Description	Full Marks	Marks Obtained
Provide the correct or amended ERD diagram from the Programming Project Assignment I.	10	
*Remove features not compatible with the relational model *Derive relations for local logical data model.	40	
*Normalization Check The produce logical schema is expected to be in 3rdNF. Student may normalise their tables to produce the 3rdNF version, or (if the schema in 3rdNF, an assurance statement that the produced relational schema is in 3rdNF is essential).	5	
List the summary of relations with attributes, primary and foreign key; A **PK** may be identified by an underline (a common practice) and a FK by any other means as described by the student (e.g. double underline, italic style, different colour font, etc.)	15	
Draw the logical ERD diagram Provide the logical erd diagram with entity, relationship, attributes and multiplicity. Primary key and Foreign key also presented in the diagram	10	
Define data type logically	10	
Define the size logically	5	
All the columns define in the table above are listed in the Data Dictionary	5	
Total	100	

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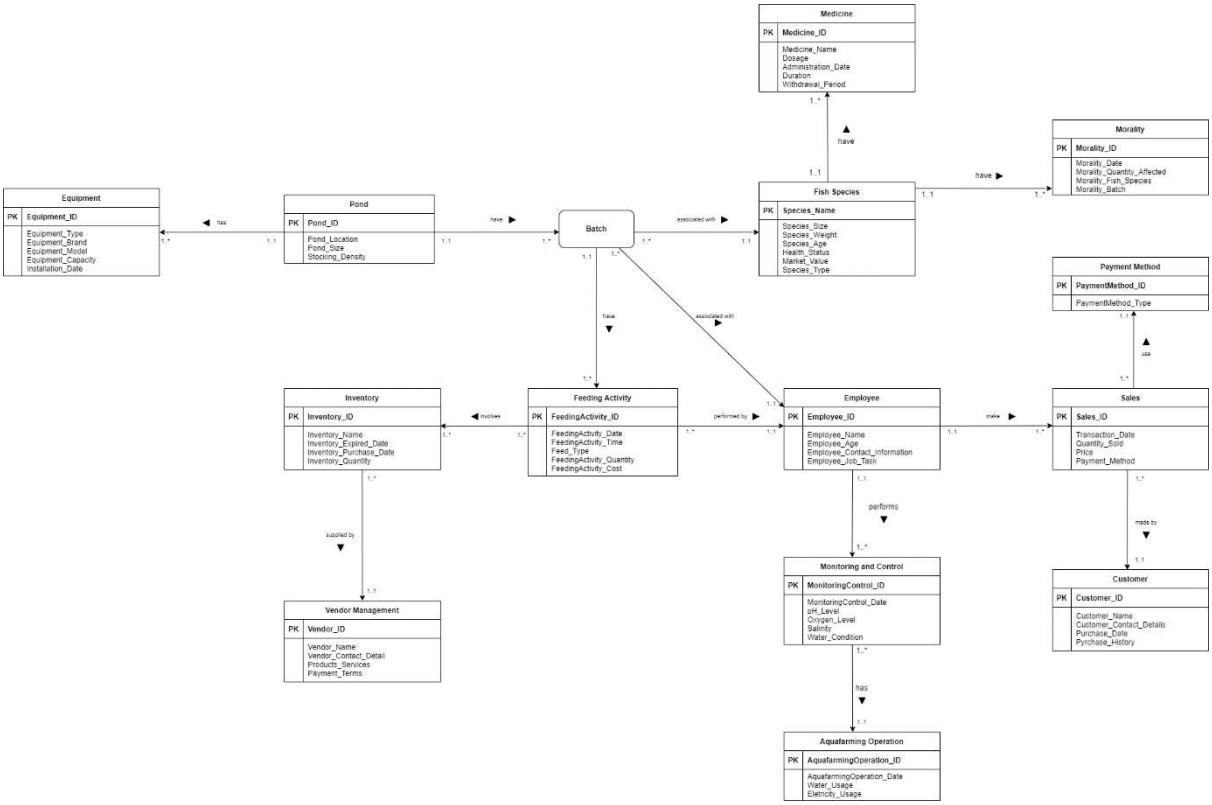
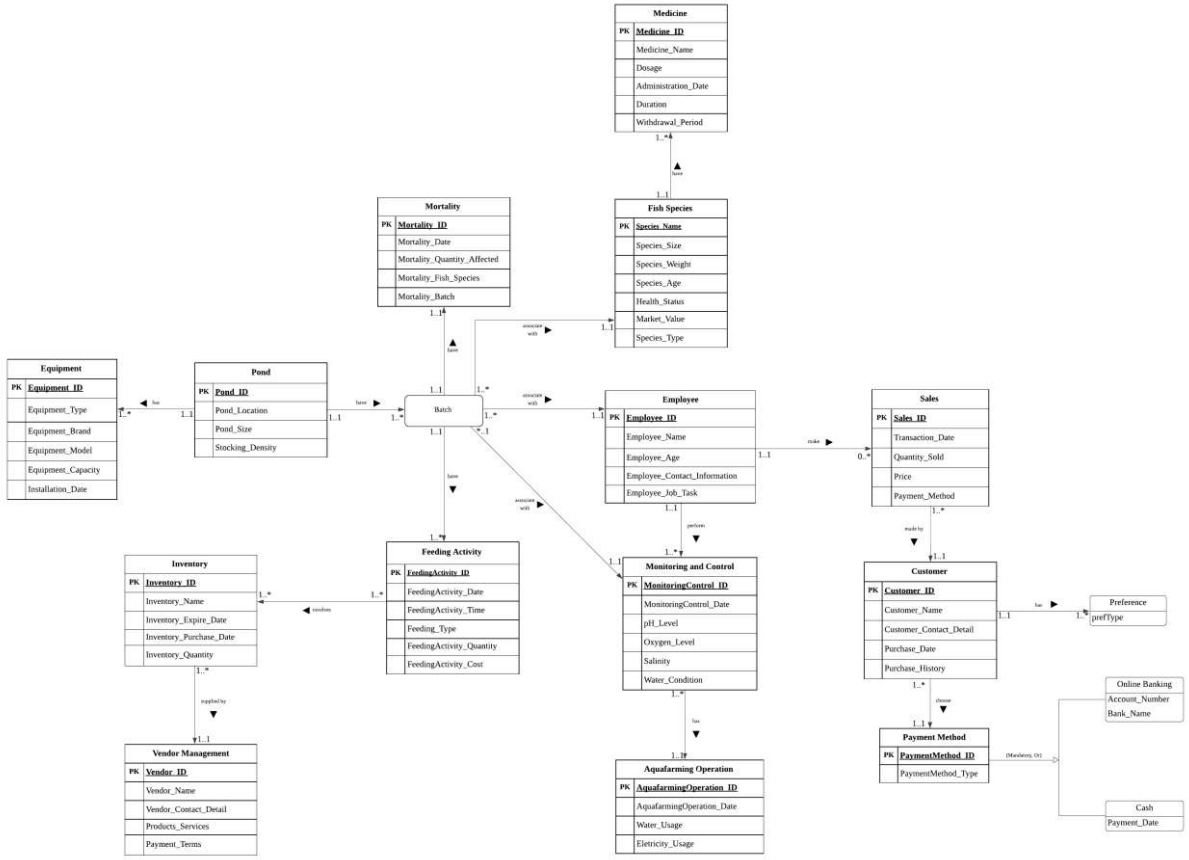
2.1 ER Diagram



