**CS3431 A17 Wong**

**Assignment 3: Relational Algebra and More SQL**

Due Date: T 9/12 at 11:59pm.

Late Policy: No late submissions. Maximum grade is 100 points.

Submission: In PDF or Word format using the Assignment 3 Submission button.

This assignment is to be typed. The following relational algebra symbols are provided for your use in the assignment:

σ, π, γ, **δ,** ⋈, 🡨, ∩, **∪**

Part 1: Tours

Given the relations below from Assignment 2:

RT 🡨 ReservedTours (reservedTourID, travelDate, ***customerID***, ***tourID***, ***guideID***, price)

C 🡨 Customers (customerID, firstName, lastName, address, phone, age)

T 🡨 Tours (tourID, tourName, description, city, state, vehicleType, price)

L 🡨 Locations (locationID, locationName, locationType, address, ***tourID***)

G 🡨 Guides (guideID, firstName, lastName, driverLicense, title, salary, licenseType)

**For the questions below, write the relational algebra. Use the abbreviations for the tables or 5 points off.**

1. (10 points) List for each level of guide - junior guide, guide or senior guide - how many mismatches there are between the required tour’s vehicle type and the guide's license type.
2. (10 points) For each customer, list the first name, last name, and total amount being spent for land-based tours.
3. (10 points) Determine the customer who will make the most number of visits to tour locations. List the firstName, lastName, and the number of location visits (use the heading Visits).

Part 2: Science Fiction Books

Given the relations given below:

**A 🡨 Authors** (fullName, address, age)

**SF 🡨 SFBooks** (ISBN, title, year, price, awardWinner, publisherName) -- science fiction books

**AB 🡨 AuthorBooks** (fullName, address, ISBN) -- relates the authors with books

**P 🡨 Publishers** (publisherName, phone, city)

**W 🡨 Warehouses** (code, address, city)

**S 🡨 Stocks** (warehouseCode, ISBN, city, numberOfBooks)

**For the questions below, use the abbreviations for the tables or 5 points off.**

1. (10 points) SF stands for science fiction books. Based on the given primary keys, specify below the foreign key relationships that exist between the tables that would make sense.
   1. Write the constraints using the following format: Foreign Key Table1.ID1 References Table2.ID2
   2. Write named SQL constraints for the foreign keys. Note that if a publisher goes out of business, all of the books published by that publisher should automatically be deleted. Otherwise, tuples in referring tables are not deleted. Assume the tables with the field names already exist but without any foreign key constraints. Use ALTER commands to create the foreign key constraints.
2. (20 points) For each author, list the author name and address, and the average price of the author’s books written by the author before 2000. For just this question, use natural joins instead of theta joins.
   1. Write the relational algebra
   2. Write the SQL code for the above, but sorted by author names
3. (20 points) Report the warehouse code and city for warehouses that stock fewer than 10 copies of any book published by the publisher ‘Wiley’.
   1. Write **efficient** relational algebra
   2. Write **efficient** SQL code

Part 3: Relational Algebra

Calculate the following output tables and be careful in labeling the attributes.

1. (5 points) N ⋈A=T ( π A as T (M) - πB as T (N))

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **M** | | | |  | **N** | | |
| **A** | **B** | **Y** | **Z** |  | **A** | **B** | **Q** |
| 3 | 4 | Tom | Jane |  | 6 | 4 | David |
| 6 | 2 | Mary | Susan |  | 7 | 10 | Jane |
| 10 | 8 | David | Paul |  | 4 | 7 | Paul |
| 4 | 3 | Mark | Helen |  | 3 | 1 | Tom |
| 1 | 1 | Lisa | Brian |  | 3 | 2 | Susan |

1. (5 points) σB<5(M) ⋈M.B=N.B and M.Z=N.Z (πB,Q,A+B as Z (N))

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **M** | | |  | **N** | | |
| **B** | **Y** | **Z** |  | **A** | **B** | **Q** |
| 2 | Mark | 3 |  | 3 | 1 | Tom |
| 3 | Lisa | 12 |  | 9 | 3 | Susan |
| 6 | Mary | 7 |  | 5 | 2 | Paul |
|  |  |  |  | 1 | 6 | Jane |
|  |  |  |  | 2 | 3 | David |

1. (10 points) (γZ, count(B) As G , min(A) As H (M)) ⋈G=A or H=Q N

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **M** | | | |  | **N** | | |
| **A** | **B** | **Y** | **Z** |  | **A** | **B** | **Q** |
| 1 | 4 | α | α |  | 2 | 3 | 4 |
| 3 | 5 | β | β |  | 8 | 2 | 3 |
| 7 | 6 | α | β |  | 2 | 5 | 10 |
| 5 | 8 | β | α |  |  |  |  |
| 13 | 10 | β | β |  |  |  |  |