CSC 623 Project Part 2
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a)
Derive relations from the conceptual model:

Client (**clientNo**, fName, lName, address, tel)
Employee (**staffNo**, fName, lName, address, salary, tel)
Requirement (**reqID**, startDate, startTime, duration, comment)
Equipment (**equipID**, description, usage, cost)

Relationships:
Client and Requirement: one-to-many
Employee and Requirement: many-to-many
Equipment and Requirement: many-to-many

Add clientNo to Requirement as foreign key (parent entity: Client, child entity: Requirement).
Create relation to represent the relationship between Employee and Requirement.
Create relation to represent the relationship between Equipment and Requirement.

Client (**clientNo**, fName, lName, address, tel)
Employee (**staffNo**, fName, lName, address, salary, tel)
Requirement (**reqID**, startDate, startTime, duration, comment, clientNo)
Equipment (**equipID**, description, usage, cost)
Assignment (**staffNo, reqID**) (linking Employee and Requirement)
Usage (**equipID, reqID**) (linking Equipment and Requirement)

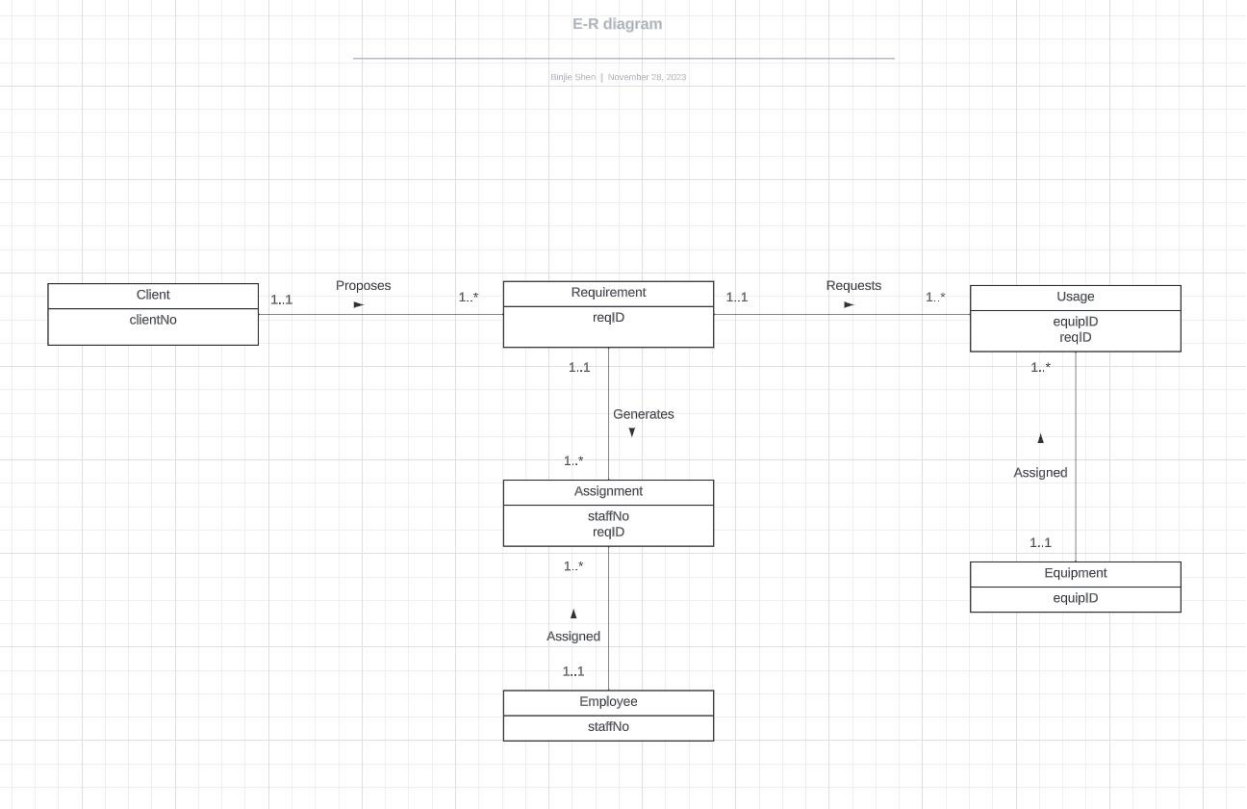
b)
1NF: All tables must have a primary key and no repeating groups or arrays. Each attribute must have atomic values.
2NF: All tables in 1NF and all non-key attributes must be fully functionally dependent on the primary key.
3NF: All tables in 2NF and no transitive dependencies