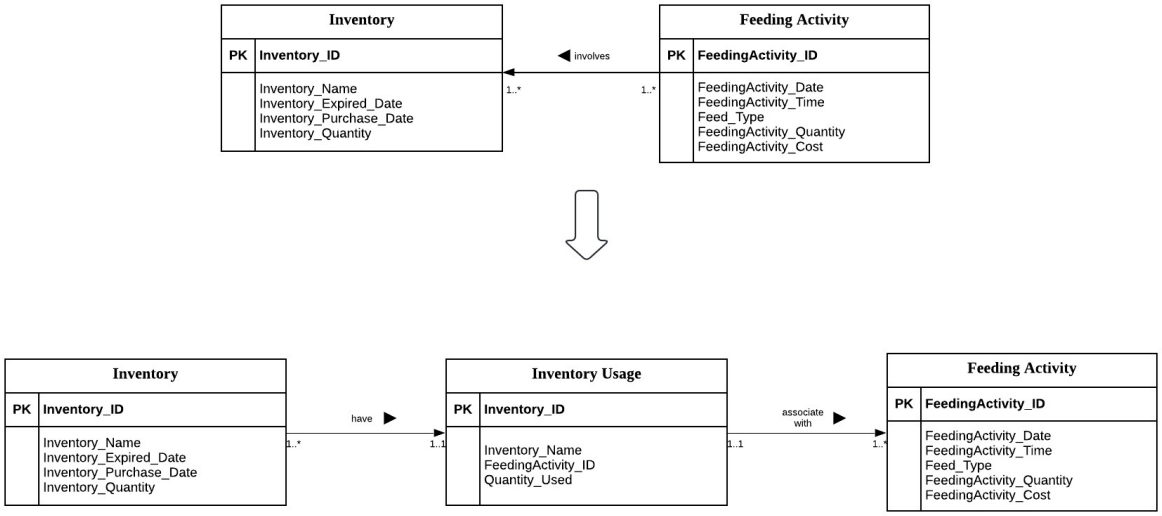
2.2 Amended ER Diagram



The amended ERD is a visual representation of the data model for a database system that has been updated or modified from its original ERD. Online banking, cash and preference are added into the ERD.

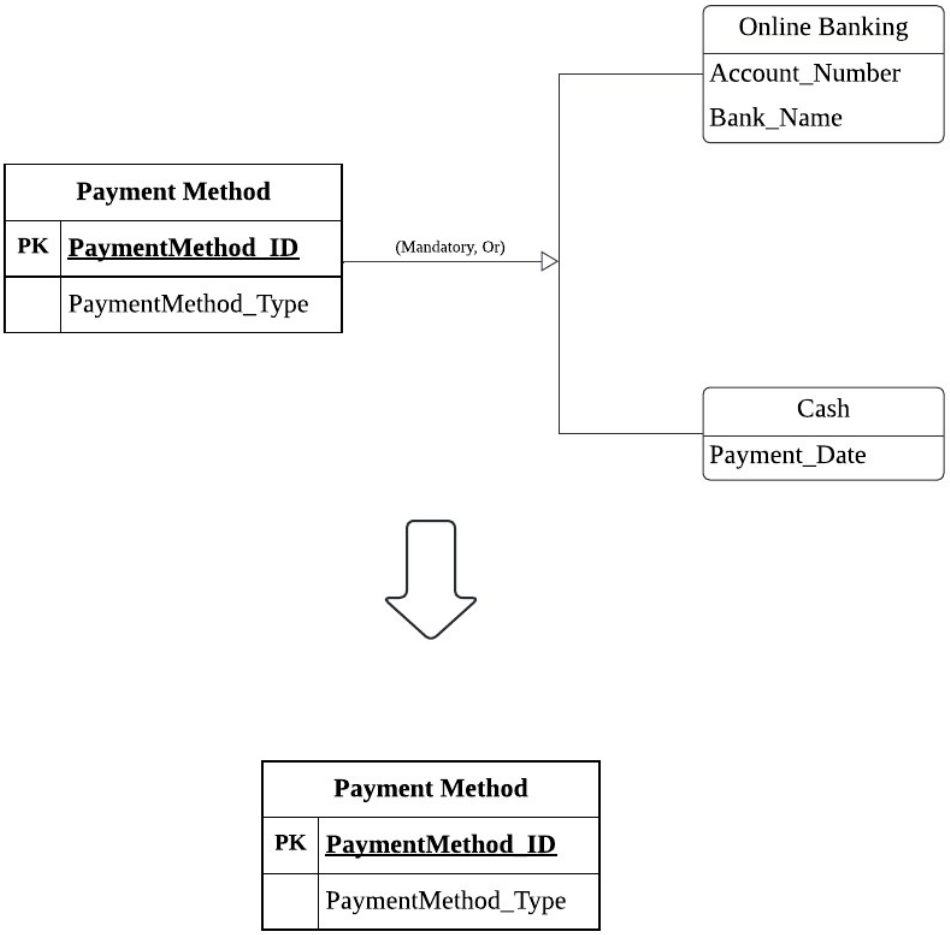
2.3 Remove Features not compatible with the relational model

