AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES

(AIMS RWANDA, KIGALI)

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Exercise 1

In order to respond to this question, let's provide a brief description of the Information Management System at AIMS, along with the data dictionary for each table and the relationships between them. It's important to note that we can provide all the attributes, but the most important aspects are the tables and their relationships. In database system modeling, there are no "worst" schemas; rather, there are good and evolving schemas, as they generally develop during the system's development process.

Problem Description:

A student at AIMS Rwanda follows a specific academic program. There are different programs offered at AIMS, and each program contains several blocks. Each block, in turn, consists of multiple courses. The student registers for these courses based on the blocks within their chosen program. Each course is taught by a lecturer, and students are required to complete the courses in order to fulfill the requirements of their respective academic programs.
In addition to the core courses, students participate in seminars, which are scheduled throughout the academic year. These seminars are conducted by lecturers and provide additional learning opportunities related to the student's program. Moreover, each student is assigned a tutor, who provides academic support and guidance throughout their studies.
The system needs to manage these relationships, along with other aspects such as student accommodations, meal plans, financial aid, research projects, and outreach programs. All data related to these entities—students, courses, blocks, programs, lecturers, seminars, and tutors—needs to be stored and linked within the system to provide a comprehensive information system that supports administrative, academic, and operational tasks at AIMS.

Data Dictionary

Below is the data dictionary for each table in the AIMS Information System Database.

Bref description of Table Academic Program

The **Academic Programs** table holds information about the various academic programs offered at AIMS. Each record represents a program, which could be a Master's program in Mathematical Sciences, an intensive block course, or other educational offerings. This table is central to the system as it connects students and courses to specific programs. The table includes details such as the program's name, level (e.g., Master's, Intensive), department offering it, and its duration.
Relationship:

- Connected to the Students table via the $program_id$ (students are enrolled in a specific program).
- Connected to the Courses table via the $program_id$ (courses are linked to a specific program).

Attribute Name	Description	Type
program_id	Primary Key, Unique identifier for the academic program.	INT
program_name	Name of the program (e.g., Master's in Mathematical Sciences).	VARCHAR(255)
program_level	Level of the program (e.g., Master's, Intensive Block Course).	VARCHAR(255)
duration	Duration of the program in years or months.	INT
start_date	Start date of the program.	DATE
end_date	End date of the program.	DATE

Table 1: Data Dictionary for the Academic Programs Table

Bref description of Table Students

The **Students table** captures data about students enrolled at AIMS, including personal details, academic records, financial aid, accommodation, and meal plans. Each student is uniquely identified by the student_id. The table records the student's full name, program enrollment, admission and graduation dates, and links to financial aid, accommodation, and meal plans.
Relationship:

- Linked to the Academic Programs table via the program_id (the student's program of study).
- Connected to the Financial Aid table via financial_aid (if the student receives financial support).
- Associated with the Accommodation table via accommodation_id (where the student resides).
- Linked to the Meal Plans table via meal_plan_id (the student's meal plan details).

Attribute Name	Description	Type
student_id	Primary Key, Unique identifier for each student.	INT
first_name	First name of the student.	VARCHAR(255)
last_name	Last name of the student.	VARCHAR(255)
program_id	Foreign Key to the academic_programs table.	INT
admission_date	Date the student was admitted.	DATE
graduation_date	Date the student graduated or will graduate.	DATE
financial_aid	Foreign Key to financial_aid table.	INT
accommodation_id	Foreign Key to accommodation table.	INT
meal_plan_id	Foreign Key to meal_plans table.	INT

Table 2: Data Dictionary for the Students Table

Bref description of Table Lecturer

The **Lecturers table** stores information about the lecturers at AIMS, including personal details such as their names, email addresses, and research interests. Each lecturer is uniquely identified by the $lecturer_id$. This table is critical for managing lecturer profiles and linking them to the courses they teach.
Relationship:

- Connected to the Courses table via the lecturer_id (lecturers teach courses).
- Linked to the Research Projects table via lecturer_id (lecturers supervise or lead research projects).