Client (**clientNo**, fName, lName, address, tel)
Employee (**staffNo**, fName, lName, address, salary, tel)
Requirement (**reqID**, startDate, startTime, duration, comment, clientNo)
Equipment (**equipID**, description, usage, cost)
Assignment (**staffNo, reqID**) (linking Employee and Requirement)
Usage (**equipID, reqID**) (linking Equipment and Requirement)

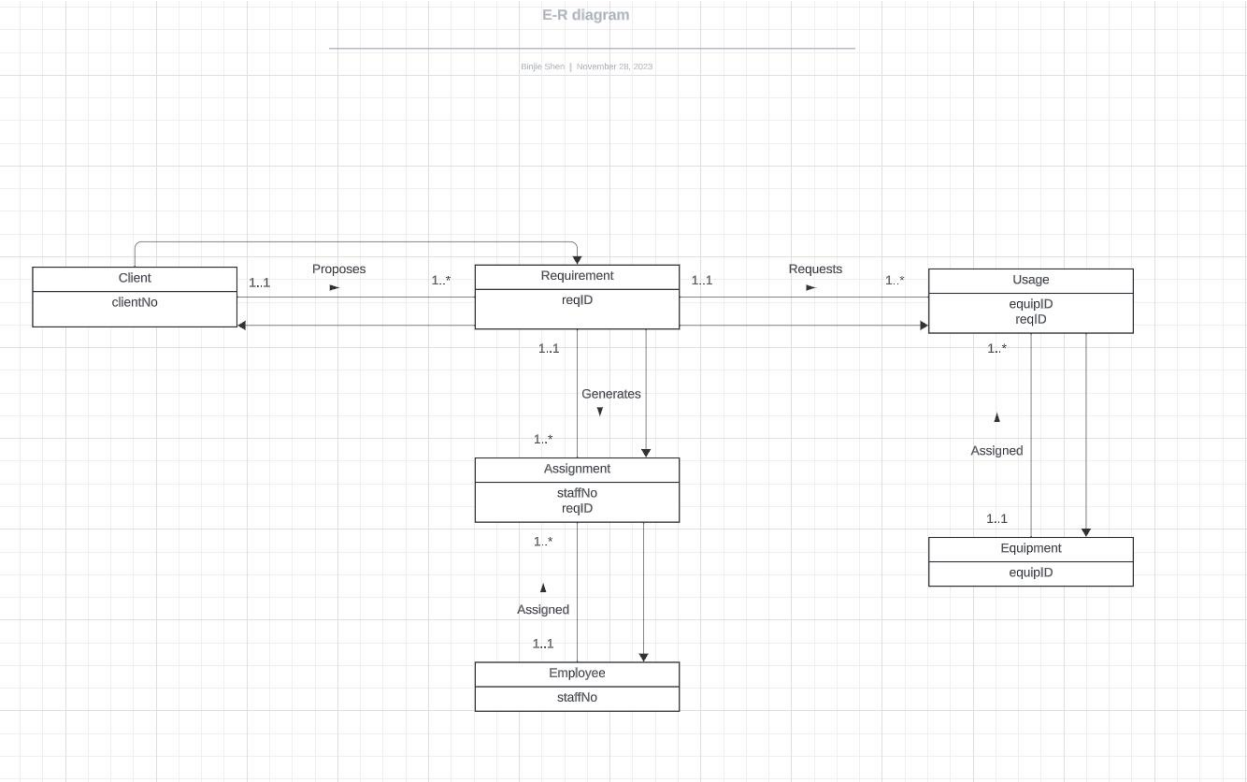
All tables in 3NF

c)
Validate the logical model against user transactions:

A client can requests multiple requirements.
An employee can be assigned to multiple requirements.
A piece of equipment can be used to fit multiple requirements.



No redundant relationships



The logical model supports the user transactions.

d)
Define integrity constraints:
i)
Primary key constraints:
Client: clientNo
Employee: staffNo
Requirement: reqID
Equipment: equipID
Assignment: composite key of staffNo and reqID
Usage: composite key of equipID and reqID

ii)
Referential integrity/ Foreign key constraints:
Requirement: clientNo references Client(clientNo).
Assignment: staffNo references Employee(staffNo) and reqID references Requirement(reqID).
Usage: equipID references Equipment(equipID) and reqID references Requirement(reqID).