a. Removal of *:* Binary Relationships types



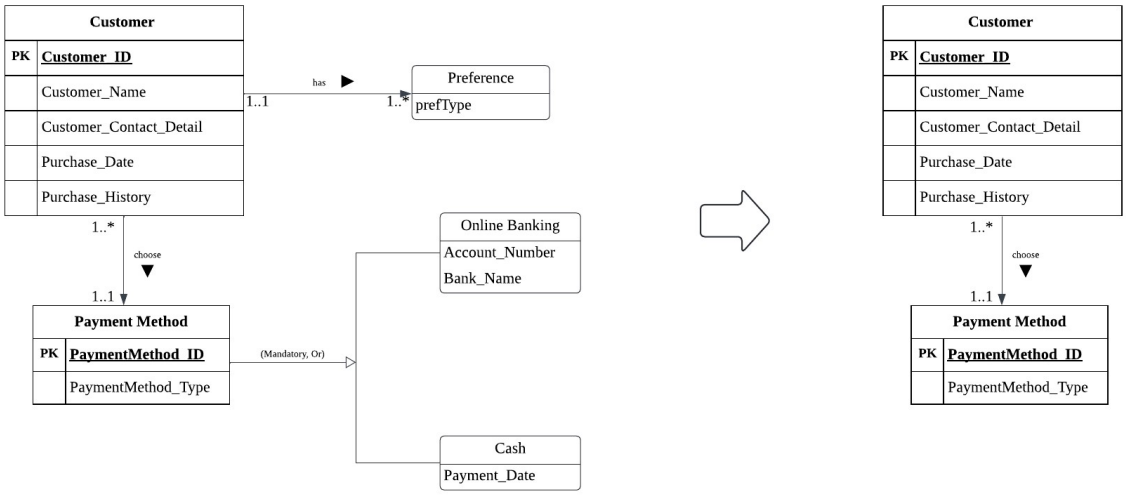
Removal of *:* relationship between inventory and feeding activity by adding a relation called inventory usage which captures specific instances of inventory items being utilized during feeding activity.

b. Removal of Superclass / Subclass Relationship



Removal of the "Online Banking" and "Cash" subclasses from the "Payment Method" superclass involves consolidating them into a single "Payment Method" relation with "PaymentMethod_ID" as the primary key.

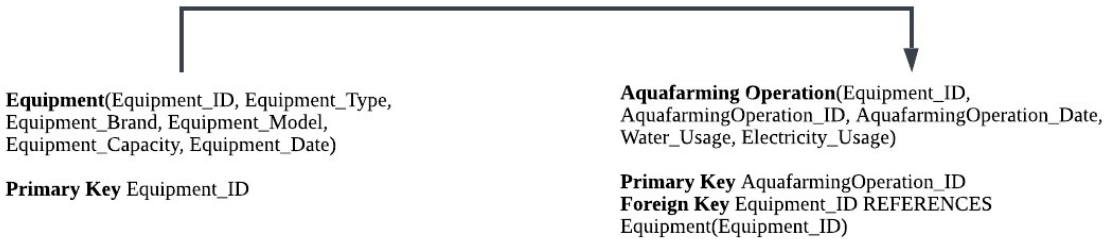
c. Removal of Entity Without Primary Key



Removal of the "Preference" entity as it lacked a primary key, which is essential for uniquely identifying each record in a relational database.

