKS W1 ON Mentee.MID=W1.MID
                                    JOIN WORKS W2 ON Mentor.MID=W2.MID
                                    WHERE W1.PID=%s AND W2.PID=%s""", (pid, pid),
fetch=True)
            for r in rows: print(f"Mentee: {r[0]} | Mentor: {r[1]}")

        elif sel == '0': break

# ==========================================
# 2. EQUIPMENT USAGE TRACKING
# ==========================================
def menu_two_equipment():
    while True:
        print("\n--- [2] EQUIPMENT USAGE TRACKING ---")
        print("1. List Equipment (Show Status)")
        print("2. Add Equipment")
        print("3. Remove Equipment")
        print("4. Checkout Equipment")
        print("5. Return Equipment")
        print("6. Show Current Users of Equipment")
        print("0. Back to Main Menu")
        sel = input("Select: ")

        if sel == '1':
            rows = execute_query("SELECT EID, ENAME, STATUS FROM EQUIPMENT",
fetch=True)
            for r in rows: print(f"{r[0]}: {r[1]} [{r[2]}]")

        elif sel == '2':
            eid = input("ID: ")
            name = input("Name: ")
            etype = input("Type: ")
            execute_query("INSERT INTO EQUIPMENT (EID, ETYPE, ENAME, STATUS, PDATE)
VALUES (%s, %s, %s, 'Available', CURDATE())", (eid, etype, name))

        elif sel == '3':
            eid = input("Equipment ID to Remove: ")
            execute_query("DELETE FROM EQUIPMENT WHERE EID=%s", (eid,))
```

```
        elif sel == '4':
            eid = input("Equipment ID: ")
            mid = input("Member ID: ")
            # CONSTRAINT CHECK
            conn = get_connection()
            cur = conn.cursor()
            cur.execute("SELECT COUNT(*) FROM USES WHERE EID=%s AND EDATE IS NULL",
(eid,))
            count = cur.fetchone()[0]
            conn.close()

            if count >= 3:
                print(">> ERROR: Max 3 users limit reached!")
            else:
                execute_query("INSERT INTO USES (MID, EID, SDATE) VALUES (%s, %s,
CURDATE())", (mid, eid))
                execute_query("UPDATE EQUIPMENT SET STATUS='In Use' WHERE EID=%s",
(eid,))

        elif sel == '5':
            eid = input("Equipment ID: ")
            mid = input("Member ID: ")
            execute_query("UPDATE USES SET EDATE=CURDATE() WHERE EID=%s AND MID=%s AND
EDATE IS NULL", (eid, mid))
            execute_query("UPDATE EQUIPMENT SET STATUS='Available' WHERE EID=%s",
(eid,))

        elif sel == '6':
            eid = input("Equipment ID: ")
            rows = execute_query("""SELECT M.NAME, P.TITLE FROM LAB_MEMBER M
                                    JOIN USES U ON M.MID=U.MID
                                    JOIN WORKS W ON M.MID=W.MID
                                    JOIN PROJECT P ON W.PID=P.PID
                                    WHERE U.EID=%s AND U.EDATE IS NULL""", (eid,),
fetch=True)
            for r in rows: print(f"User: {r[0]} | Project: {r[1]}")

        elif sel == '0': break

# ==========================================
# 3. GRANT AND PUBLICATION REPORTING
# ==========================================
def menu_three_reporting():
    while True:
        print("\n--- [3] GRANT AND PUBLICATION REPORTING ---")
        print("1. Member with Highest Publications")
        print("2. Avg Student Pubs per Major")
        print("3. Count Active Projects by Grant & Date")
```

```
        print("4. Top 3 Members on Grant (Most Pubs)")
        print("0. Back to Main Menu")
        sel = input("Select: ")

        if sel == '1':
            rows = execute_query("""SELECT M.NAME, COUNT(*) as C FROM LAB_MEMBER M
                                    JOIN PUBLISHES P ON M.MID=P.MID GROUP BY M.MID
ORDER BY C DESC LIMIT 1""", fetch=True)
            if rows: print(f"Top Publisher: {rows[0][0]} ({rows[0][1]} pubs)")

        elif sel == '2':
            rows = execute_query("""SELECT S.MAJOR, COUNT(P.PID)/COUNT(DISTINCT S.MID)
FROM STUDENT S
                                    LEFT JOIN PUBLISHES P ON S.MID=P.MID GROUP BY
S.MAJOR""", fetch=True)
            for r in rows: print(f"{r[0]}: {float(r[1]):.2f}")