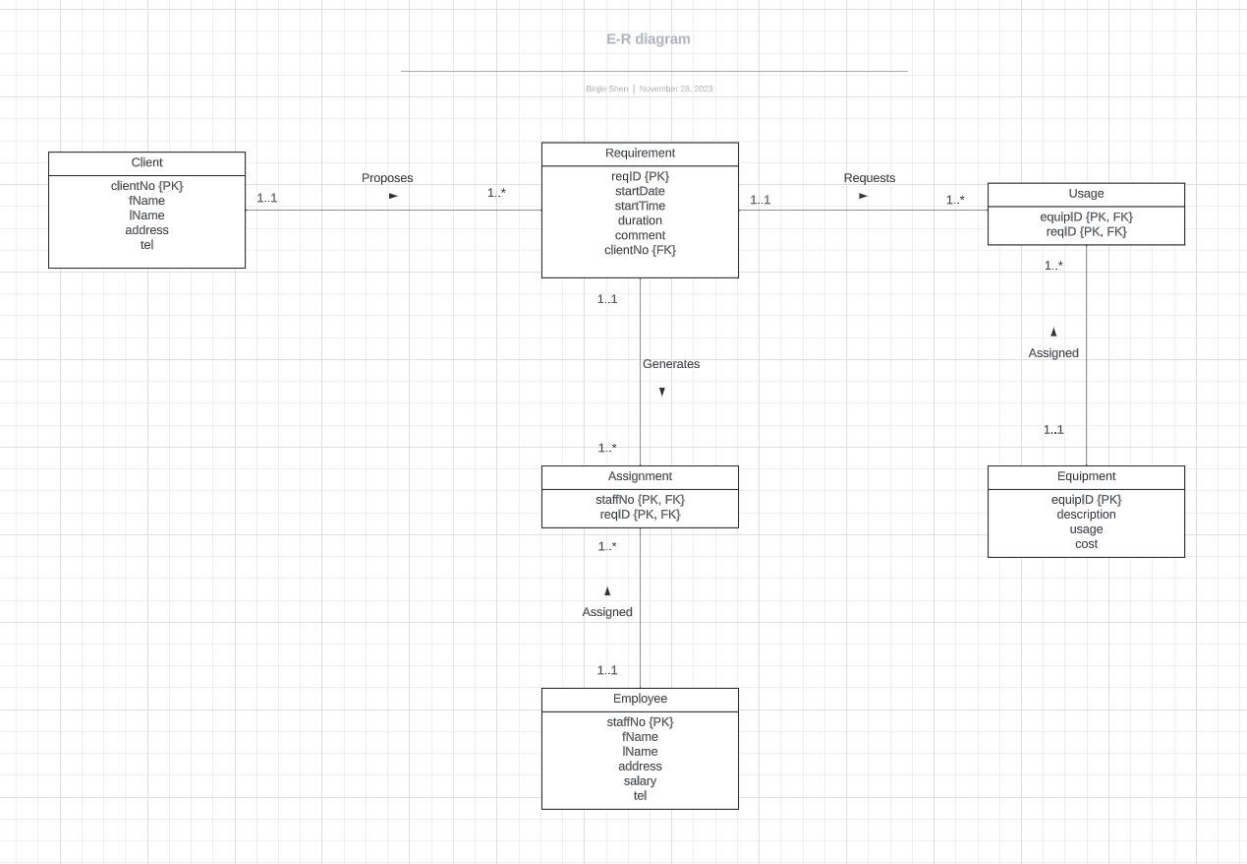
iii)
Alternate key constraints:
No alternate key except for all the primary keys.

iv)
Required data:
Client: all fields are required.
Employee: all fields are required.
Requirement reqID, startDate, startTime, duration, clientNo should be required.
Equipment equipID, description, and cost should be required.
Assignment: all fields are required.
Usage: all fields are required.

v)
Attribute domain constraints:
Client, Employee: tel should be a valid phone number formats
Employee: salary might have a minimum value
Requirement: startDate and startTime should be valid dates and times; duration should have a range.
Equipment: cost should be a positive number.

vi)
General constraints:
Employee cannot be assigned to some requirement past the duration.
StartTime should not be some day in the past.

e)
E-R diagram for the logical level


E-R diagram
Binjie Shen | November 28, 2023
Client
clientNo {PK}
fName
lName
address
tel
1..1
Proposes
1..*
Requirement
reqID {PK}
startDate
startTime
duration
comment
clientNo {FK}
1..1
Requests
1..*
Usage
equipID {PK, FK}
reqID {PK, FK}
1..*
Assigned
1..1
Equipment
equipID {PK}
description
usage
cost
1..1
Generates
1..*
Assignment
staffNo {PK, FK}
reqID {PK, FK}
1..*
Assigned
1..1
Employee
staffNo {PK}
fName
lName
address
salary
tel