

University of Toronto Mississauga
CSC 343 Winter 2018
Group Assignment 1
Due: Monday February 12th, 2018 by 9:00am

Michael Liut

January 17, 2018

I. Relational Model (13 marks)

Question 1 (3 marks)

State the two properties of data independence provided in a DBMS. Why are they important? Give an example situation of when data independence is useful.

Question 2 (10 marks)

Consider the relations `Students`, `Faculty`, `Courses`, `Rooms`, `Enrolled`, `Teaches`, and `MeetsIn` defined as:

- `Students`(sid: string, name: string, login: string, age: integer, gpa: real)
- `Faculty`(fid: string, fname: string, sal: real)
- `Courses`(cid: string, cname: string, credits: integer)
- `Rooms`(rno: integer, address: string, capacity: integer)
- `Enrolled`(sid: string, cid: string, grade: string)
- `Teaches`(fid: string, cid: string)
- `MeetsIn`(cid: string, rno: integer, time: string)

- (a) [6 marks] List all the foreign key constraints among these relations.
- (b) [4 marks] Give an example of a (plausible) constraint involving one or more of these relations that is not a primary key or foreign key constraint.

NOTE: For each of your constraints in (a) and (b), describe in one sentence why your constraint is necessary.

II. E-R Diagram (40 marks)

You and your partner have both been hired by Hamilton Street Railway (HSR) as Database Architects, where you have been tasked with preparing an Entity-Relationship (ER) diagram describing the transit schema for the city of Hamilton. The HSR is a public transport agency providing bus service in the Hamilton area. The head of HSR has hired you to design a database that tracks the activity and operations of its bus fleet so they can analyze the utilization of buses and its resources in serving customers.

HSR would like to record information about all persons associated with the transit system. A person may be a passenger, a bus driver, or a maintenance personnel. A person has a unique identifier, first name, last name, gender, date of birth, street address, city address, province, and occupation. A person has at least one contact phone number, and if there is more than one (e.g., home, work, cell number), they are all recorded. A passenger has a type (Child, Senior, or Student), and a separate relation stores the fares for each type of passenger. A bus driver has a salary (in CAD), his/her years of service, and any driving infractions incurred. For driving infractions, the database should record the date of occurrence, type of infraction (e.g., collision, speeding), demerit points incurred, and the financial penalty in CAD dollars. A driver may have zero to many infractions during the course of their employment (but at most one infraction per day), and an infraction is associated to exactly one driver. For maintenance personnel, the database records the employees area specialization (e.g., engine, tire, tune-up, etc), their level (technician, senior technician, Supervisor, Manager), years of service, and salary (in CAD). A maintenance personnel should work on (fix) at least one bus, and a bus can be fixed by many maintenance personnel. The date the fix was applied should be recorded.

HSR would like you to record information about buses, routes and stops. A bus consists of a unique identifier, years in operation, the number of seats, manufacturer, advertising revenue, and the fuel type. A bus can be driven by any driver. A route is served by many buses, and a bus serves exactly one route. A route and a stop each consist of a unique identifier and a name. There are two relationships between routes and stops: (1) a route contains many stops and a stop may belong to many routes; and (2) a schedule relationship that records the arrival time at a stop for each bus on a route. The arrival times record bus arrivals from 6am to 11pm each day between May 1, 2017 and May 7, 2017.

Sites are commonly visited locations such as a local supermarket, library, stadium, and parks. For each site, the database records its name, address, phone number, capacity, and category. HSR would also like to associate bus stops to sites so passengers have an easy way to arrive to sites. There is at least one stop associated to a site, and a stop can serve multiple sites. Some (not all) sites can host events such as concerts and sporting meets. For each event hosted by a site, the database records the name of the event, the event date and time, and the expected number of participants. For this initial design, we will assume that each event is held exactly once at a site. Finally, there is a relationship that associates routes to sites. Each site is served by at least one route, and a route can serve zero or more sites.

Question 3 (40 marks)

- (a) [25 marks] Draw the ER diagram capturing the described requirements. You may use any electronic drawing tool of your choice, but please ensure your ER diagram is clearly readable. Hand-written models will not be accepted.
- (b) [5 marks] Give a brief (one sentence) description of each of your entities, relationships, and any constraints that exist. For example, X is a weak entity with attributes (a, b, c), and has a many-to-one relationship with Y.
- (c) [10 marks] Provide the corresponding MySQL “CREATE TABLE” statements describing the relational schema. Please include all your statements in an executable script (HSR.ddl) that can be run on the CSC MySQL server. Scripts that do not execute on the server will not be marked.

Grading

This is a group assignment to be completed in pairs (i.e. a team of 2 people). This assignment is worth 13.3% of your final grade in this course.

Submission

All files are to be submitted using the Blackboard platform (portal.utoronto.ca). Only one person from each group is required to submit the files. Please ensure your answers are typed and submissions are clearly legible. Include your and your partner’s full name and student ID number in all files. Submit your written solutions to all questions and ER diagram in one file called **A1.pdf** alongside your MySQL executable script in a file called **HSR.ddl**.

This means you will submit a total of two files: A1.pdf and HSR.ddl.

Please note that late assignments will be docked 20% per day of lateness and after four (4) days, the assignment will no longer be accepted.

Plagiarism

Please refer to the course outline and introduction slides. To serve as a reminder: Turnitin will be used for all written work and MOSS for all code submissions. UTM’s policy on Academic Integrity: <http://academicintegrity.utoronto.ca/>