

CS 386/586 Winter 2013 Assignment 3

Assigned: Wednesday, January 23, 2013

Due: Wednesday, February 6, 2013 at midnight

General Information:

You are strongly encouraged to complete substantial work on Assignment 3 by Wednesday, February 6, 2013 (one week after it is assigned). This schedule allows you to ask questions during class (on Wednesday, January 30) before it is due – the following Wednesday.

Submission: you **must** post a **note** to the “**instructors**” with the **attachment** (listed below) in Piazza. You **must** put your note with the attachment in the **turn-in-assign-here3** folder.

You can submit your assignment at any time. But, students are not allowed to delete questions or notes (even their own questions or notes) and they are not allowed to delete attachments. So, please submit your assignment when it's ready. If you need to resubmit, please modify the same post and upload the new file with an appropriate name (e.g. v2). If you need to have us delete one of your questions or notes, please let us know – either through another post to instructors in piazza or by e-mail to one of us.

Assignment Details:

1. Exercise 16.2.2: Give examples to show that:
 - a) Projection cannot be pushed below set union.
 - b) Projection cannot be pushed below set or bag difference
2. Exercise 16.2.4: Some laws that hold for sets hold for bags; others do not. For each of the laws below that are true for sets, indicate whether or not it is true for bags by giving a proof that the law for bags is true, or by giving a counterexample.
 - a) $R \cup R = R$ (the idempotent law for union).
 - b) $R \cap R = R$ (the idempotent law for intersection).
3. Write the following queries in both SQL and extended relational algebra (for bags), based on the Spy database schema
 - a) Find the average salary of an agent.
 - b) Find the average salary of agents in the USA.
 - c) Find the average salary of agents on team # 12
 - d) Find the number of agents who either speak German or are demolition experts.
 - e) Find the average salary of an agent for each country.
 - f) Find the average salary of an agent for each skill_id.
 - g) Find the agent id for agents who speak at least three languages.
 - h) Find the maximum salary of agents who speak French.
 - i) For each agent with clearance ID above 2, find the average salary
 - j) Find the average salary of agents from the USA for each mission, where the mission has a clearance_id = 5.

4. Suppose relations R and S have tuples m and n tuples, respectively. Give the minimum and maximum numbers of tuples that the results of the following expressions can have.
- $R \cap S$.
 - R Full Outer Join S
5. The Circle and Sphere relations in a Geometry database give the center point of a circle or sphere of radius 5. Given the following data for these two tables:

$Circle(X,Y): \{(1,2), (3,4), (1,2), (3,5), (4,5)\}$

$Sphere(X,Y,Z): \{(1,2,3), (3,5,7), (3,6,2), (4,5,5), (1,3,5), (4,5,2)\}$

Compute the query answer for the following queries:

Note: these queries use the extended relational algebra operators that are defined for bags.

- $\pi_{X+Y, 2*X, 2*Y}$ (Circle)
- $\pi_{X+1, Y*2, Z-1}$ (Sphere)
- $\tau_{Y,X}$ (Circle)
- $\tau_{Y,Z}$ (Sphere)
- δ (Circle)
- δ (Sphere)
- $\gamma_{X, SUM(Y)}$ (Circle)
- $\gamma_{Y, AVG(Z), AVG(X)}$ (Sphere)
- γ_X (Circle)
- $\gamma_{X,Y, MAX(Z)}$ (Circle \bowtie C.X = S.X and C.Y = S.Y Sphere S)
- Circle Left Outer Join C.X = S.X and C.Y = S.Y Sphere
- Circle Right Outer Join C.X = S.X and C.Y = S.Y Sphere