Description of Entities and their Attributes

Company Director and Founder

Although the Company Director and Founder is the owner of AS and does not realistically report to anyone, they are still considered as an 'employee' in the company so as to allow scope for when the company gets bought by a larger one, whereby the Company Director and Founder 'officially' becomes an employee. Treating this entity as an employee also assists with the operational reportings in accounting, finance, HR, and company resources distribution.

The Company Director and Founder is identified by their unique and non-null Employee ID, which is a Primary Key (PK). The rest of the attributes can be non-unique, including Employee Name, Employee Role, Employee Department, Phone Number, and Email.

Company Director and Founder is a strong entity as it does not have an FK that is a PK to any entities.

Technical Service Manager

The Technical Service Manager is an employee of AS, and exhibits the same attributes as the Company Director and Founder, except, it has an additional attribute, Manager's Employee ID, which is a Foreign Key (FK) referencing the Employee ID PK of the Company Director and Founder. Thus, Technical Service Manager is a weak entity with respect to the Company Director and Founder.

Technician

The Technician is an employee of AS, and exhibits the same attributes as the Technical Service Manager. Its Manager's Employee ID attribute is an FK referencing the Employee ID PK of the Technical Service Manager. Thus, Technician is a weak entity with respect to the Technical Service Manager.

AS Job

An AS Job represents a job that is logged by a BME towards AS. It does not have any indication on the job status or how the job was completed.

Each AS Job is identified by its unique, non-null AS Job Number, which is its PK.

Other attributes include the AS Job Creation Date, the Healthcare Facility of the Medical Equipment, Location of the Medical Equipment, the Model of the Medical Equipment, the Brand of the Medical Equipment, the AS Job Category describing whether the job is a maintenance job or a repair service, and an AS Job Request describing the fault reported by the BME upon logging the job.

The remaining attributes are FKs that refer to attributes from the Technician entity or the Medical Equipment entity. They include the Technician Employee ID, which refers to the PK of the Technician entity, and the Equipment Asset Number and Equipment Serial Number. Thus, AS Job is a weak entity with respect to the Technician and the Medical Equipment.

FSR

An FSR reflects the job that is completed by the Technician and is generated by its underlying AS Job. As such, most of its attributes are derived from the AS Job entity. It has information additional to the AS Job, which describe the details on the completed job.

Each FSR is identified by its unique, non-null, FSR Number, which is its PK.

The FKs of the FSR refer to the PKs of the AS Job, the Technician, and the Medical Equipment. They are the AS Job Number, the Technician Employee ID, and the Medical Equipment Asset and Serial Numbers, respectively. Thus, FSR is a weak entity with respect to the AS Job, Technician, and Medical Equipment entities.

Service Invoice

A Service Invoice represents the work completed by the Technician and is generated by its underlying FSR. As such, most of its attributes are derived from the FSR entity.

Each Service Invoice is identified by its unique, non-null, Invoice Number, which is its PK.

The FKs of the Service Invoice refer to the PKs of the FSR, the Technician, and the Medical Equipment. They are the FSR Number, the Technician Employee ID, and the Medical Equipment Asset and Serial Numbers, respectively. Thus, Service Invoice is a weak entity with respect to the FSR, the Technician, and the Medical Equipment entities.

Part

A Part entity details the parts that are available to be used by AS for any AS Job.

A Part is identified by its unique, non-null Item Number.

The other attributes include the Description of the Part, the Sell Price of the Part which is the amount to charge the BME Department, the Purchase Price of the part which is the price it was sourced at, the Part Number which is an identifier number derived from manufacturer, and the Manufacturer which describes the name of the manufacturer.

Part is a strong entity as it does not have an FK that is a PK to any entities.

Part Assignment

A Part Assignment is a composite entity that bridges the many-to-many relationship between the Part entity and the Service Invoice entity. It details the part(s) that are used to complete an AS Job. These parts are listed in the Service Invoice.

A Part Assignment is identified by its unique, non-null, Invoice Number and Item Number, which are its PKs. These attributes also reference the PKs of the Service Invoice entity and the Part entity, respectively. Thus, the Part Assignment is a weak entity with respect to the Part entity and the Service Invoice entity.