2.4 Derive relations for local logical data model

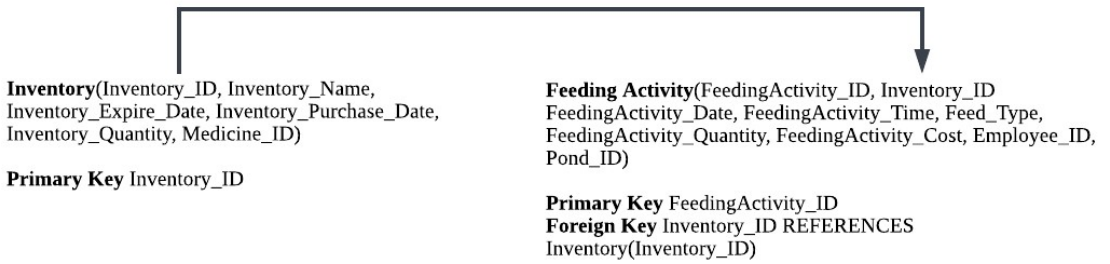
a. Post **Equipment_ID** into **Aquafarming Operation** to model 1..* **Utilises** relationship.



Parent Entity: Equipment

Child Entity: Aquafarming Operation

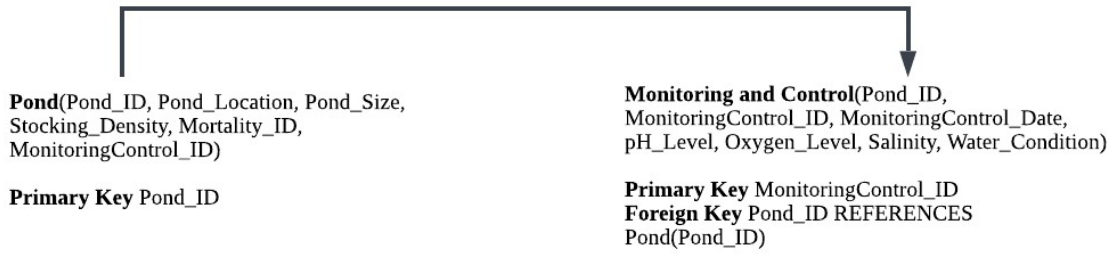
b. Post **Inventory_ID** into **Feeding Activity** to model 1..* **Used In** relationship.



Parent Entity: Inventory

Child Entity: Feeding Activity

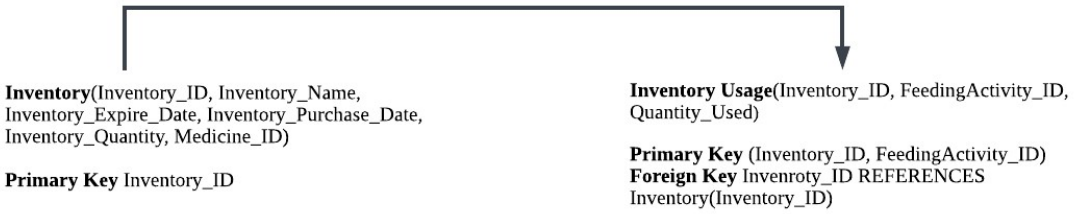
c. Post **Pond_ID** into **Monitoring and Control** to model a 1..* **Monitored At** relationship.



