# In-class exercises

Week 2023-02

## Relational algebra exercises

Given these sample tables:

car

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***id*** | ***make*** | ***model*** | ***year*** | ***mileage*** | ***fuel*** | ***type*** | ***price*** | ***dealer\_id*** |
| 1 | Volkswagen | Passat | 2017 | 97805 | diesel | station wagon | 425000 | Bdf |
| 2 | Mazda | CX-3 | 2019 | 19777 | petrol | suv | 378900 | Gjvk |
| 3 | Volkswagen | UP! | 2017 | 16551 | electric | hatchback | 125000 | Bdf |
| 4 | Toyota | RAV4 | 2019 | 39661 | hybrid | suv | 428900 | Hmr |
| 5 | Mercedes-Benz | C Class | 2004 | 301204 | diesel | sedan | 31707 | Hmr |
| 6 | Audi | Q3 | 2020 | 18516 | diesel | suv | 624900 | Hrst |
| 7 | Toyota | Corolla | 2020 | 8738 | hybrid | station wagon | 354900 | Hmr |
| 8 | Mazda | CX-3 | 2019 | 23100 | petrol | suv | 289900 | Gjvk |
| 9 | Volkswagen | Passat | 2019 | 43162 | diesel | station wagon | 375000 | Hrst |

dealer county

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***id*** | ***city*** | ***county\_no*** |  | ***no*** | ***name*** |
| Bdf | Bardufoss | 54 |  | 30 | Viken |
| Bo | Bodø | 18 |  | 3 | Oslo |
| Elv | Elverum | 34 |  | 34 | Innlandet |
| Frst | Fredrikstad | 30 |  | 38 | Vestfold og Telemark |
| Gjvk | Gjøvik | 34 |  | 42 | Agder |
| Hmr | Hamar | 34 |  | 11 | Rogaland |
| Hrst | Harstad | 54 |  | 46 | Vestland |
| Jsh | Jessheim | 30 |  | 15 | Møre og Romsdal |
| Ksvg | Kongsvinger | 34 |  | 50 | Trøndelag |
| Lhr | Lillehammer | 34 |  | 18 | Nordland |
| Mo | Mo i Rana | 18 |  | 54 | Troms og Finnmark |
| Ms | Moss | 30 |  |  |  |
| Ot | Otta | 34 |  |  |  |
| Sarp | Sarpsborg | 30 |  |  |  |
| Trms | Tromsø | 54 |  |  |  |
| Trd | Trondheim | 50 |  |  |  |
| Vrd | Verdal | 50 |  |  |  |

Q1:

* What is the result of: Πname(county)?

Q2:

* What is the result of: Πid, city(dealer)?

Q3:

* What is the result of: Πid, make, model, year(car)?

Q4:

* What relational algebra expression defines a relation containing names of dealer cities in the dealer relation?

Q5:

* What relation algebra expression defines a relation containing the id, make, type, year, mileage, and price of cars in the car relation?

Q6:

* What is the result of: σyear < 2010 OR mileage > 50000(car)?

Q7:

* What is the result of: σfuel <> 'diesel'(car)?

Q8:

* What is the result of: σmake IN ('Mercedes-Benz', 'Audi')(car)?

Q9:

* What relational algebra expression defines a relation containing rows from the car relation where the car is either a station wagon or costs no more than 360,000?

Q10:

* What relational algebra expression defines a relation containing rows from the car relation where the car is not an Audi or a Volkswagen

Q11:

* Decompose this expression: Πcity(σcounty\_no = 34(dealer))?
* What is the result?

Q12:

* Decompose this expression:  
  σdealer\_id IN ('Gjvk', 'Hmr', 'Lhr')(Πid, make, year, dealer\_id(car))?
* What is the result?

Q13:

* What relational algebra expression defines a relation containing the ids from the dealer relation where the dealer resides in the county with county number 18 or county number 50?

Q14:

* What relational algebra expression defines a relation containing the id, make, model, type, and price from the car relation where the car is either a station wagon or a suv and the price is between 300,000 and 450,000?

Q15:

* What relational algebra expression defines a relation containing id, make, model, and type from the car relation where the car is not an SUV?

Q16:

* What is the result of:   
  Πcity, make, model(σfuel <> 'diesel'(car ⨝dealer\_id = dealer.id dealer))?

Q17:

* Which of these expressions are equivalent – if any:
  + car × dealer
  + σdealer\_id = dealer.id(car × dealer)
  + car ⨝dealer\_id = dealer.id dealer

Q18:

* What relational algebra expression defines a relation containing county name and city names for dealers in the counties named Trøndelag or Nordland:

Q19:

* What relational algebra expression defines a relation containing city name, maker name for cars on sale in the county named Innlandet?

Q20:

* What relational algebra expression defines a relation containing county name, make, and year for cars of type suv costing less than 400,000?

Q21:

* What relational algebra expression defines a relation containing city name, make, year, and price for hybrid or diesel cars on sales by dealers in the cities of Gjøvik, Hamar or Lillehammer:

Q22:

* What is the result of: Πcity, make, model(car ⟖dealer\_id = dealer.id dealer)?

Q22:

* Which of these expressions are equivalent – if any:
  + car ⨝dealer\_id = dealer.id dealer
  + car ⟕dealer\_id = dealer.id dealer
  + car ⟖dealer\_id = dealer.id dealer

Q23:

* What relational algebra expression defines a relation containing the city name and the make name for 2019 and 2020 cars on sale in all the cities – even those that have no such cars for sale.

Q24

* What is the result of: COUNT id(σfuel = 'petrol'(car))

Q25

* What is the result of:   
  MIN mileage, MAX mileage(car ⨝dealer\_id = dealer.id dealer  
   ⨝county\_no = no σname = 'Innlandet'(county))

Q26

* What is the result of:   
  COUNT dealer.id(σcar.id IS NULL(car ⟖dealer\_id = dealer.id dealer))

Q27:

* What relational algebra expression defines a relation that holds the year of the oldest car for sale.

Q28:

* What relational algebra expression defines a relation counting the number of Volkswagen Passat cars for sale in the cities of Harstad and Bardufoss combined.

Q29

* What is the result of:  
  city SUM price(car ⨝dealer\_id = dealer.id dealer)

Q30

* What is the result of:  
  city, make SUM price(car ⨝dealer\_id = dealer.id dealer)

Q30

* What is the result of:  
  σSUM price > 750000(city, make SUM price(car ⨝dealer\_id = dealer.id dealer))

Q31:

* What relational algebra expression defines a relation that holds the average mileage per year for cars for sale.

Q32:

* What relational algebra expression defines that holds the number of cars per type per county.