CSC423/CSC623
Project: Design, development and implementation of a relational database
Part 2

Pablo de la Fuente, Jesse Aronson, Tyler Tejera

Part 2: Develop a logical data model based on the following requirements: (11/28/23)
a. Derive relations from the conceptual model.
b. Validate the logical model using normalization to 3NF.
c. Validate the logical model against user transactions.
d. Define integrity constraints:
i. Primary key constraints.
ii. Referential integrity/Foreign key constraints.
iii. Alternate key constraints (if any).
iv. Required data.
v. Attribute domain constraints.
vi. General constraints (if any).
e. Generate the E-R diagram for the logical level (contains FKs as attributes).

A. Relations form the conceptual model

a. **Employee relation: attributes - staffnumber(PK), first name, last name, address, salary, telephone number**
b. **Client relation: attributes - client number (PK), first name, last name, address, telephone number**
c. **Equipment relation: attributes - equipment id (PK), description, usage, cost**
d. **Equipment request relation: attributes - request id (PK), special equipment id (FK), special equipment quantity, standard equipment id(FK), standard equipment quantity, client number (FK)**
e. **Service schedule relation: attributes - schedule id (PK), client number (FK), employee staff number (FK), request id(FK), day of the week, start time, end time**
f. **Special equipment assignment relation: attributes - assignment id (PK), schedule id (FK), equipment id (FK), usage frequency**

B. Logical normalization to 3nf

- **a. Employee table**
  - **i. Staffnumber (PK)**
  - **ii. First name**
  - **iii. Last name**
  - **iv. Address**
  - **v. Salary**
  - **vi. telephone number**
- **b. Client table**
  - **i. Clientnumber (PK)**
  - **ii. First name**
  - **iii. Last name**
  - **iv. Address**
  - **v. telephone number**
- **c. Equipment table**
  - **i. Equipment id (PK)**
  - **ii. Description**
  - **iii. Usage**
  - **iv. Cost**
- **d. Equipment request table**
  - **i. Request id(PK)**
  - **ii. Clientnumber(FK)**
  - **iii. Employeestaffnumber (FK)**
  - **iv. Request date**
- **e. Service schedule table**
  - **i. Schedule id(PK)**
  - **ii. Dayoftheweek**
  - **iii. Start time**
  - **iv. End time**
  - **v. Client number (FK)**
  - **vi. Employeestaffnumber(FK)**
- **f. Special equipment request table**
  - **i. Assignment id(PK)**
  - **ii. Schedule id(FK)**
  - **iii. Equipment id(FK)**
  - **iv. Usage frequency**

C. **A user wants to request cleaning service. The data involved is client detail, employee details, requested equipment, scheduling details. Entities involved are equipment request , client , employee, equipment, service schedule. The steps for the transaction is the user creates a new cleaning service request, specifying the client, employee, requested equipment and scheduling details. The system checks for the existence of the client and employee in the client and employee tables. The system checks if the requested equipment is available in the equipment table. The system creates a new record in the equipment request table, with the client, employee, and equipment. The system creates a new record in the service schedule table, specifying the day of the week, start time, and end time for the cleaning service. The validation is ensuring that the equipment request table contains attributes like request id, clientnumber, employee staff number, request date, and others necessary for recording the request details. Confirm that the foreign key relationships are properly defined, check that the service schedule table has attributes like schedule id, day of the week, start time, end time, and foreign keys to associate the schedule with the client and employee. Verify that necessary constraints are in place.**

D.

Employee Table:
i. Primary Key Constraint:
Staffnumber (PK)

ii. Referential Integrity/Foreign Key Constraints:
No foreign key constraints in the Employee table.

iii. Alternate Key Constraints:
No alternate key constraints in the Employee table, since name, last name, phone number and address are not necessarily unique.

iv. Required Data:
All attributes are required (not nullable), as the company should have the contact information and basic information of their employees

v. Attribute Domain Constraints:
Staffnumber must be unique.
Salary must be an integer greater than zero.

