

## 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] ⊆ department[did]`
- `manages[manager] ⊆ employee[eid]`
- `manages[junior] ⊆ employee[eid]`
- `sales[eid] ⊆ 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.

Look closely at the integrity constraints. Notice that the attribute name on the LHS does not have to be the same as the attribute name on the RHS.

### 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.

Submitted after the deadline!

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

product, natural join, and the set operators (union, intersection, and set 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.

### P3-Q2



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

Write a query to report every department name.

```
1 | \project_{name} department;
```

History

Submit

✓ Your submission is correct!

Submitted after the deadline!

✓ Test Case Passed

Expected Result is Hidden

Actual

name

Electronics

Housewares

Widgets

### P3-Q3



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

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

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

History

Submit

✔ Your submission is correct!

Submitted after the deadline!

✔ Test Case Passed

Expected Result is Hidden

Actual

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

P3-Q4

**sales**(eid, day, amount)  
**employee**(eid, name, salary, dept)  
**manages**(manager, junior)  
**department**(did, name, division)  
employee[dept] ⊆ department[did]  
manages[manager] ⊆ employee[eid]  
manages[junior] ⊆ employee[eid]  
sales[eid] ⊆ 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} (employee \natural_join sales);
```

History

Submit

✔ Your submission is correct!

Submitted after the deadline!

✔ Test Case Passed

Expected Result is Hidden

Actual

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

## 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_{manages.manager=employee.eid} (manages \product employee);
```

History

Submit

✓ Your submission is correct!

Submitted after the deadline!

✓ Test Case Passed

Expected Result is Hidden

Actual

name	salary
Bill Gates	59
Marissa Mayer	82
Sheryl Sandberg	17

## 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 | workers(name, eid, salary, dName) := \project_{employee.name, eid, salary, department.name}
   | (employee \theta_join_{employee.dept = department.did} department);
2 | \project_{name, eid, salary} \select_{dName = 'Widgets'} workers;
```

History

Submit

✓ Your submission is correct!

Submitted after the deadline!

✔ Test Case Passed

Expected Result is Hidden

Actual

name	eid	salary
Bill Gates	1	59
Sheryl Sandberg	3	17
Tim Cook	5	48
Marissa Mayer	2	82

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 | salesman(mid) := \project_{manager} \select_{manages.junior = sales.eid and amount > 50}
   | (manages \product sales);
2 | \project_{name, eid} (salesman \theta_join_{mid = eid} employee);
```

History

Submit

✔ Your submission is correct!

Submitted after the deadline!

✔ Test Case Passed

Expected Result is Hidden

Actual

name	eid
Sheryl Sandberg	3
Bill Gates	1

P3-Q9

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

History

Submit

✓ Your submission is correct!

Submitted after the deadline!

✓ Test Case Passed

Expected Result is Hidden

Actual

eid

6

8