Attribute Name	Description	Type
lecturer_id	Primary Key, Unique identifier for the lecturer.	INT
first_name	First name of the lecturer.	VARCHAR(255)
last_name	Last name of the lecturer.	VARCHAR(255)
email	Email address of the lecturer.	VARCHAR(255)
research_interests	Research areas of the lecturer.	TEXT
profile_url	URL to the lecturer's profile.	VARCHAR(255)

Table 3: Data Dictionary for the Lecturers Table

Bref description of Table Course

The **Courses table** defines all the courses offered at AIMS, including the course name, credits, and scheduling details. Each course is assigned a unique $course_id$ and is linked to a specific academic program and lecturer. This table is essential for linking students to the courses they are enrolled in.
Relationship:

- Linked to the Lecturers table via lecturer_id (courses are taught by lecturers).
- Connected to the Academic Programs table via program_id (courses belong to specific programs).
- Linked to the Schedules table via schedule_id (provides the time and day details of the courses).

Attribute Name	Description	Type
course_id	Primary Key, Unique identifier for each course.	INT
course_name	Name of the course.	VARCHAR(255)
credits	Number of credits awarded for the course.	INT
lecturer_id	Foreign Key to the lecturers table.	INT
program_id	Foreign Key to the academic_programs table.	INT
block_id	Foreign Key to the block table. Indicates which block the course belongs to.	INT

Table 4: Data Dictionary for the Courses Table (Linked to Block Table)

Bref description of Table Block

The Block table defines the intensive teaching periods at AIMS, where each block consists of multiple courses taught during a specific time frame. Each block is assigned a unique $block_id$ and includes information such as the block's name, start date, end date, and location. The Block table is essential for organizing courses and ensuring that students are enrolled in the right blocks as part of their academic program.
Relationship:

- Linked to the Courses table via block_id (each block contains multiple courses).
- Connected to the Academic Programs table via program_id (blocks are part of specific academic programs).

Attribute Name	Description	Type
block_id	Primary Key, Unique identifier for each block.	INT
block_name	Name or title of the block	VARCHAR(255)
start_date	Start date of the block period.	DATE
end_date	End date of the block period.	DATE
location	Location where the block courses are conducted.	VARCHAR(255)

Table 5: Data Dictionary for the Block Table

Bref description of Table Staff

The **Staff table** contains details about the administrative and support staff at AIMS, such as their names, roles, contact information, and hire date. This table is used to manage and maintain records of all staff members.

Attribute Name	Description	Type
staff_id	Primary Key, Unique identifier for staff members.	INT
first_name	First name of the staff member.	VARCHAR(255)
last_name	Last name of the staff member.	VARCHAR(255)
role	Role of the staff member (e.g., administrative, HR).	VARCHAR(255)
email	Email address of the staff member.	VARCHAR(255)
hire_date	Date the staff member was hired.	DATE

Table 6: Data Dictionary for the Staff Table

Bref description of Table Course

The **Accommodation table** tracks dormitory and room assignments for students. Each accommodation record includes the room number, building name, and the maintenance status of the room. The $student_id$ links each accommodation record to a student.
Relationship:

- Linked to the Students table via student_id (each student is assigned a room).

Attribute Name	Description	Type
accommodation_id	Primary Key, Unique identifier for accommodation records.	INT
room_number	Number of the room in the dormitory.	VARCHAR(255)
building_name	Name of the building.	VARCHAR(255)
student_id	Foreign Key to the students table.	INT
maintenance_status	Status of the room (e.g., under maintenance, available).	VARCHAR(255)
room_capacity	Number of people the room can accommodate.	INT

Table 7: Data Dictionary for the Accommodation Table

Bref description of Meal Plans

The **Meal Plans table** stores information regarding the meal plans available to students, including the type of plan (e.g., vegetarian, standard) and any dietary restrictions. It also records the start and end dates of the meal plan.
Relationship:

- Linked to the Students table via student_id (each student is associated with a meal plan).

Attribute Name	Description	Type
meal_plan_id	Primary Key, Unique identifier for meal plan.	INT
plan_type	Type of the meal plan (e.g., vegetarian, standard).	VARCHAR(255)
dietary_restrictions	Dietary restrictions (e.g., vegan, gluten-free).	TEXT
student_id	Foreign Key to the students table.	INT
start_date	Start date of the meal plan.	DATE
end_date	End date of the meal plan.	DATE

Table 8: Data Dictionary for the Meal Plans Table

Bref description of Financial Aid

The **Financial Aid table** manages records related to scholarships, loans, and other forms of financial aid provided to students. It includes the amount of aid, type (scholarship or loan), and the approval status. Each financial aid record is linked to a specific student. Relationship:

- Linked to the Students table via student_id (students who receive financial aid).