Client Table:
i. Primary Key Constraint:
Clientnumber (PK)

ii. Referential Integrity/Foreign Key Constraints:
No foreign key constraints in the Client table.

iii. Alternate Key Constraints:
No alternate key constraints in the Client table, since the other attributes apart from the primary key are not necessarily unique.

iv. Required Data:
All attributes are required (not nullable), as the company will need to contact the client and will need the basic information stored in the attributes

v. Attribute Domain Constraints:
Clientnumber must be unique.

Equipment Table:
i. Primary Key Constraint:
Equipment id (PK)

ii. Referential Integrity/Foreign Key Constraints:
No foreign key constraints in the Equipment table.

iii. Alternate Key Constraints:
No alternate key constraints in the Equipment table, since the other attributes apart from the primary key are not necessarily unique.

iv. Required Data:
All attributes are required (not nullable).

v. Attribute Domain Constraints:
Equipment id must be unique.
Cost must be a non-negative value integer.

Equipment Request Table:
i. Primary Key Constraint:

Request id (PK)

ii. Referential Integrity/Foreign Key Constraints:
Clientnumber (FK) references Client table(Clientnumber).
Employeestaffnumber (FK) references Employee table(Staffnumber).
iii. Alternate Key Constraints:
No alternate key constraints in the Equipment Request table.

iv. Required Data:
All attributes are required (not nullable).

v. Attribute Domain Constraints:
Request id must be unique.
Clientnumber and Employeestaffnumber must exist in their respective tables.

Service Schedule Table:
i. Primary Key Constraint:
Schedule id (PK)

ii. Referential Integrity/Foreign Key Constraints:
Clientnumber (FK) references Client table(Clientnumber).
Employeestaffnumber (FK) references Employee table(Staffnumber).
Request id (FK) references Equipment Request table(Request id).

iii. Alternate Key Constraints:
No alternate key constraints in the Service Schedule table, since the other attributes apart from the primary key are not necessarily unique.

iv. Required Data:
All attributes are required (not nullable).

v. Attribute Domain Constraints:
Schedule id must be unique.
Clientnumber, Employeestaffnumber, and Request id must exist in their respective tables.
End Time must be greater than Start Time.

Special Equipment Assignment Table:
i. Primary Key Constraint:

Assignment id (PK)