        elif sel == '3':
            gid = input("Grant ID: ")
            d = input("Date (YYYY-MM-DD): ")
            rows = execute_query("""SELECT COUNT(*) FROM PROJECT P
                                    JOIN FUNDS F ON P.PID=F.PID
                                    WHERE F.GID=%s AND (P.SDATE <= %s AND (P.EDATE >=
%s OR P.EDATE IS NULL))""", (gid, d, d), fetch=True)
            print(f"Active Projects: {rows[0][0]}")

        elif sel == '4':
            gid = input("Grant ID: ")
            rows = execute_query("""SELECT M.NAME, COUNT(Pub.PID) as C
                                    FROM LAB_MEMBER M
                                    JOIN WORKS W ON M.MID=W.MID
                                    JOIN FUNDS F ON W.PID=F.PID
                                    LEFT JOIN PUBLISHES Pub ON M.MID=Pub.MID
                                    WHERE F.GID=%s
                                    GROUP BY M.MID ORDER BY C DESC LIMIT 3""", (gid,),
fetch=True)
            for r in rows: print(f"- {r[0]} ({r[1]} pubs)")

        elif sel == '0': break

if __name__ == "__main__":
    main_menu()
```

## 6) Screenshots of the Program

1. PROJECT AND MEMBER MANAGEMENT

• Query, add, update, and remove members and projects.
• Display the status of a project.
• Show members who have worked on projects funded by a given grant.

• Show mentorship relations among members who have worked on the same project.

```
Last login: Thu Dec 11 13:35:54 on ttys000
(base) shaurypratapsingh@Mac ~ % cd Downloads
(base) shaurypratapsingh@Mac Downloads % python app.py

============================================================
      RESEARCH LAB MANAGER SYSTEM
============================================================
1. PROJECT AND MEMBER MANAGEMENT
2. EQUIPMENT USAGE TRACKING
3. GRANT AND PUBLICATION REPORTING
4. Exit

Enter Selection: 1

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 1
(1, 'Dr. Alice Smith', datetime.date(2019, 1, 1), 'Faculty', None)
(2, 'Dr. Bob Jones', datetime.date(2020, 5, 15), 'Faculty', None)
(3, 'Charlie Lee', datetime.date(2021, 8, 20), 'Student', 1)
(4, 'Diana Ross', datetime.date(2022, 1, 10), 'Student', 1)
(5, 'Evan Wright', datetime.date(2022, 9, 1), 'Student', 2)
(6, 'Frank Miller', datetime.date(2023, 1, 15), 'Collaborator', None)
(7, 'Grace Hopp', datetime.date(2023, 2, 1), 'Student', 2)

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 2
ID: 99
Name: Virat Kohli
Type (Faculty/Student/Collaborator): Faculty
>> Action Successful.
```

```
--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 1
(1, 'Dr. Alice Smith', datetime.date(2019, 1, 1), 'Faculty', None)
(2, 'Dr. Bob Jones', datetime.date(2020, 5, 15), 'Faculty', None)
(3, 'Charlie Lee', datetime.date(2021, 8, 20), 'Student', 1)
(4, 'Diana Ross', datetime.date(2022, 1, 10), 'Student', 1)
(5, 'Evan Wright', datetime.date(2022, 9, 1), 'Student', 2)
(6, 'Frank Miller', datetime.date(2023, 1, 15), 'Collaborator', None)
(7, 'Grace Hopp', datetime.date(2023, 2, 1), 'Student', 2)
(99, 'Virat Kohli', datetime.date(2025, 12, 12), 'Faculty', None)

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 3
Member ID to Update: 99
New Name: Sachin
>> Action Successful.
```

```
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 1
(1, 'Dr. Alice Smith', datetime.date(2019, 1, 1), 'Faculty', None)
(2, 'Dr. Bob Jones', datetime.date(2020, 5, 15), 'Faculty', None)
(3, 'Charlie Lee', datetime.date(2021, 8, 20), 'Student', 1)
(4, 'Diana Ross', datetime.date(2022, 1, 10), 'Student', 1)
(5, 'Evan Wright', datetime.date(2022, 9, 1), 'Student', 2)
(6, 'Frank Miller', datetime.date(2023, 1, 15), 'Collaborator', None)
(7, 'Grace Hopp', datetime.date(2023, 2, 1), 'Student', 2)
(99, 'Sachin', datetime.date(2025, 12, 12), 'Faculty', None)

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 4
Member ID to Delete: 99
>> Action Successful.

