# COS221

## Group Assignment 4

|  |  |
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# DataCenter Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Datacenter | | | | | | | | | | | | | | | |
| Datacenter | | | | | | | | Room | | | | Warehouse | | | |
| MTXid | Name | Location | Address | PlantSpecialists | EnergyConsumption | NumberOfServers | RackCount | RoomId | Capacity | RoomType | RoomName | WarehouseNo | Capacity | WarehouseName | WarehouseStatus |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

* Columns in Green are suggested groupings for nested attributes.
* Columns in Red are identified candidate keys for the relation.

## Task 1 -Functional Dependencies

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Determining Attribute | Determines | Functional dependency 1 | Functional dependency 2 | Functional dependency 3 | Functional dependency 4 |
| 1 | MTXid | -> | Name | Address | WareHouseNo | RoomID |
| 2 | RoomID | -> | Room - Capacity | RoomType | RoomName |
| 3 | WareHouseNo | -> | Warehouse - Capacity | WarehouseName | WarehouseStatus |
| 4 | NumberOfServers | -> | RackCount | EnergyConsumption |
| 5 | Address | -> | Location |
| 6 | Room - Capacity | -> | RackCount |
| 7 | WareHouse - Capacity | -> | Room - Capacity |
| 8 | Room - Capacity | -> | NumberOfServers |
| 9 | MTXid, RoomID, WarehouseNo | -> | PlantSpecialist |

## Task 2- Candidate Keys

|  |  |
| --- | --- |
| Candidate Key | Rationale |
| {MTXid} | Determines the datacenter major |
| {RoomID} | Determines the room in the datacenter |
| {WareHouseNo} | Determines a warehouse making up part of a datacenter |
| {Mtxid, RoomID, WareHouseNo} | Together they make up a unique datacenter room |

## Task 2- Suggested Foreign Keys (to existing and potential relations)

|  |  |
| --- | --- |
| Foreign Key | Rationale |
| PlantSpecialists | Links to project table with project ID or has a singular emplID |
|  |  |
|  |  |

# Energy Equipment Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EnergyEquipment | | | | | | | | | | | | | | |
| EnergyEquipment | | | | | | | | | | Rectifier | | | | |
| EquipmentID | EqName | Rating | Utilization | ServiceStatus | CommsProtocol | Location | MTXid | Model | SerialNumber | RectID | RectCapacity | RectUtilization | ActiveAlarms | ServiceDate |

Continued:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UPS-Service | | | | Generator | | | | | Transformers | | | |
| UPSNo | UPSCapacity | UPSUtilization | UPSStatus | GenID | GenCapacity | GenUtilization | ActiveAlarms | ServiceDate | TransformerID | TransformerID | TransformerRating | TransformerUtilzation |

* Columns in green are suggested nested attributes.
* Columns in gold are suggested candidate keys.

## Task 1 Functional Dependencies

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Determining Attribute | Determines | Functional dependency 1 | Functional dependency 2 | Functional dependency 3 | Functional dependency 4 | Functional dependency 5 | Functional dependency 6 | Functional dependency 7 | Functional dependency 8 |
| 1 | EquipmentID | -> | EqName | Rating | Utilization | ServiceStatus | CommsProtocol | Location | Model | SerialNumber |
| 2 | GenID | -> | GenCapacity | GenUtilization | ActiveAlarms | ServiceDate |
| 3 | RectID | -> | RectCapacity | RectUtilization | ActiveAlarms | ServiceDate |
| 4 | UPSNo | -> | UPSCapacity | UPSUtilization | UPSStatus |
| 5 | TransformerID | -> | TransformerID | TransformerRating | TransformerUtilzation |
| 6 | Model | -> | Utilization | Rating |

## Task 2- Candidate Keys

|  |  |
| --- | --- |
| Candidate Key | Rationale |
| {EquipmentID} | Identifies the equipment |
| {RectID} | Identifies the rectifier |
| {UPSNO} | Identifies the UPS device |
| {GenID} | Identifies the generator |
| {TransformerID} | Identifies the transformer |

## Task 2- Suggested Foreign Keys (to existing and potential relations)

|  |  |
| --- | --- |
| Foreign Key | Rationale |
| MTXid (given) | Given in the relation and is identified as a foreign key |
|  |  |
|  |  |

# Server Table

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Server | | | | | | | | | | | |
| ServerID | ServerName | RackID | RackLabel | Model | SerialNumber | ProcessorDetails | Utilization | Vendor | VMNames | VMCount | ResponsibleStaff |

* Columns in gold are suggested candidate keys.