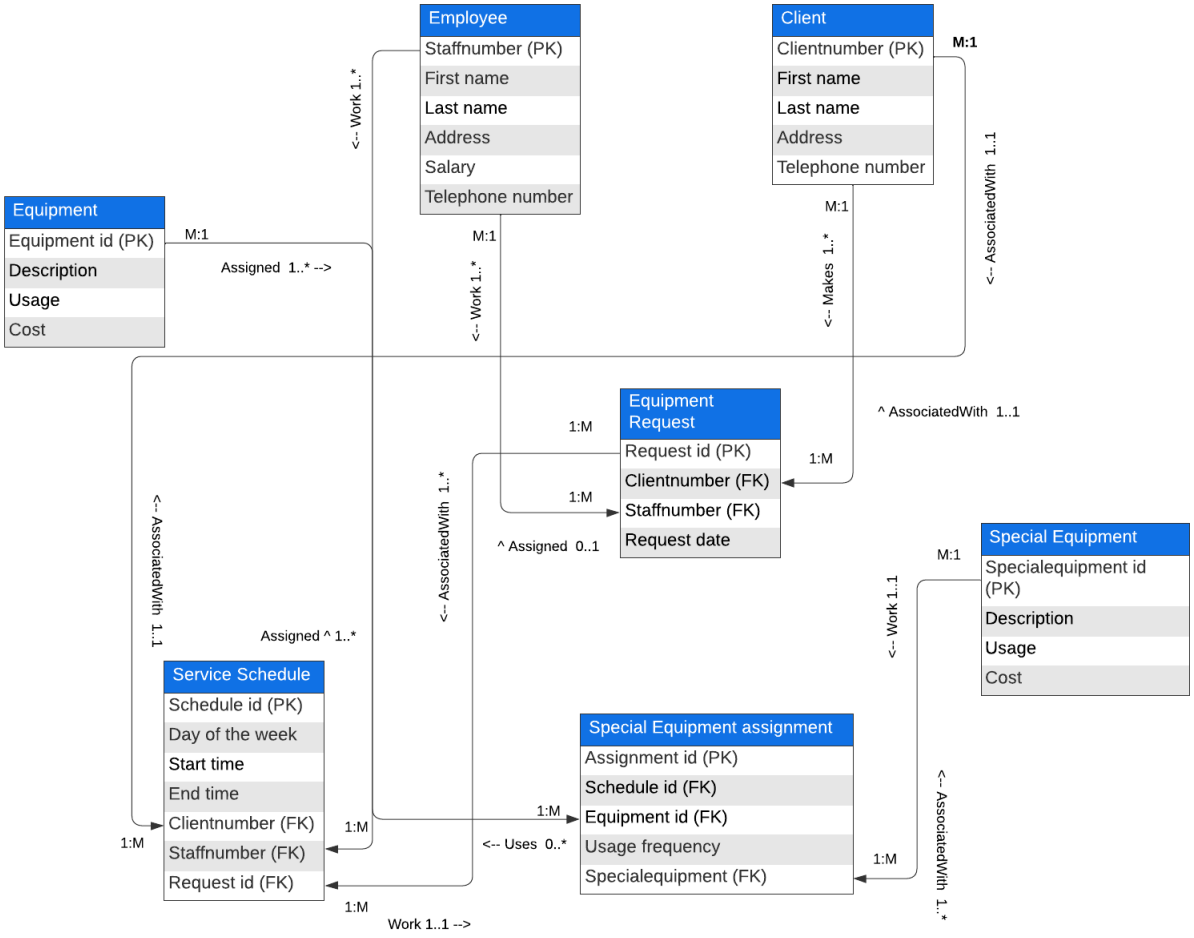
ii. Referential Integrity/Foreign Key Constraints:
Schedule id (FK) references Service Schedule table(Schedule id).
Equipment id (FK) references Equipment table(Equipment id).

iii. Alternate Key Constraints:
No alternate key constraints in the Special Equipment Assignment table, since the other attributes apart from the primary key are not necessarily unique.

iv. Required Data:
All attributes are required (not nullable).

v. Attribute Domain Constraints:
Assignment id must be unique.
Schedule id and Equipment id must exist in their respective tables.

E.


Employee
Staffnumber (PK)
First name
Last name
Address
Salary
Telephone number
Client
Clientnumber (PK)
First name
Last name
Address
Telephone number
Equipment
Equipment id (PK)
Description
Usage
Cost
Equipment Request
Request id (PK)
Clientnumber (FK)
Staffnumber (FK)
Request date
Special Equipment
Specialequipment id (PK)
Description
Usage
Cost
Service Schedule
Schedule id (PK)
Day of the week
Start time
End time
Clientnumber (FK)
Staffnumber (FK)
Request id (FK)
Special Equipment assignment
Assignment id (PK)
Schedule id (FK)
Equipment id (FK)
Usage frequency
Specialequipment (FK)
<-- Work 1..*
M:1
Assigned 1..* -->
M:1
<-- Work 1..*
M:1
<-- Makes 1..*
M:1
<-- AssociatedWith 1..1
^ AssociatedWith 1..1
1:M
1:M
^ Assigned 0..1
<-- AssociatedWith 1..*
<-- AssociatedWith 1..1
Assigned ^ 1..*
1:M
1:M
M:1
<-- Work 1..1
1:M
<-- Uses 0..*
1:M
1:M
<-- AssociatedWith 1..*
Work 1..1 -->