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 1
(1, 'Dr. Alice Smith', datetime.date(2019, 1, 1), 'Faculty', None)
(2, 'Dr. Bob Jones', datetime.date(2020, 5, 15), 'Faculty', None)
(3, 'Charlie Lee', datetime.date(2021, 8, 20), 'Student', 1)
(4, 'Diana Ross', datetime.date(2022, 1, 10), 'Student', 1)
(5, 'Evan Wright', datetime.date(2022, 9, 1), 'Student', 2)
(6, 'Frank Miller', datetime.date(2023, 1, 15), 'Collaborator', None)
(7, 'Grace Hopp', datetime.date(2023, 2, 1), 'Student', 2)
```

```
--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 5
ID: 501 | Title: AI Health | Status: Active
ID: 502 | Title: Big Data Ops | Status: Completed

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 6
ID: 800
Title: AI Research
Leader ID (Faculty): 1
>> Action Successful.

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 5
ID: 501 | Title: AI Health | Status: Active
ID: 502 | Title: Big Data Ops | Status: Completed
ID: 800 | Title: AI Research | Status: Active
```

```
ID: 800 | Title: AI Research | Status: Active

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 7
Project ID: 800
New Title: Advance AI
>> Action Successful.

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 5
ID: 501 | Title: AI Health | Status: Active
ID: 502 | Title: Big Data Ops | Status: Completed
ID: 800 | Title: Advance AI | Status: Active

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 8
Project ID to Delete: 800
>> Action Successful.
```

```
--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 5
ID: 501 | Title: AI Health | Status: Active
ID: 502 | Title: Big Data Ops | Status: Completed

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 1
(1, 'Dr. Alice Smith', datetime.date(2019, 1, 1), 'Faculty', None)
(2, 'Dr. Bob Jones', datetime.date(2020, 5, 15), 'Faculty', None)
(3, 'Charlie Lee', datetime.date(2021, 8, 20), 'Student', 1)
(4, 'Diana Ross', datetime.date(2022, 1, 10), 'Student', 1)
(5, 'Evan Wright', datetime.date(2022, 9, 1), 'Student', 2)
(6, 'Frank Miller', datetime.date(2023, 1, 15), 'Collaborator', None)
(7, 'Grace Hopp', datetime.date(2023, 2, 1), 'Student', 2)

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 5
ID: 501 | Title: AI Health | Status: Active
ID: 502 | Title: Big Data Ops | Status: Completed
```

```
--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 9
Enter Grant ID: 101
- Dr. Alice Smith
- Charlie Lee
- Diana Ross

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 10
Enter Project ID: 501
Mentee: Charlie Lee | Mentor: Dr. Alice Smith
Mentee: Diana Ross | Mentor: Dr. Alice Smith

--- [1] PROJECT & MEMBER MANAGEMENT ---
MEMBERS:
  1. List Members
  2. Add Member
  3. Update Member Name
  4. Remove Member
PROJECTS:
  5. List Projects (Display Status)
  6. Add Project
  7. Update Project Title
  8. Remove Project
QUERIES:
  9. Show Members funded by a Grant
  10. Show Mentorships in a Project
  0. Back to Main Menu
Select: 0
```

## 2. EQUIPEMENT USAGE TRACKING

• Query, add, update, and remove equipment and equipment usage.
• Show status of a piece of equipment• Show members currently using a given piece of equipment and the projects they
are working on.

```
==============================================================
      RESEARCH LAB MANAGER SYSTEM
==============================================================
1. PROJECT AND MEMBER MANAGEMENT
2. EQUIPMENT USAGE TRACKING
3. GRANT AND PUBLICATION REPORTING
4. Exit

Enter Selection: 2

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 1
10: GPU Cluster [Available]
11: Electron Scope [In Use]
12: MacBook Pro Lab [Available]

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 2
ID: 55
Name: Laser Scanner
Type: Optical
>> Action Successful.

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 1
10: GPU Cluster [Available]
11: Electron Scope [In Use]
12: MacBook Pro Lab [Available]
55: Laser Scanner [Available]

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 3
Equipment ID to Remove: 55
>> Action Successful.
```

```
--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 1
10: GPU Cluster [Available]
11: Electron Scope [In Use]
12: MacBook Pro Lab [Available]

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 6
Equipment ID: 11
User: Diana Ross | Project: AI Health

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 4
Equipment ID: 11
Member ID: 3
>> Action Successful.
>> Action Successful.

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 4
Equipment ID: 11
Member ID: 4
>> Action Successful.
>> Action Successful.

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 4
Equipment ID: 11
```

```
--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 4
Equipment ID: 11
Member ID: 5
>> ERROR: Max 3 users limit reached!

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 4
Equipment ID: 11
Member ID: 1
>> ERROR: Max 3 users limit reached!