## Task 1 Functional Dependencies

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Determining Attribute | Determines | Functional dependency 1 | Functional dependency 2 | Functional dependency 3 | Functional dependency 4 |
| 1 | {ServerID} | -> | ServerName | VMNames | VMCount | RackID |
| 2 | {Model} | -> | ProcessorDetails | Vendor | SerialNumber |
| 3 | {RackID, SeverID} | -> | ResponsibleStaff |
| 4 | {RackID} | -> | RackLabel |

## Task 2- Candidate Keys

|  |  |
| --- | --- |
| Candidate Key | Rationale |
| {ServerID} | Identifies the server |
| {RackID} | Identifies the rack which may hold 1 to many servers |
| {ServerID,RackID} | Identifies ResponsibleStaff |

## Task 2- Suggested Foreign Keys (to existing and potential relations)

|  |  |
| --- | --- |
| Foreign Key | Rationale |
| MTXid | What center does the server belong to |
| RoomID, WareHouseNo | Where in the center the rack is contained |
| VMCodes | Relate to a VM table instead of a composite attribute VMNames |
| ResponsibleStaff | StaffID or links instead to the ProjectID table to all responsible staff or another new relation |

# Staff Table

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Staff | | | | | | | | | | | |
| EmplID | Name | Address | PhoneNumber | Department | EmergencyContacts | ProjectID | ProjectName | HoursInDataCenter | Supervisor | Age | HealthStatus |

* Columns in gold are suggested candidate keys.

## Task 1 Functional Dependencies

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Determining Attribute | Determines | Functional dependency 1 | Functional dependency 2 | Functional dependency 3 | Functional dependency 4 | Functional dependency 5 | Functional dependency 6 | Functional dependency 7 | Functional dependency 8 |
| 1 | EMPLID | -> | Name | Address | PhoneNumber | EmergencyContact | ProjectID | HoursInDataCenter | Age | HealthStatus |
| 2 | ProjectID | -> | Supervisor | ProjectName |
| 3 | Department | -> | Supervisor |

## Task 2- Candidate Keys

|  |  |
| --- | --- |
| Candidate Key | Rationale |
| {EmpID} | Identifies the employee |
| {ProjectID} | Identifies the ProjectName and Department |

## 

## Task 2- Suggested Foreign Keys (to existing and potential relations)

|  |  |
| --- | --- |
| Foreign Key | Rationale |
| ProjectID | Relate to a more detailed project relation |
| EmergencyContactID (or use EmergencyContact) | Relate to a table with the emergency contacts details |
| MTXid, RoomID, WareHouseNo | Relate to where they work (this may also be linked relationally through projectID perhaps) |

# Task 3 -Suggested extra relations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ServerUtilization | | DCIM’s have a goal of monitoring the usage of the system to identify efficiencies and redundancies within the system. | | | | | | |
| Attributes | | | | | | | | |
| ServerID | RackID | PeakEnergyCosnumption | PeakEnergyDuration | IDLE\_Consumption | IDLE\_Duration | DiskUtilization\_Average | Peak\_DiskUtil | Lowest\_DIskUtil |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Recovery Systems | DCIM aim to identify points of critical risk and redundancy within a datacenter such that no data is lost because of some sort of incident. Server can be chained MainServer – BackUpServer – MainServer depending on the number of backups and levels of redundancies desired with a certain raid level. | | | |
| Attributes | | | | |
| MainServer (ServerID) | | BackUpServer (ServerID) | LastBackUp | RaidLevel |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| AirFlow\_Logistics | | DCIM companies are hiring mechanical engineers to design the airflow of the racks/ server blocks in the center rooms to be more temperature efficient and increase server performance under intense load | | | | | |
| Attributes | | | | | | | |
| RoomID | AirflowEngineer (EMPLid) | | HighestTemp | High\_duration | LowestTemp | Low\_duration | dailyPowerConsumption |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CounterMeasureSystems | | | | | The monitoring systems of a datacenter are important in determining any possible flaws in protecting the datacenter physically and electronically | | | |
| Attributes | | | | | | | | |
| RoomID | CoolingType | UPSID | AirControlEngineer | TemperatureControlSystemID | | SiteMonitorID (staff member) | AI\_MonitoringSystemID | SecuritySoftwareID |

