Homework 01: Data Modeling

CS 355 Database Systems
Habib University
Fall 2023

1 Instructions

- The deadline for submitting this Homework is 22 September 2023, 11:59 PM.
- This homework must be submitted online via CANVAS.
- You are required to submit a **single pdf** which contains images of both scenarios.
- This homework will be done in pairs. Please ensure that both the members have joined the same team on Canvas. **If your team does not correspond with your group name on Canvas, then your submission will not be graded.**
- The pdf file should be named HW_01_team_XX.pdf where *XX* will be replaced with your respective team number on Canvas.
- *Files that don't follow the appropriate naming convention will not be graded.*

1.1 Marking scheme

This Homework will be marked out of 100.

- 40 Marks are for Scenario 1
- 60 Marks are for Scenario 2

1.2 Submission Guidelines

- Models can be developed in DB Designer or any Database Diagram tool that can generate a schema.

- **No handwritten submissions will be accepted**
- If you make any assumptions regarding the scenario, clearly state them in your pdf document. **Your assumptions should not contradict the actual scenario.**

1.3 Late submission policy

No Late Submissions are allowed for this homework.

1.4 Use of AI

Taking help from any AI-based tools such as ChatGPT is strictly prohibited and will be considered plagiarism. Course staff may call students for Viva in case they feel that **AI** has been used for doing the lab.

2 Objective

The purpose of this homework is to enable students to analyze real-world business specifications and construct their data model. This skill helps them build the data management system of any business entity.

3 Exercise

You have to build database systems for the business domains mentioned in Q1 – Q2. Draw a data model of each scenario. Your model diagram should contain the following information:

- Entities
- Attributes
- Primary & Foreign keys
- Relationships & Cardinalities

Question 01 - Employee Management System

We are building an enterprise application for an organization to help them in appraisals of their employees. The system stores information about employees, their work histories at the organization, and the project they are working on.

The company is spread in different cities of Pakistan with the headquarter in Islamabad. However, the system should allow changing the headquarter in the future, if required. The company has more than 10 departments and each department consisting more than 50 employees. An employee can't be associated with more than one department; however, a person can be a manager for more than one department. Each office may have employees of different departments. So, a department may have a presence in different cities as well. Each employee is assigned to a project and each project has its starting and ending date. If a project isn't completed, then it does not have any ending date. Sometimes, a project can be managed by a single department but most of the time more than one department is associated with a project. The lead of the project assigned different tasks to each employee with a starting and ending date. We also store the completion date of the task which is updated by the project lead once the task is completed.

The top management is intended to receive the following reports after the implementation of the system.

- List of projects which are in the process
- Who is managing which project
- The number of tasks done by an employee
- How many times the employee missed the deadline

- Who is more productive under which project leads
- The number of projects done by a department in a year
- The number of employees in each city
- The number of employees of a department in each city

You have to design the database for the above-mentioned scenario. You have to provide the schema and ER diagram with clear identification of primary and foreign keys

Entities correctly identified	25%
All Attributes mentioned	15%
Relationships drawn and resolved correctly	20%
Correct Cardinalities	15%
PK, FK identified and FK is placed in appropriate Entity table	25%

Table 1: Rubric for Question 01

Question 02 - World Health Organization (WHO)

The WHO is building a global system to track the progress of the COVID-19 vaccination and booster shots. The system will be deployed in all countries participating in the WHO vaccination program. The people at the WHO will create country managers that will manage all hospitals in the respective countries. Each country can register all hospitals opted for the program. Each country will also record the type of vaccination being used and the rates for it. After registration of the hospitals, the country manager will create hospital managers to manage users at each hospital level. Hospital managers can create users to perform operations such as patient registration etc.

Each hospital will dedicate a number of doctors for the program and all doctors must be registered in the system with basic information such as name, national identity number, gender, and years of experience. Hospitals must register the patient with basic information such as national identity number, name, gender, age, etc. On registration, a sequence number will be issued with a date of vaccination. The date will be decided through mutual discussion with the patient and the doctor. During this meeting, the doctor should also record the medical history of each patient. A medical history must be recorded as symptoms present at the time of meetings (if any) and already prescribed medicines taken by the patient if any. After 2 vaccination shots, the patients become eligible for annual booster shots and are notified by hospitals when they can get one. The hospitals also keep a record of vaccination compatibility for booster shots in case they have more than one

company's vaccines available. They also keep track of which vendors are providing them with which vaccinations and also keep a check of inventory.

The WHO is looking forward to generating the following reports from the system, other than, usual reports:

- How many patients build more symptoms after first vaccination (regardless of the type of symptoms)
- How many patients build more symptoms after the second vaccination (regardless of the type of symptoms)
- The total number of doses done by each country
- Country-wise number of patients who couldn't complete two doses
- Number of patients who couldn't survive after one dose
- Number of patients who couldn't survive after two doses

You are required to build an ERD for the above-mentioned requirements.

Additional Points - Suppose that WHO wants to build an interactive map that visualizes information of all these vaccination sites. This map has geolocation pins that map all hospitals in a country that provide vaccinations. On hovering over the pin, we see a pop up that displays the types of vaccinations available and a link to book a slot. What additional changes will you make to the existing ERD to store the above information ? . **Please note that you only have to list additional changes rather than making a new ERD**

Entities correctly identified	20%
All Attributes mentioned	15%
Relationships drawn and resolved correctly	20%
Correct Cardinalities	15%
PK, FK identified and FK is placed in appropriate Entity table	20%
Additional Points	10%

Table 2: Rubric for Question 02