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## Database Design

## 

## GTG Vehicle Maintenance Database Project

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**CONCEPTUAL DESIGN**

**TASK 1. CONCEPTUAL DESIGN in ER**

**Entities and their attributes**

* **Technician**: {tID, name (fName, lName), address (town, street, postcode), gender, salary, dob, postType, qualifications}
* tID – unique
* name – composite
* address - composite
* qualifications- multivalued
* age – derived
* **Branch**: {branch ID, phone number, faxNumber, address}
* branchID – unique
* address – not composite
* **Vehicle:** {regNumber, make, fuelType, vehicleType}
* RegNumber – unique
* **Customer:** {cID, name (fName, lName), address, gender, phoneNumber}
* cID – unique
* name – composite
* address – not composite
* **Accessories**: {aID, name, price, quantity, dateofSale}
* aID – unique

**Identify relationship**

* Employs – Relationship between branch and technicians
* Deals with - Relationship between branch and customer
* Repairs – Relationship between technician and vehicle

Attribute hours

* Owns – Customer owns vehicle
* Stores – Relationship between branch and accessories

Attribute quantity

* Supervise – Recursive relationship between technician (the supervisor) and technician (the supervisee).
* Manages – Relationship between manager and branch

Attribute - start date, annual bonus

* Buys – Relationship between customer and accessories

Attribute date of sale

**Relationship and their attribute**

1. Employs {(branch, technician), (1…\*), (1...1)};

* Each branch (min:1) employs many technician (max: \*)
* A technician (min: 1) works for one branch (max:1)
* **Cardinality ratio:** one-to-many (1: \*)

1. Deals with {(branch, customer), (1…\*), (1…1)};

* Each branch (min:1) deals with many customers (max: \*)
* Each customer (min:1) deals with only one branch (max:1)
* **Cardinality ratio:** one-to-many (1: \*)

1. Repairs {(technician, vehicle), (2…\*), (1…\*)}; Attribute: repair hours spent

* Every technician (min: 2) repairs more than one vehicle (max: \*)
* A vehicle (min: 1) is repaired by more than one technician (max: \*)
* **Cardinality ratio: many-to-many (\*: \*)**

1. Owns {(customer, vehicle), (1…1), (1…\*)};

* Each vehicle (min: 1) is owned by one customer (max: 1)
* A customer (min: 1) may own one or more vehicles (max: \*)
* **Cardinality ratio:** one-to-many (1: \*)

1. Stores {(branch, accessories), (1…\*), (1…\*)}; Attribute: quantity

* Each branch (min: 1) stores many accessories (max: \*)
* Many accessories (min: 1) is available in all branches (max: \*)
* **Cardinality ratio: one-to-many (\*: \*)**

1. Buys {(customer, accessory), (0…\*), (0…\*)}; Attribute: date of sale, quantity

* Not all customer (min: 0) buys an accessory, those who do buys (max: \*)
* Not all items (min: 0) are sold, an item may be sold to many customers (max: \*)
* Cardinality ratio: many-to-many (\*: \*)

1. Manages {(technician, branch), (1…1), (0…1)}; Attribute: start date, annual bonus

* Each branch (min: 1) is managed by one technician (max: 1)
* Not all technician (min: 0) manages a branch (max: 1)
* **Cardinality ratio:** one-to-one (1:1)

1. Supervise {(technician supervisor, technician supervisee), (1…\*), (1…1)}

* A technician (supervisor) (min: 1) supervise more than one technician (max: \*)
* A technician (supervisee) (min: 1) is supervised by one technician (supervisor) (max: 1)
* **Cardinality ratio:** (1: \*)

**PARTIAL ER DIAGRAMS**

|  |
| --- |
| Technician |
| tID (PK)  name  fname  lname  address  town  street  postcode  gender  salary  dob  qualifications {1…\*}  post type |

|  |
| --- |
| Branch |
| bID (PK)  phone number  fax number  address |

|  |
| --- |
| Customer |
| cID (PK)  name  fName  lName  address  gender  phoneNumber |

|  |
| --- |
| Accessories |
| aID (PK)  name  price  quantity  date of sale |

|  |
| --- |
| Vehicle |
| regNumber (PK)  make  fuelType  vehicleType |

**LOGICAL DESIGN**

**Task 2. Logical Design in Relational**

**Mapping entities, relationship and multivalued attributes using table**

|  |  |
| --- | --- |
| Elements in ER | Represented by Elements in Relational |
| Entity Technician | Relation Technician |
| Entity Branch | Relation Branch |
| Entity Vehicle | Relation Vehicle |
| Entity customer | Relation Customer |
| Entity Accessories | Relation Accessories |
| Repairs – m:n relationship between entity technician and vehicle | Relation Repairs with 2 foreign keys. tID references technician and regNumber references vehicle |
| Stores – m:n relationship between entity branch and accessories | Relation Stores with 2 foreign keys. bID references branch and aID references accessories |
| Buys – m:n relationship between entity customer and accessories | Relation Buys with 2 foreign keys. cID references customer and aID references accessories |
| Employs – 1:m relationship between entity branch and technician | Attribute bID in relation technician, which is a foreign key that references Branch(bID) |
| dealsWith – 1:m relationship between entity branch and customer | Attribute bID in relation customer, which is a foreign key that references Branch (bID) |
| Owns – 1:m relationship between customer and vehicle | Attribute cID in relation vehicle, which is a foreign key that references Customer (cID) |
| Manages – 1:1 relationship between technician and branch | Attribute techManagerID in relation branch, which is a foreign key that references technician (tID) |
| Qualification (1:\*) – multivalued attribute in entity technician | Relation qualification with one foreign key qualificationID that references technician (tID) |

**Final Relational Schema**

* **Technician**: {tID, fName, lName, town, street, postcode, gender, salary, dob, postType, bID, techSupervisorID}

**Primary key**: tID

**Foreign key**: bID references branch(bID)

**Foreign key**: techSupervisorNo (Recursive Relationship)

* **Branch**: {branchID, phone number, faxNumber, address, techManagerID, startDate, annual bonus}

**Primary key**: branchID

**Foreign key**: techManagerID references Technician (tID)

* **Vehicle:** {regNumber, make, fuelType, vehicleType, cID}

**Primary key:** regNumber

**Foreign key:** cID references Customer (cID)

* **Customer:** {cID, fName, lName, address, gender, phoneNumber, bID}

**Primary key:** cID

**Foreign key:** bID references Branch (bID)

* **Accessories**: {aID, name, price, quantity, dateofSale}

**Primary key**: aID

* **Stores**: {bID, aID, quantity}

**Primary key**: bID, aID

**Foreign key**: bID references branch (bID)

**Foreign key**: aID references accessories (aID)

* **Buys**: {cID, aID, quantity, dateofSale}

**Primary key:** cID, aID

**Foreign key:** cID references customer (cID)

**Foreign key:** aID references accessories (aID)

* **Repairs**: {tID, regNumber, hours}

**Primary key**: tID, regNumber

**Foreign key**: tID references technician (tID)

**Foreign key**: regNumber references vehicle (regNumber)

* **Multivalued attribute**

**Qualifications** (tID, qualificationID)

**Primary key:** tID, qualificationID