|  |  |  |  |
| --- | --- | --- | --- |
| SoftwareUtilities | | Software utilities which are applied to certain servers, racks, rooms, or warehouses this may be based on the DCIM contract of the client (if independently contracted) | |
| Attributes | |  | |
| ServerID | SofwareID | | SoftwareName |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Clients | | | DCIM’s may be independently contracted by a company to solve all their DCIM requirements. This may be extended with a table for linking the relevant servers, rooms, warehouses, software etc. to the client | | |
| Attributes | | | | | |
| ClientID | ClientName | ContactDetails | | LengthOfContract | ResponsibleEmployee |

## Possible tables inferred from given tables:

* Project table for projects
* Datacenter locations table
* Virtual Machines table
* Emergency Contact details table

# Task 4

The clients table is chosen to be added to the schema:

|  |
| --- |
| ClientID |
| License |
| Name |
| Contract\_Details |
| Name |
| Contract\_Start |
| Contract\_End |
| Contract\_Length |
| Servers |
| ProjectID |
| Responsible\_Employee |

## Table Normal Forms

Datacenter, Server, Staff and Client are in no normal form due to the multivalued attributes PlantSpecialists, VMNames, Names, servers respectively.

Server, and EnergyEquipment also contain nested relations (multivalued in nature) being for Server: Room and for EnergyEquipment having: Rectifier and Generator.

Thus, EnergyEquipment is also in no normal form.

## BCNF

None of the tables fulfill the requirements before normalization for Boyce-Codd normal form (BCNF). BCNF is required for a table to be in at least normal form two to allow normalization to either BCNF or Normal form three.

BCNF helps prevent update anomalies and tables with redundancies from being formed. The attribute is required to be a prime attribute which is an attribute fully functionally dependent on the primary key.

## Anomalies

### Insert Anomaly

Insert anomalies occur when data cannot be added to a relation due to the primary key being given a value of null. This may be due to a relation not being focused on a single entity.

#### Example 1 - Datacenter

A new warehouse is built but has not been assigned to a datacenter. Nor any of its room.

#### Example 2 - Datacenter

A new room is cleared out in a datacenter and becomes unused.

#### Example 3 - Datacenter

A new datacenter is designated but no warehouses nor rooms have been designated yet.

#### Example 4 – Energy Equipment

A new generator is purchased but cannot be added until it is associated with a UPS, Transformer, Rectifier and EquipmentID.

#### Example 5 – Energy Equipment

Similarly, a transformer cannot be added alone

#### Example 6 – Energy Equipment

A UPS cannot be added alone.

#### Example 7 – Energy Equipment

A Rectifier cannot be added alone.

#### Example 8 – Server

A new rack is purchased or made but cannot be added to the system until associated with a server.

#### Example 9 – Staff

A new project can only be added after a staff member is assigned to it.

### Modification Anomaly

Modification anomalies occur when an attribute in a relation is to be updated but not all the desired tuples holding the attribute are updated. This leads to a contradiction in information between an old and new value. This may be caused by data being stored redundantly and the update process (query/transaction) being performed incorrectly to change the attribute’s value. Possibly if more than one set of candidate keys may be used to query the data and the data to be updated is redundantly stored in the relation.

#### Example 1 – Datacenter

Datacenters belong to a certain location. If the location were to change all the associated MTXid with room and warehouse combinations would be required to be changed accordingly.

#### Example 2 – Datacenter

The status on a warehouse changes. All associated datacenters are required to be updated. A query involving the MTXid is used.

#### Example 3 – Energy Equipment

The rating of the transformer is desired to be updated. All energy equipment associated must be updated.

#### Example 4 – Energy Equipment

A specific UPS has its status changed. All the UPS’s must be updated.

#### Example 5 – Server

A certain rack model changes. All racks using the model must be changed.

#### Example 6 – Staff

A project name changes, all pertaining records must be updated.

### Delete Anomaly

Deletion anomalies occur when information is lost in a deletion. Certain information may be contained as attributes in a tuple. This information is desired to exist in the schema but is lost when no tuple holds the information. This information then ceases to exist when the tuple is deleted. This is again due to a relation not being focused on a singular entity.

