198:336 Principles of Data and Information Management
Relational Algebra Examples

February 27, 2026

1 Stores

(20 points) Consider the following relational database schema:

- `Store(sid, address, budget, status)`
  (`status` is either 'open' or 'closed')
- `Sells(pid, sid)`
- `Product(pid, price, name, color)`

Express the following queries in Relational Algebra:

1. Find the address of all stores that sell ice cream but not pizza (both ice cream and pizza are product names)*(5 points)*

$$\Pi_{address}(\Pi_{sid}(\sigma_{name=ice\ cream}(Product \bowtie Sells)) - (\Pi_{sid}(\sigma_{name=pizza}(Product \bowtie Sells)) \bowtie store)$$

2. `Find the address of all open stores that sell blue products` *(5 points)*

$$\Pi_{address}(\sigma_{Store.status="open" \wedge Product.color="blue"}(Product \bowtie Sells \bowtie Store))$$

3. Draw a possible query execution tree for the following query

$$\Pi_{status,address}(\sigma_{price>10}(Product \bowtie Sells \bowtie Store))$$

(5 points)

4. Describe the what previous query does in a single English sentence. *(3 points)*

Will there be repeated tuples in the return of the above query? (Remember this is relational algebra, not SQL) *(2 points)*

2 Relational algebra

(18 points) 5 pts each, except last one which is 3 pts Consider the following relational database schema:

- Farm(<u>fid</u>, Number_of_fields, address, budget, owner)
- Field(<u>fieldid</u>, fid, cost)
- Crop(<u>fieldid, cropid</u>, name, color)

Express the following queries in Relational Algebra:

5. Find the address of all farms that sell wheat

$$\Pi_{address}(\sigma_{crop.name=\text{"wheat"}}(Farm \bowtie Field \bowtie Crop))$$

6. Draw a possible query execution tree for the following query

$$\Pi_{cropid,name}(\sigma_{cost>10}(Field \bowtie Crop))$$

IN SQL:

```
SELECT C.cropid, C.name
FROM Feild F JOIN CROP C
    ON F.fieldid = C.fieldid
WHERE F.cost > 10;
```

7. Describe the what previous query does in a single English sentence.

8. Why did the previous query use the Field relation when there are no attributes from that relation in the results?

3 Maximum

9. Find maximum

$$\rho_{T1(N1)}(T) \times \rho_{T2(N2)}(T)$$