CSCB20 - Tutorial 2

Relational Algebra

Learning Objectives

This week, we're practicing our fundamental terminology and understanding of tables and relations, and getting practice with relational algebra.

Tables & Keys

Review:

- Data is stored in **Tables** or **Relations**

- The **Rows** or **Tuples** of a table define the information for a particular entity or instance of the relation

- The **Columns** or **Attributes** define the particular values for a given relation

- **Superkeys** are sets of keys that uniquely identify a tuple

- **Candidate Keys** are superkeys that do not have any extraneous attributes

- **Primary Keys** are the candidate key that we (the database designers) choose for a given table to be our unique identifiers

- **Foreign Keys** are Primary Keys from another table added to your table to create a link between the two tables

Practice:

Consider the following database schema for a bank:

```
Branch(address, city, manager_name, opening_hours, has_atm)
Customer(first_name, last_name, address, date_joined)
Loan(loan_id, amount, date, term)
```

- Give two or more superkeys for each relation

- Give one or more candidate keys for each relation

- Choose a primary key for each relation (hint: for one or more of these, you may want to add new attribute to serve as your primary key moving forward)

- Add a relation to represent an account (money that is held by a specific individual at a specific branch)

- Amend the schema to allow us to know which customer borrowed which loan

- Be sure to indicate primary and foreign keys in all your relations

Relational Algebra

Review:

- All relational operators take tables (1 or 2) as input and return a single table as output

- There may be multiple ways to solve any given problem by combining different operations

- Don't get caught up on syntax, make sure you're clearly indicating what you want the operator to do

- Solve one problem at a time, don't try to do too many operations at once

Practice:

Given your schema from the previous part (feel free to adjust your schema to make this part easier or to add relations/attributes needed to answer questions) write relational algebra queries to answer the following queries:

- The names of all branch managers in Vancouver

- The dates of all loans by customers with the name 'Anita Borg'

- The names of all people who have loans of more than $10,000

- The names of all people who have accounts in Toronto and loans of more than $5,000

- The names of all people who have accounts in Toronto but do not have any loans

- The names of all people who have a loan of more than $10,000 and a loan of less than $1,000