Another attribute of Part Assignment is the Part Quantity, which describes the number of the Part that is used in the AS Job, which is to appear in the Service Invoice.

Chief Biomedical Engineer

The Chief Biomedical Engineer is the manager of the BME department. They are an employee of the healthcare facility and exhibits attributes that describe an employee of the healthcare facility.

The Chief Biomedical Engineer is identified by their unique, non-null, Employee ID, which is their PK.

The remaining attributes are the Employee Name, the Employee Role, the Manager Employee ID which is the Employee ID of the manager they report to, the Employed Department which is the BME Department, the Phone Number, and the Email of the Chief Biomedical Engineer.

BME

A BME is a member of the BME department. A BME is an employee of the healthcare facility and, similarly to the Chief Biomedical Engineer, exhibits attributes that describe an employee of the healthcare facility.

One of the BME's attributes, the Manager Employee ID, is an FK that refers to the Employee ID of the Chief Biomedical Engineer in which the BME reports to. Thus, BME is a weak entity with respect to the Chief Biomedical Engineer entity.

BME Job

A BME Job is a job that is logged into the BME system, where then a BME is assigned it.

Each BME Job is identified by its unique, non-null, BME Job Number, which is its PK.

The FKs of the BME refer to the PKs of the Medical Equipment and the BME. They are the Equipment Asset Number and the assigned BME's Employee ID, respectively. Thus, the BME Job is a weak entity with respect to the Medical Equipment entity and the BME entity.

The remaining attributes of the BME Job include the BME Job Creation Date, the Medical Equipment's Location, the BME Job Description describing the request on the BME Job, the BME Job Category describing whether the BME Job is a 'maintenance' or 'repair' job, and the BME Job Status describing the whether the job is 'outstanding', 'in progress', or 'completed'.

Medical Equipment

A Medical Equipment is the entity in which the BME and AS Technicians perform their work on.

Each Medical Equipment is identified by its unique, non-null Asset Number and Serial Number, which are its PKs.

The remaining attributes of the Medical Equipment are the Model and Brand of the Medical Equipment, the Equipment Location describing where the equipment is situated at, the Commission Date of the Medical Equipment, the Equipment Category describing the Medical Equipment type, and the BME Job Status describing whether the Medical Equipment is 'active' (still in use), 'inactive' (condemned), or 'lost' (unable to be located).

Medical Equipment is a strong entity as it does not have an FK that is a PK to any entities.

Description of Relationships and Cardinalities

Company Director and Founder ↔ Technical Service Manager

There is only one Company Director and Founder, who manages one Technical Service Manager at AS. Hence, the cardinalities between them is 1-to-1 on both sides.

Despite both entities having the Employee ID as their PKs, their values are not identical. As they share no PK attributes, the relationship between them is weak.

Technical Service Manager ↔ Technician

There is only one Technical Service Manager, whereas there are many Technicians at AS. Hence, the cardinalities between them is 1-to-1 on the Technical Service Manager side, and 1-to-Many on the Technician side.

Despite both entities having the Employee ID as their PKs, their values are not identical. As they share no PK attributes with same values, the relationship between them is weak.

Technician ↔ AS Job

One Technician can be assigned to at least one AS Job, but one AS Job can only be assigned to by one Technician. Hence, the cardinalities between them is 1-to-1 on the Technician side, and 1-to-Many on the AS Job side.

As they share no PK attributes, the relationship between them is weak.

Technician ↔ FSR

One Technician can appear in at least one FSR, but one FSR can only show one Technician. Hence, the cardinalities between them is 1-to-1 on the Technician side, and 1-to-Many on the FSR side.

As they share no PK attributes, the relationship between them is weak.

As Job ↔ FSR

One AS Job generates one FSR, and one FSR can only be generated by one AS Job. Hence, the cardinalities between them is 1-to-1 on both sides.

As they share no PK attributes, the relationship between them is weak.

Service Invoice ↔ FSR

One Service Invoice is generated by one FSR, and each FSR can only generate one Service Invoice. Hence, the cardinalities between them is 1-to-1 on both sides.

As they share no PK attributes, the relationship between them is weak.