Attribute Name	Description	Type
aid_id	Primary Key, Unique identifier for the financial aid record.	INT
student_id	Foreign Key to the students table.	INT
amount	Amount of financial aid or scholarship.	DECIMAL
type	Type of aid (e.g., scholarship, loan).	VARCHAR(255)
status	Status of the aid (e.g., Pending, Approved).	VARCHAR(255)

Table 9: Data Dictionary for the Financial Aid Table

Bref description of Research Projects

The **Research Projects table** tracks student research projects, including the project title, status (e.g., ongoing or completed), and the supervising lecturer. It links research projects to students and grants. Relationship:

- Connected to the Students table via student_id (students are involved in research projects).
- Linked to the Lecturers table via supervisor_id (lecturers supervise research projects).
- Connected to the Grants table via grant_id (research projects may receive funding)

Attribute Name	Description	Type
project_id	Primary Key, Unique identifier for research projects.	INT
student_id	Foreign Key to the students table.	INT
title	Title of the research project.	VARCHAR(255)
supervisor_id	Foreign Key to the lecturers table.	INT
status	Status of the project (e.g., ongoing, completed).	VARCHAR(255)
grant_id	Foreign Key to the grants table.	INT

Table 10: Data Dictionary for the Research Projects Table

Bref description of Gant

The **Grants table** holds information about external funding or grants provided for research projects. It includes the amount of the grant, the organization providing it, and its status (e.g., active or expired). Relationship:

- Linked to the Research Projects table via project_id (grants are assigned to specific research projects).

Attribute Name	Description	Type
grant_id	Primary Key, Unique identifier for grants.	INT
amount	Amount of the grant.	DECIMAL
organization	Organization providing the grant.	VARCHAR(255)
project_id	Foreign Key to the research_projects table.	INT
status	Status of the grant (e.g., active, expired).	VARCHAR(255)

Table 11: Data Dictionary for the Grants Table

Bref description of Schedules Table

The **Schedules table** defines the scheduling information for courses offered at AIMS. It contains the day of the week, start time, and end time for each course. Relationship:

- Linked to the Courses table via $course_id$ (each course has a specific schedule).

Attribute Name	Description	Type
schedule_id	Primary Key, Unique identifier for the course schedule.	INT
day_of_week	Day when the course is held.	VARCHAR(255)
start_time	Start time of the course.	TIME
end_time	End time of the course.	TIME
course_id	Foreign Key to the courses table.	INT

Table 12: Data Dictionary for the Schedules Table

Brief Description of Table Seminars

The **Seminars table** stores details about seminars held at AIMS, including the topic, the scheduled week, and the lecturers conducting them. Each seminar is uniquely identified by the seminar_id. This table allows the institution to schedule and track weekly seminars, with potential for multiple seminars in each week.
Relationship:

- Linked to the Lecturers table via lecturer_id (lecturers lead seminars).
- Each seminar is associated with a particular week or schedule.

Attribute Name	Description	Type
seminar_id	Primary Key, Unique identifier for each seminar.	INT
seminar_topic	The topic or title of the seminar.	VARCHAR(255)
week_number	The week number in which the seminar is held (e.g., Week 1, Week 2).	INT
semester_id	Foreign Key to the semesters table (if you have a table tracking semesters).	INT
lecturer_type	Type of lecturer: "Internal" or "External".	Boolean
lecturer_id	Foreign Key to the lecturers table. Indicates who is leading the seminar.	INT
schedule_id	Foreign Key to the schedules table (if you want to track specific days and times for seminars).	INT

Table 13: Data Dictionary for the Seminars Table

Brief Description of Table Tutors

The **Tutors table** stores information about the tutors assigned to students. Each tutor is uniquely identified by the tutor_id. This table tracks which tutor is assigned to each student, and also records which course the tutor follows during a specific block.
Relationship:

- Linked to the Students table via student_id‘ (each student is assigned a personal tutor).
- Linked to the Courses table via course_id (each tutor follows one course during the block).
- Linked to the Block table via block_id (indicates the block during which the course is taken).

Attribute Name	Description	Type
tutor_id	Primary Key, Unique identifier for each tutor.	INT
first_name	First name of the tutor.	VARCHAR(255)
last_name	Last name of the tutor.	VARCHAR(255)
email	Email address of the tutor.	VARCHAR(255)
course_id	Foreign Key to the courses table. The course the tutor follows during the block.	INT
block_id	Foreign Key to the block table. Indicates the block the tutor is involved with.	INT
student_id	Foreign Key to the students table. Links to the student assigned to this tutor.	INT

Table 14: Data Dictionary for the Tutors Table