#### Example 1 – Datacenter

If a single data center holds unique information with regards to a Room and Warehouse, when the datacenter is deleted, this information is lost in the process.

#### Example 2 – Energy Equipment

When an equipment ID is to be deleted, unique rectifier, UPS and transformer info is lost in the deletion if only contained in a single record.

#### Example 3 – Server

Rack and VM information are lost when the Server is to be deleted if held in a singular record.

#### Example 4 – Staff

Project information is lost when the last staff member from the project is deleted.

## Some simplifications

Datacenter has the composite attribute PlantSpecialists which is simplified into a SpecialistID and Name field. This field can be repeated N times depending on the workforce required.

Staff has the names field defined as a first, middle and last name; that is then treated as a nested relation staff names

# Task 5

## Datacenter

### First normal form:

Datacenter has an identified nested relation ROOM, and composite attribute PlantSpecialists. It is decomposed into:

#### Datacenter

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Location | Address | EnergyConsumption | NumberOfServers | RackCount | MTXid | WareHouseNo | Capacity | WareHouseName | WareHouseStatus |

#### Room

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MTXid | RoomID | Capacity | RoomType | RoomName | RoomStatus |

#### PlantSpecialists

|  |  |  |
| --- | --- | --- |
| MTXid | SpecialistID | SpecialistName |

### Second normal form

For datacenter, the candidate key {MTXid,WareHouseNo} will be defined as the primary key for the relation as a datacenter may be spread across multiple warehouses. Thus the attributes regarding Warehouse are not fully functionally dependent on the key and the details relating to the datacenter similarly. The relation is decomposed further as followed:

#### Datacenter-Spread

|  |  |  |  |
| --- | --- | --- | --- |
| MTXid | WareHouseNo | Location | Address |

#### WareHouse

|  |  |  |  |
| --- | --- | --- | --- |
| WareHouseNo | Capacity | WareHouseName | WarehouseStatus |

#### Datacenter

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| MTXid | Name | EnergyConsumption | NumberOfServers | RackCount |

#### Room\_sub

|  |  |
| --- | --- |
| MTXid | RoomID |

#### Room

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| RoomID | Capacity | RoomName | RoomType | RoomStatus |

#### PlantSpecialists\_sub

|  |  |
| --- | --- |
| MTXid | SpecialistID |

#### PlantSpecialists

|  |  |
| --- | --- |
| SpecialistID | SpecialistName |

### Third normal form

Datacenter has the rack count and energy consumption transitively dependent on the NumberOfServers. Location is transitively dependent on the address.

#### Datacenter-Spread

|  |  |  |
| --- | --- | --- |
| MTXid | WareHouseNo | Address |

#### Datacenter\_Locations

|  |  |
| --- | --- |
| Address | Location |

#### Datacenter

|  |  |  |
| --- | --- | --- |
| MTXid | Name | NumberOfServers |

#### Datacenter\_Consumption\_info

|  |  |  |
| --- | --- | --- |
| NumberOfServers | RackCount | EnergyConsumption |

### BCNF

All the above relations follow BCNF.

## Energy Equipment

### First normal form

EnergyEquipment has been identified to contain the nested relations: rectifier and Generator. It is decomposed into:

#### EnergyEquipment

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EquipmentID | EqName | Rating | CommsProtocol | ServiceStatus | | Location | MTXid | Model | SerialNumber | | UPSNO | UPSCapacity | UPSUtilization | UPS\_Status |
| TransformerID | | | | | TransformerRating | | | | | TransformerUtilization | | | | |

#### Rectifier

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MTXid | RectID | RectCapacity | RectUtilization | ActiveAlarms | ServiceDate |

#### Generator

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MTXid | GenID | GenCapacity | GenUtilization | ActiveAlarms | ServiceDate |

### Second normal form

EnergyEquipment: EquipmentID with MTXid is the primary key as the code would be desired to be unique to monitor all equipment uniquely and ensure no equipment go missing and requires to exist at a datacenter. Model functionally determines the rating among other attributes. The tables are decomposed as followed:

#### EnergyEquipment

|  |  |  |  |
| --- | --- | --- | --- |
| EquipmentID | MTXid | UPSNO | TransformerID |

#### EquipmentInfo

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EquipmentID | EqName | Location | Model | CommsProtocol | Rating | Utilization | SerialNumber | ServiceStatus |

