

Relational Algebra

1. Consider the following relational database schema of car insurance company where the primary keys are underlined.

person (driver-id, name, address)

car (license, year, model)

accident (report-number, location, date)

- **owns** (driver-id, license)

participated (report-number, driver-id, license, damage-amount)

Formulate each of the following queries in **relational algebra(RA)**

1. Find the names of all persons whose names are "Suman".
 2. Find the names of all persons who have a "KIA" car.
 3. Find the report numbers for those accidents that have happened in "Kathmandu" in 2013.
 4. Find the report numbers of those accidents that happened in 2013 and their damage amount was less than Rs. 10,000.
 5. Find the report numbers of accidents that have happened until today and the names of drivers involved into those accidents are "Suman".
 6. Find the report numbers of those accidents that either happened in "Kathmandu" or their damage amount was more than Rs. 10,000.
 7. Find the names of those drivers that had accidents in "Kathmandu" from 2011 to 2013, and their cars were "KIA".
 8. Find out the total sum of damage amounts of the accidents at each city.
1. Consider the following relational database schema of a sale database, selling products from different manufacturers through their catalogs, where the primary keys are underlined.

Product (pid: integer, pname: string, color: string)

Manufacturer (mid: integer, mname: string, address: string)

Catalog (mid: integer, pid:integer , price: decimal)

Formulate each of the following queries in relational algebra.

1. Find the name and address of the manufacturers that produce a product named leather-folder for at most Rs. 100.
2. Find the ids of manufacturers who produce a red part and a green part
3. Find the ids of manufacturers who produce every red part or every green part in the catalog.
4. Find the ids of manufacturers who produce all the part(s) which are manufactured by the manufacturer 102.
5. Find the product id of the most expensive product(s) manufactured by the manufacturer with id = 150

Submission status

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Database & ER Diagrams

Group I (6 points)

1. Assuming you are the database manager of yeti Airlines, what are the most important reasons to use a database system instead of a file-processing system? Please explain.
2. Explain the difference between physical and logical data independence.
3. What are the responsibilities of the DBA and the database designers?
4. Explain different components of overall database system architecture.

Group II

Assume that you are hired by the Mines Extraction Department of a Cement Industry, as a DBA and are provided with the following information necessary to design and develop its database. The first task assigned to you is to organize the information about all the vehicles maintained. The following points can be considered.

1. Every vehicle has a registration number, and each vehicle is of a specific model and type.
2. The station accommodates a number of vehicle models, and each model is identified by a model number, and has a capacity, usage, weights, mileage.
3. A number of technicians work at the station. You need to store the name, Citizenship number, address, phone numbers, and salary of each technician.
4. Mines engineers are also employees at the station which are required to have an annual medical examination. For each mines engineer, you must store all dates of his/her examinations and the total number of examinations since he/she is hired.
5. The station runs a number of types of tests that are used to ensure that the vehicles are still in good condition to extract mines. Each test has a Test Number and a Test Name.
6. Test is performed periodically (e.g. once a month) on all vehicles. Each such test also has a date, hours, and the score for the test

1. Considering the descriptions given above, draw an **ER diagram** for the database, illustrating all its details such as entity sets, attributes, and relationship sets, etc. Please pay attention to clear identification and representing different kinds of attributes (e.g. Composite, multi-valued, derived, primary keys, etc.), and the mapping cardinalities, the total participation for each relationship set, and all other detailed elements for a complete ER diagram.

(7 points)

1. Based on the designed ER diagram, describe the following concepts and illustrate the purpose of use in the diagram. Explanation is required even if the listed items are not used in your diagram.
 1. Strong Entity sets
 2. Relationship sets
 3. Attributes for entity sets
 4. Primary keys
 5. Composite attributes
 6. Multi-valued attributes
 7. Derived attributes
 8. Total participation for the relationship sets
 9. Attributes for the relationship sets
 10. Mapping cardinalities for the relationship sets
 11. Weak entity sets
 12. Identifying relationship sets
 13. Generalization
 14. Aggregation

(7 points)

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