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 0

============================================================
      RESEARCH LAB MANAGER SYSTEM
============================================================
1. PROJECT AND MEMBER MANAGEMENT
2. EQUIPMENT USAGE TRACKING
3. GRANT AND PUBLICATION REPORTING
4. Exit

Enter Selection: 3

--- [3] GRANT AND PUBLICATION REPORTING ---
1. Member with Highest Publications
2. Avg Student Pubs per Major
3. Count Active Projects by Grant & Date
4. Top 3 Members on Grant (Most Pubs)
0. Back to Main Menu
Select: 1
Top Publisher: Dr. Alice Smith (2 pubs)

--- [3] GRANT AND PUBLICATION REPORTING ---
1. Member with Highest Publications
2. Avg Student Pubs per Major
3. Count Active Projects by Grant & Date
4. Top 3 Members on Grant (Most Pubs)
0. Back to Main Menu
Select: 2
CS: 0.50
DataSci: 0.50
```

## 3. GRANT AND PUBLICATION REPORTING.

• Identify the name of the member(s) with the highest number of publications.
• Calculate the average number of student publications per major.
• Find the number of projects that were funded by a grant and were active during a given period of time.
• Find the three most prolific members who have worked on a project funded by a given grant.

```
--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 1
10: GPU Cluster [Available]
11: Electron Scope [In Use]
12: MacBook Pro Lab [Available]

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 6
Equipment ID: 11
User: Diana Ross | Project: AI Health

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 4
Equipment ID: 11
Member ID: 3
>> Action Successful.
>> Action Successful.

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 4
Equipment ID: 11
Member ID: 4
>> Action Successful.
>> Action Successful.

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 4
Equipment ID: 11
```

```
--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 4
Equipment ID: 11
Member ID: 5
>> ERROR: Max 3 users limit reached!

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 4
Equipment ID: 11
Member ID: 1
>> ERROR: Max 3 users limit reached!

--- [2] EQUIPMENT USAGE TRACKING ---
1. List Equipment (Show Status)
2. Add Equipment
3. Remove Equipment
4. Checkout Equipment
5. Return Equipment
6. Show Current Users of Equipment
0. Back to Main Menu
Select: 0

============================================================
      RESEARCH LAB MANAGER SYSTEM
============================================================
1. PROJECT AND MEMBER MANAGEMENT
2. EQUIPMENT USAGE TRACKING
3. GRANT AND PUBLICATION REPORTING
4. Exit

Enter Selection: 3

--- [3] GRANT AND PUBLICATION REPORTING ---
1. Member with Highest Publications
2. Avg Student Pubs per Major
3. Count Active Projects by Grant & Date
4. Top 3 Members on Grant (Most Pubs)
0. Back to Main Menu
Select: 1
Top Publisher: Dr. Alice Smith (2 pubs)

--- [3] GRANT AND PUBLICATION REPORTING ---
1. Member with Highest Publications
2. Avg Student Pubs per Major
3. Count Active Projects by Grant & Date
4. Top 3 Members on Grant (Most Pubs)
0. Back to Main Menu
Select: 2
CS: 0.50
DataSci: 0.50
```

```
2. EQUIPMENT USAGE TRACKING
3. GRANT AND PUBLICATION REPORTING
4. Exit

Enter Selection: 3

--- [3] GRANT AND PUBLICATION REPORTING ---
1. Member with Highest Publications
2. Avg Student Pubs per Major
3. Count Active Projects by Grant & Date
4. Top 3 Members on Grant (Most Pubs)
0. Back to Main Menu
Select: 1
Top Publisher: Dr. Alice Smith (2 pubs)

--- [3] GRANT AND PUBLICATION REPORTING ---
1. Member with Highest Publications
2. Avg Student Pubs per Major
3. Count Active Projects by Grant & Date
4. Top 3 Members on Grant (Most Pubs)
0. Back to Main Menu
Select: 2
CS: 0.50
DataSci: 0.50

--- [3] GRANT AND PUBLICATION REPORTING ---
1. Member with Highest Publications
2. Avg Student Pubs per Major
3. Count Active Projects by Grant & Date
4. Top 3 Members on Grant (Most Pubs)
0. Back to Main Menu
Select: 3
Grant ID: 101
Date (YYYY-MM-DD): 2021-06-01
Active Projects: 1

--- [3] GRANT AND PUBLICATION REPORTING ---
1. Member with Highest Publications
2. Avg Student Pubs per Major
3. Count Active Projects by Grant & Date
4. Top 3 Members on Grant (Most Pubs)
0. Back to Main Menu
Select: 4
Grant ID: 101
- Dr. Alice Smith (2 pubs)
- Charlie Lee (1 pubs)
- Diana Ross (0 pubs)

--- [3] GRANT AND PUBLICATION REPORTING ---
1. Member with Highest Publications
2. Avg Student Pubs per Major
3. Count Active Projects by Grant & Date
4. Top 3 Members on Grant (Most Pubs)
0. Back to Main Menu
Select: 0

------------------------------------------------------------
```