Service Invoice ↔ Part Assignment

Some AS Jobs may use at least one Part, whereas others may not use any Parts at all. Thus, the Service Invoice may contain zero or many Part Assignment. Only one Part Assignment can be associated with one Service Invoice since one of its PKs is the Invoice Number of the Service Invoice. Hence, the cardinalities between them is 1-to-1 on the Service Invoice side, and Zero-to-Many on the Part Assignment side.

As both entities share the Invoice Number as their PKs, the relationship between them is strong.

Part ↔ Part Assignment

Some AS Jobs may use at least one Part, whereas others may not use any Parts at all. Thus, the Service Invoice may contain zero or many Part Assignments. Only one Part Assignment can be associated with one Part since one of its PKs is the Item Number of the Part. Hence, the cardinalities between them is 1-to-1 on the Part side, and Zero-to-Many on the Part Assignment side.

As both entities share the Item Number as their PKs, the relationship between them is strong.

AS Job ↔ Medical Equipment

Some Medical Equipment may not require any AS work to be performed on, whereas others may require at least one AS work to be performed on throughout its lifetime. Thus, one Medical Equipment can appear in zero or many AS Jobs. Only one AS Job can be assigned to one Medical Equipment. Hence, the relationship between them is 1-to-1 on the Medical Equipment side, and Zero-to-Many on the AS Job side.

As they share no PK attributes, the relationship between them is weak.

FSR ↔ Medical Equipment

Some Medical Equipment may not require any AS work to be performed on, whereas others may require at least one AS work to be performed on throughout its lifetime. Thus, one Medical Equipment can appear in zero or many FSRs. Only one FSR can be attached to one Medical Equipment. Hence, the cardinalities between them is 1-to-1 on the Medical Equipment side, and Zero-to-Many on the FSR side.

As they share no PK attributes, the relationship between them is weak.

Service Invoice ↔ Medical Equipment

Some Medical Equipment may not require any AS work to be performed on, whereas others may require at least one AS work to be performed on throughout its lifetime. Thus, one Medical Equipment can appear in zero or many Service Invoices. Only one Service Invoice can be attached to one Medical Equipment. Hence, the cardinalities between them is 1-to-1 on the Medical Equipment side, and Zero-to-Many on the Service Invoice side.

As they share no PK attributes, the relationship between them is weak.

Chief Biomedical Engineer ↔ BME

At each healthcare facility, there is only one Chief Biomedical Engineer, who manages at least one BME. One BME can only be managed by one Chief Biomedical Engineer. Hence, the cardinalities between them is 1-to-1 on both sides.

Despite both entities having the Employee ID as their PKs, their values are not identical. As they share no PK attributes with the same values, the relationship between them is weak.

BME ↔ BME Job

One BME is assigned to at least one BME Job. Only one BME Job can be assigned to by one BME. Hence the cardinalities between them is 1-to-1 on the BME side, and 1-to-Many on the BME Job side.

As they share no PK attributes, the relationship between them is weak.

BME Job ↔ Medical Equipment

Some Medical Equipment may not require any BME or AS work to be performed on, whereas others may require at least one BME or AS work to be performed on throughout its lifetime. Thus, one Medical Equipment can be assigned to by zero or many BME Jobs. Only one BME Job can be assigned to one Medical Equipment. Hence, the cardinalities between them is 1-to-1 on the Medical Equipment side, and Zero-to-Many on the BME Job side.

As they share no PK attributes, the relationship between them is weak.

BME Job ↔ FSR

Some Medical Equipment may not require any AS work to be performed on, whereas others may require at least one AS work to be performed on throughout its lifetime. Thus, some BME Jobs can attach an FSR, whereas others do not attach any FSRs at all. Only one FSR can be attached to by one BME Job. Hence, the cardinalities between them is Zero-to-1 on the FSR side, and 1-to-1 on the BME Job side.

As they share no PK attributes, the relationship between them is weak.

BME Job ↔ Service Invoice

Some Medical Equipment may not require any AS work to be performed on, whereas others may require at least one AS work to be performed on throughout its lifetime. Thus, some BME Jobs can attach a Service Invoice, whereas others do not attach any Service Invoices at all. Only one Service Invoice can be attached to by one BME Job. Hence, the cardinalities between them is Zero-to-1 on the Service Invoice side, and 1-to-1 on the BME Job side.

As they share no PK attributes, the relationship between them is weak.