



Prep 3 - Part 1 of 1

Below is a schema for a database about a company's employees.

- `employee(eid, name, salary, dept)`

A tuple `employee(a, b, c, d)` indicates that employee `a`, whose name is `b`, has salary `c` and works in department `d`.

- `department(did, name, division)`

A tuple `department(a, b, c)` indicates that department `a` has name `b` and is in division `c`. A division is a group of departments in the company.

- `sales(eid, day, amount)`

A tuple `sales(a, b, c)` indicates that employee `a` had sales valued at `c` dollars on day `b`.

- `manages(manager, junior)`

A tuple `manages(a, b)` indicates that employee `a` manages employee `b`.

- `employee[dept] \subseteq department[did]`
- `manages[manager] \subseteq employee[eid]`
- `manages[junior] \subseteq employee[eid]`
- `sales[eid] \subseteq employee[eid]`

Throughout these prep exercises, and all our work in relational algebra, assume that every attribute in every tuple has a value. For those of you who happen to know some SQL, this means that there are no null values.

Important: When the PCRS summarizes the schema with each question, it will underline the attributes of a multi-attribute key individually. You will be more familiar with seeing a single underline, as shown above.

Important: Notice that the attribute name on the LHS of a referential integrity constraint does not have to be the same as the attribute name on the RHS. Look closely at the integrity constraints; they will help you put tables together in the appropriate way.

Important: The PCRS syntax for relational algebra is finicky. Please read the four points about it on the Lecture Preps page. These cover some specific things that past students have gotten snagged on.

P3-Q1



Which of the following rules does the schema enforce? Check all that apply.

- ☒ An employee cannot belong to two departments.
- ☐ An employee must have a manager.
- ☐ An employee must not have more than one manager.
- ☐ Managers cannot have sales recorded in the sales relation.
- ☒ Every department must belong to a division.
- ☒ An employee can have only one sales amount recorded on any given day.

History

Submit

✓ Your solution is complete.

You are about to write relational algebra queries on this schema. So far, we have learned these operators:

- select, expressed as `\select` in PCRS,



- project, expressed as `\project`,
- Cartesian product, expressed as `\product`,
- natural join, expressed as `\natural_join`, and
- the set operators: union (`\union`), intersection (`\intersect`), and set difference (`\difference`).

You need nothing more than these operators to solve these questions.

You are welcome to use assignment, as we have done in class, to break an answer down into steps. Just make sure that the final step is an expression that yields the answer when evaluated. It should not be an assignment.

The full documentation on PCRS syntax for relational algebra is available on the Preps page on Quercus.

P3-Q2



```

sales(eid, day, amount)
employee(eid, name, salary, dept)
manages(manager, junior)
department(did, name, division)
employee[dept]  $\subseteq$  department[did]
manages[manager]  $\subseteq$  employee[eid]
manages[junior]  $\subseteq$  employee[eid]
sales[eid]  $\subseteq$  employee[eid]
  
```

Write a query to report every department name.

1 `\project_{name} department;`

History

Submit

✓ Your submission is correct!



✓ Test Case Passed

Expected Result is Hidden

Actual

name

Widgets

Electronics

Housewares



P3-Q3



sales(eid, day, amount)
employee(eid, name, salary, dept)
manages(manager, junior)
department(did, name, division)
 employee[dept] \subseteq department[did]
 manages[manager] \subseteq employee[eid]
 manages[junior] \subseteq employee[eid]
 sales[eid] \subseteq employee[eid]

Write a query to report the name and eid of every employee whose salary is more than 55.

```

1 |
2 | \project_{eid, name} (\select_{salary > 55 }employee);
  
```

History

Submit

✓ Your submission is correct!

✓ Test Case Passed

Expected Result is Hidden

Actual

eid	name
1	Bill Gates
2	Marissa Mayer
6	Mark Zuckerberg
8	Larry Page

P3-Q4



sales(eid, day, amount)
employee(eid, name, salary, dept)
manages(manager, junior)
department(did, name, division)
 employee[dept] \subseteq department[did]
 manages[manager] \subseteq employee[eid]
 manages[junior] \subseteq employee[eid]
 sales[eid] \subseteq employee[eid]



Write a query to report the name and eid of every employee who has recorded at least one sales amount.

```
1 \project_{name,eid} \select_{amount >= 1}(employee \natural_join sales);
```

History

Submit

✓ Your submission is correct!

✓ Test Case Passed

Expected Result is Hidden

Actual

name	eid
Larry Page	8
Larry Ellison	4
Tim Cook	5
Mark Zuckerberg	6
Jeff Weiner	7

P3-Q5



sales(eid, day, amount)
employee(eid, name, salary, dept)
manages(manager, junior)



department(did, name, division)
employee[dept] \subseteq department[did]
manages[manager] \subseteq employee[eid]
manages[junior] \subseteq employee[eid]
sales[eid] \subseteq employee[eid]

Write a query to report the name and salary of every manager.

```
1 \project_{name, salary} \select_{M.manager = E.eid} (\rename_{M} manages
  \product \rename_{E} employee);
```

History

Submit

✓ Your submission is correct!

✓ Test Case Passed

Expected Result is Hidden

Actual

name	salary
Bill Gates	59
Sheryl Sandberg	17
Marissa Mayer	82

P3-Q7



sales(eid, day, amount)
employee(eid, name, salary, dept)
manages(manager, junior)
department(did, name, division)
 employee[dept] \subseteq department[did]
 manages[manager] \subseteq employee[eid]
 manages[junior] \subseteq employee[eid]
 sales[eid] \subseteq employee[eid]

Write a query to report the name, eid and salary of every employee who works in the department whose name is Widgets. [In case you are wondering, there is no P3-Q6.]

```

1 | \project_{E.name, eid, salary} \select_{D.did = E.dept and D.name =
   | 'Widgets'} (\rename_{D} department \product \rename_{E} employee);
  
```

History

Submit

✓ Your submission is correct!

✓ Test Case Passed

Expected Result is Hidden

Actual

name	eid	salary
Bill Gates	1	59
Marissa Mayer	2	82
Sheryl Sandberg	3	17



Tim Cook

5

48

P3-Q8



sales(eid, day, amount)
employee(eid, name, salary, dept)
manages(manager, junior)
department(did, name, division)
employee[dept] \subseteq department[did]
manages[manager] \subseteq employee[eid]
manages[junior] \subseteq employee[eid]
sales[eid] \subseteq employee[eid]

Write a query to report the name and eid of every employee who manages someone who has recorded sales over 50 on a single day.

```
1 Junior(eid) := \project_{eid} \select_{amount > 50} (employee \natural_join
  sales);
2 M(eid) := \project_{manager} \select_{manages.junior = eid} (manages
  \product Junior);
3 \project_{name, eid} (employee \natural_join M);
```

History

Submit

Your submission is correct!

Test Case Passed

Expected Result is Hidden



Actual

name	eid
Bill Gates	1
Sheryl Sandberg	3

P3-Q9



sales(eid, day, amount)
employee(eid, name, salary, dept)
manages(manager, junior)
department(did, name, division)
 employee[dept] \subseteq department[did]
 manages[manager] \subseteq employee[eid]
 manages[junior] \subseteq employee[eid]
 sales[eid] \subseteq employee[eid]

Write a query to report the eid of everyone who has had a day with sales valued at over 90, but has never had a day with sales valued at over 100.

```
1 \project_{eid} \select_{amount > 90 and amount < 100} sales;
```

History

Submit

✓ Your submission is correct!

✓ Test Case Passed



Expected Result is Hidden

Actual

eid

6

8

