University of Toronto
CSC343, Winter 2016

Assignment 1: Your name and student number here

Unary operators on relations:

- $\Pi_{x,y,z}(R)$
- $\sigma_{condition}(R)$
- $\rho_{New}(R)$
- $\rho_{New(a,b,c)}(R)$

Binary operators on relations:

- $R \times S$
- $R \bowtie S$
- $R \bowtie_{condition} S$
- $R \cup S$
- $R \cap S$
- $R - S$

Logical operators:

- $\vee$
- $\wedge$
- $\neg$

Assignment:

- $New(a, b, c) := R$

Below is the text of the assignment questions; we suggest you include it in your solution. We have also included a nonsense example of how a query might look in LaTeX. We used `\var` in a couple of places to show what that looks like. If you leave it out, most of the time the algebra looks okay, but certain words, *e.g.*, "Offer" look horrific without it.

The characters "\\" create a line break and "[5pt]" puts in five points of extra vertical space. The algebra is easier to read with extra vertical space. We chose "–" to indicate comments, and added less vertical space between comments and the algebra they pertain to than between steps in the algebra. This helps the comments visually stick to the algebra.

Part 1: Queries

1. Find all concerts in Toronto in 2016 that have one or more unsold seats costing under $25. Report the event ID.

   – sID has a grade of at least 85.
   $HaveHighGrade(sID) := \Pi_{sID}\sigma_{grade \geq 85}Took$

   – sID passed a course taught by Atwood.
   $PassedAtwood(sID) := \Pi_{sID}\sigma_{instructor:=\text{“}Atwood\text{”} \wedge grade \geq 50}(Took \bowtie Offering)$

   – sID got 100 at least twice.
   $AtLeastTwice(sID) :=$
   $$\Pi_{T1.sID}\sigma_{T1.oID \neq T2.oID \wedge T1.sID = T2.sID \wedge T1.grade = 100 \wedge T2.grade = 100}[(\rho_{T1}Took) \times (\rho_{T2}Took)]$$

2. Find all users who have paid at least $200 for some ticket, but have never bought a ticket to a musical. You might call these people “big spenders” who hate musicals. For each of them, find all the tickets they’ve bought for over $200. Report the username, ticket price, event ID, event date and time, and event name.

3. Find all users who, in two consecutive years, have bought multiple tickets for a single event. Report their user names and email addresses.

4. Find all events in 2015 or earlier for which none of the seats at the top price were sold, but every seat at a lower price was sold. Report the event ID and event name.

5. For each venue in New York, find the least expensive and the most expensive ticket price for a seat in that venue (for any event) in 2015. Report the venue ID, venue name, lowest price and highest price.

6. Find the venue with the greatest number of accessible seats. Report the venue name and city.

7. Find every event for which one user bought every ticket for an accessible seat. Report the event name, date and city, and username of the person who bought all the accessible seats.

8. Find the events in Toronto in 2015 at which at least half of the seats were unsold. Report the event ID, name and date.

9. Find all users who have bought a ticket to at least one event, but have never bought two or more tickets to one event. Report the username, last name and first name.

10. Find all users who have bought a ticket for each concert that the Rolling Stones have played in Toronto in 2000 or since. Report the usernames.

11. Find all venues at which the Rolling Stones have played a sold out concert (*i.e.* the event is a concert and its name is “Rolling Stones”). For each of these venues, report the name of the owner of the venue.

12. Find all users who bought a ticket for either the first talk or the second talk in Toronto in 2016. Report their email addresses. Note: There may be only one talk in Toronto in 2016, in which case, the only people in the answer will have bought a ticket to that first (and only) talk. If there is *no* talk in Toronto in 2016, the answer should be an empty relation.

Part 2: Additional Integrity Constraints

1. A ticket for an event must be for a seat in the same venue as the event venue.
2. A ticket for an event cannot be purchased after the event.