#### UPS

|  |  |  |  |
| --- | --- | --- | --- |
| UPSNO | UPSCapacity | UPSUtilization | UPS\_Status |

#### Transformers

|  |  |  |
| --- | --- | --- |
| TransformerID | TransformerRating | TransformerUtilization |

#### Rect\_sub

|  |  |
| --- | --- |
| MTXid | RectID |

#### Rectifier

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| RectID | RectCapacity | RectUtilization | ActiveAlarms | ServiceDate |

#### Generator\_sub

|  |  |
| --- | --- |
| MTXid | GenID |

#### Generator

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| GenID | GenCapacity | GenUtilization | ActiveAlarms | ServiceDate |

### Third normal form

Model functionally determines some characteristics of the equipment.

#### EquipmentInfo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| EquipmentID | EqName | Location | Model | CommsProtocol |

#### EqModel\_info

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model | Rating | Utilization | SerialNumber | ServiceStatus |

### BCNF

Defining the superkey as {EquipmentID, MTXid}, UPSno and TransformerID are decomposed further due to being dependent on EquipmentID only:

#### EnergyEquipment

|  |  |
| --- | --- |
| EquipmentID | MTXid |

UPS\_Equipment

|  |  |
| --- | --- |
| EquipmentID | UPSNO |

Transformer\_Equipment

|  |  |
| --- | --- |
| EquipmentID | TransformerID |

## Server

### First normal form

Server has been identified to contain a composite attribute VM\_Names, it is decomposed as followed:

#### Server

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ServerID | RackID | ServerName | RackLabel | Model | SerialNumber | ResponsibleStaff | Utilization | Vendor | VMCount | ProcessorDetails |

#### VM\_Names

|  |  |
| --- | --- |
| ServerID | VM\_Name |

### Second normal form

Server is decomposed as followed based on a candidate key of ServerID and RackID:

#### Server

|  |  |  |
| --- | --- | --- |
| ServerID | RackID | ResponsibleStaff |

#### Server\_info

|  |  |  |
| --- | --- | --- |
| ServerID | ServerName | VMCount |

#### Rack\_info

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| RackID | RackLabel | Model | SerialNumber | Utilization | Vendor | ProcessorDetails |

### Third normal form

Info about the rack is transitively dependent on the model of the rack model.

#### Rack\_info

|  |  |  |  |
| --- | --- | --- | --- |
| RackID | RackLabel | Model | Utilization |

#### Rack\_models

|  |  |  |  |
| --- | --- | --- | --- |
| Model | SerialNumber | Vendor | ProcessorDetails |

### BCNF

The tables all conform to BCNF.

## Staff

### First normal form

Staff has been identified to contain the composite attributes EmergencyContacts and Names it is decomposed as followed:

#### Staff

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Address | EmplID | PhoneNumber | Department | ProjectID | ProjectName | HoursInDataCenter | Supervisor | Age | HealthStatus |

#### Emergency\_Contacts

|  |  |  |  |
| --- | --- | --- | --- |
| EmplID | EM\_fname | EM\_Sname | EM\_phone |

#### Staff\_names

|  |  |  |  |
| --- | --- | --- | --- |
| EmplID | fName | mName | sName |

### Second normal form

The candidate key of {ProjectID, EmplID} is used:

#### Staff\_Projects

|  |  |
| --- | --- |
| EmplID | ProjectID |

#### Employee\_info

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Address | EmplID | PhoneNumber | Department | HoursInDataCenter | Supervisor | Age | HealthStatus |

#### Project\_info

|  |  |
| --- | --- |
| ProjectID | ProjectName |

### Third normal form

#### Employee\_info

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Address | EmplID | PhoneNumber | Department | HoursInDataCenter | Age | HealthStatus |

#### Department\_Supervisor

|  |  |
| --- | --- |
| Supervisor | Department |

### BCNF

The tables all conform to BCNF.

## Client

### First normal form

The added custom table has the complex attributes ContactDetails and servers decomposed.

#### Client

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Client\_ID | Name | ContractName | Contract\_Start | Contract\_End | Contract\_Length | ProjectID | Responsible\_Employee | License |

#### Client\_ContactInfo

|  |  |
| --- | --- |
| Client\_ID | ContactDetails |

#### Client\_Servers

|  |  |
| --- | --- |
| Client\_ID | Servers |

### Second normal form

#### Client

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Client\_ID | Name | ProjectID | Responsible\_Employee | License |

#### Contracts

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ProjectID | ContractName | Contract\_Start | Contract\_End | Contract\_Length |

### Third normal form

Conforms.

