University
Mohammed VI
Polytechnic

College of Computing

Moroccan National Health Services (MNHS)

Data Management Course

Mohammed VI Polytechnic University (UM6P)

Professor: Karima Echihabi **Program:** Computer Engineering

Session: Fall 2025

Part III: Relational Algebra, SQL and Functional Dependencies

Preparatory Exercises

Before starting Project Part III, students should review and solve the following textbook exercises.

Textbook Exercises

Reference: Ramakrishnan, Raghu, and Johannes Gehrke, *Database Management Systems*, 3rd Ed. [1].

- Chapter 4 (Relational Algebra): Exercises 4.3, 4.5
- Chapter 19 (Schema Refinement and Normal Forms): Exercises 19.3

1. Relational Algebra and SQL

Objectives

- Express non-trivial queries over MNHS using Relational Algebra (RA).
- Translate the same queries into SQL.

Tasks

For each query, provide RA and SQL.

1. Find the names of patients who have had at least one clinical activity handled by active staff.
2. Find Staff IDs of staff who are either 'Active' or have issued at least one prescription.
3. Find Hospital IDs of hospitals located in 'Benguerir' or having at least one department with the specialty 'Cardiology'.
4. Find Hospital IDs of hospitals that have both 'Cardiology' and 'Pediatrics' departments.
5. Find staff members who have worked in every department of the hospital with HID = 1.
6. Find staff members who participated in every clinical activity of the department with DEP_ID = 2.
7. Find pairs of staff members (s_1, s_2) such that s_1 has handled more clinical activities than s_2.
8. Find Patient IDs of patients who had clinical activities with at least two different staff members.

9. Find CAIDs of clinical activities performed in September 2025 at hospitals located in "Benguerir".
10. Find Staff IDs of staff who have issued more than one prescription.
11. List IIDs of patients who have scheduled appointments in more than one department.
12. Find Staff IDs who have no scheduled appointments on the day of the Green March holiday (November 6).
13. Find departments whose average number of clinical activities is below the global departmental average.
14. For each staff member, return the patient who has the greatest number of completed appointments with that staff member.
15. List patients who had at least 3 emergency admissions during the year 2024.

2. Refinement

Objectives

- Identify and state functional dependencies (FDs) in the MNHS schema.

Tasks

1. Derive functional dependencies from the MNHS schema.

Deliverable

- RA expressions and SQL for all queries above.
- A clear list of functional dependencies for the MNHS schema.

References

[1] Raghu Ramakrishnan, Johannes Gehrke, and Johannes Gehrke. *Database management systems*, volume 3. McGraw-Hill New York, 2003.