

Homework 2: Relational Algebra

Name:

Instructions: Print this assignment using single-side pages. Fill in your name above, and write in the solutions in the space provided below each question. You are allowed to use the back of each page. If you used any scratch paper to show your work, append those to the end. **Note:** It is important you use this format for gradescope.

Submission: After you've filled in the answers, scan all pages into a PDF, and submit to canvas.

Problems

1. Assume we have two relations $R(A, B)$ and $S(B, C)$. Assume that $R = \{(1, 2), (2, 3), (3, 4)\}$, and $S = \{(2, 2), (2, 3), (5, 1)\}$. How many tuples are in the result of $\pi_A(R \bowtie S)$? (5pts)

2. Using primitive relational-algebra operators only*, define left-anti join $R \triangleright S$. The left-anti join retains all tuples in R for which there is no tuple in S that is equal on their common attributes. (* You may use \bowtie in your expression.)

$R \triangleright S = ?$ (5pts)

For the remaining problems, consider the relation instances below for a sports league. In this league each city may have multiple teams (e.g., New York). Teams in this league are split into two conferences: AFC and NFC. Within each conference, there are four divisions: North, South, East, and West. Games are played by “home” and “away” (i.e., the traveling) teams, identified by the teamIDs. For instance, game 7 was between Atlanta (24 points) and Arizona (6 points) on 9/8/1980.

Team

teamID	city	name	conference	division	networth
0	Seattle	Seahawks	NFC	West	500M
1	Cleveland	Browns	AFC	North	100M
2	Pittsburgh	Steelers	AFC	North	-50M
3	San Francisco	49ers	NFC	West	800M
4	Oakland	Raiders	AFC	West	350M
5	Arizona	Cardinals	NFC	West	400M
6	Miami	Dolphins	AFC	East	200M
7	Houston	Texans	AFC	South	250M
8	New York	Giants	NFC	East	800M
9	New York	Jets	AFC	East	400M
10	Buffalo	Bills	AFC	East	100M
11	Atlanta	Falcons	NFC	South	200M
12	Baltimore	Ravens	AFC	North	0M
13	Indianapolis	Colts	AFC	South	90M

Game

gameID	awayTeam	homeTeam	date	year	awayScore	homeScore
0	0	11	9/2	2012	0	3
1	3	13	10/17	2009	23	0
2	5	10	10/10	2012	10	10
3	4	9	11/20	2015	17	7
4	2	7	9/27	2014	7	14
5	9	8	10/30	1990	14	15
6	8	3	8/30	1980	21	9
7	11	5	9/8	1980	24	6
8	4	2	10/28	1981	35	15
9	12	10	11/27	2012	3	40
...

Coach

name	teamID	title
Carroll	0	Head Coach
Jackson	1	Head Coach
Tomlin	2	Head Coach
Kelly	3	QB Coach
Brown	1	Strength Coach
Chiu	0	Neck Coach
...

3. Consider the following expression:

$$\pi_{city,name}(Team \bowtie_{(teamID=T.awayTeam \vee teamID=T.HomeTeam)} \\ \rho_T(\pi_{awayTeam,homeTeam}(\sigma_{awayScore=homeScore}(Game))))$$

(a) Draw the *expression tree*. (5pts)

(b) What tuples does this expression return? (5pts)

(c) In your own words, what is the expression asking for? (5pts)

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