### BCNF

Conforms.

## Final Tables

### Datacenter

#### Datacenter-Spread

|  |  |  |
| --- | --- | --- |
| MTXid | WareHouseNo | Address |

#### Datacenter\_Locations

|  |  |
| --- | --- |
| Address | Location |

#### WareHouse

|  |  |  |  |
| --- | --- | --- | --- |
| WareHouseNo | Capacity | WareHouseName | WarehouseStatus |

#### Datacenter

|  |  |  |
| --- | --- | --- |
| MTXid | Name | NumberOfServers |

#### Datacenter\_Consumption\_info

|  |  |  |
| --- | --- | --- |
| NumberOfServers | RackCount | EnergyConsumption |

#### Room\_sub

|  |  |
| --- | --- |
| MTXid | RoomID |

#### Room

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| RoomID | Capacity | RoomName | RoomType | RoomStatus |

#### PlantSpecialists\_sub

|  |  |
| --- | --- |
| MTXid | SpecialistID |

#### PlantSpecialists

|  |  |
| --- | --- |
| SpecialistID | SpecialistName |

### Energy Equipment

#### EnergyEquipment

|  |  |
| --- | --- |
| EquipmentID | MTXid |

#### UPS\_Equipment

|  |  |
| --- | --- |
| EquipmentID | UPSNO |

#### Transformer\_Equipment

|  |  |
| --- | --- |
| EquipmentID | TransformerID |

#### EquipmentInfo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| EquipmentID | EqName | Location | Model | CommsProtocol |

#### EqModel\_info

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model | Rating | Utilization | SerialNumber | ServiceStatus |

#### UPS

|  |  |  |  |
| --- | --- | --- | --- |
| UPSNO | UPSCapacity | UPSUtilization | UPS\_Status |

#### Transformers

|  |  |  |
| --- | --- | --- |
| TransformerID | TransformerRating | TransformerUtilization |

#### Rect\_sub

|  |  |
| --- | --- |
| EquipmentID | RectID |

#### Rectifier

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| RectID | RectCapacity | RectUtilization | ActiveAlarms | ServiceDate |

#### Generator\_sub

|  |  |
| --- | --- |
| EquipmentID | GenID |

#### Generator

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| GenID | GenCapacity | GenUtilization | ActiveAlarms | ServiceDate |

### Server

#### Server

|  |  |  |
| --- | --- | --- |
| ServerID | RackID | ResponsibleStaff |

#### Server\_info

|  |  |  |
| --- | --- | --- |
| ServerID | ServerName | VMCount |

#### VM\_Names

|  |  |
| --- | --- |
| ServerID | VM\_Name |

#### Rack\_info

|  |  |  |  |
| --- | --- | --- | --- |
| RackID | RackLabel | Model | Utilization |

#### Rack\_models

|  |  |  |  |
| --- | --- | --- | --- |
| Model | SerialNumber | Vendor | ProcessorDetails |

### Staff

#### Staff\_Projects

|  |  |
| --- | --- |
| EmplID | ProjectID |

#### Employee\_info

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Address | EmplID | PhoneNumber | Department | HoursInDataCenter | Age | HealthStatus |

#### Department\_Supervisor

|  |  |
| --- | --- |
| Supervisor | Department |

#### Project\_info

|  |  |
| --- | --- |
| ProjectID | ProjectName |

#### Emergency\_Contacts

|  |  |  |  |
| --- | --- | --- | --- |
| EmplID | EM\_fname | EM\_Sname | EM\_phone |

#### Staff\_names

|  |  |  |  |
| --- | --- | --- | --- |
| EmplID | fName | mName | sName |

### Client

#### Client

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Client\_ID | Name | ProjectID | Responsible\_Employee | License |

#### Contracts

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ProjectID | ContractName | Contract\_Start | Contract\_End | Contract\_Length |

#### Client\_ContactInfo

|  |  |
| --- | --- |
| Client\_ID | ContactDetails |

#### Client\_Servers

|  |  |
| --- | --- |
| Client\_ID | Servers |