Parent Entity: Pond

Child Entity: Monitoring and Control

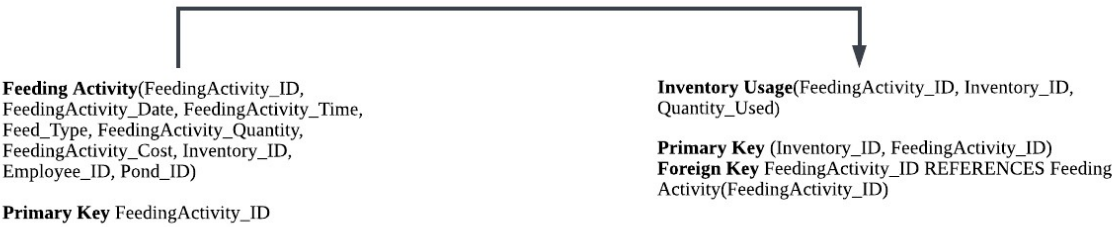
d. Post **Inventory_ID** into **Inventory Usage** to model a 1..* **Used In** relationship.



Parent Entity: Inventory

Child Entity: Inventory Usage

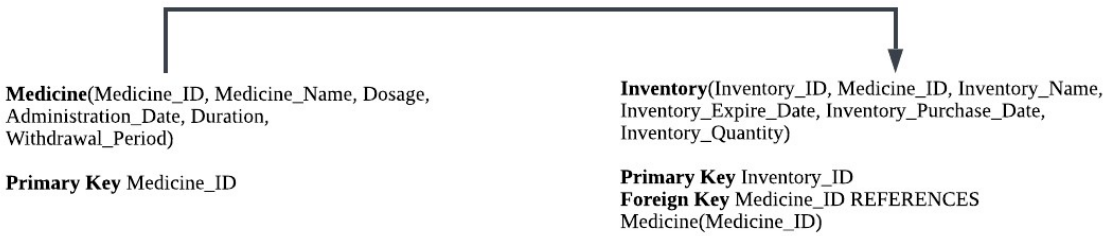
e. Post **FeedingActivity_ID** into **Inventory Usage** to model a 1..* **Utilises** relationship.



Parent Entity: Feeding Activity

Child Entity: Inventory Usage

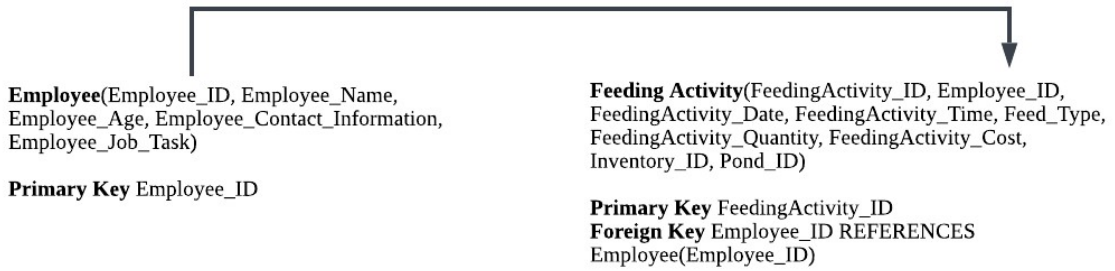
f. Post **Medicine_ID** into **Inventory** to model a 1..* **Stored In** relationship.



Parent Entity: Medicine

Child Entity: Inventory

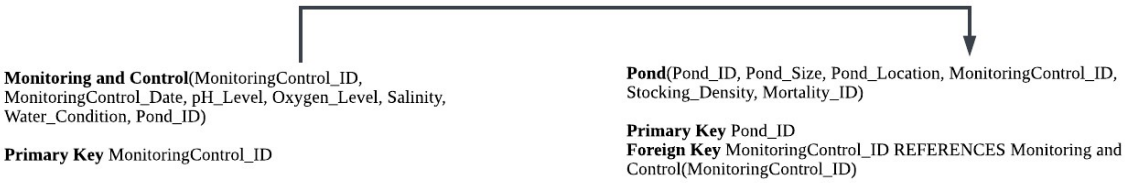
g. Post **Employee_ID** into **Feeding Activity** to model a 1..* **Performs** relationship.



Parent Entity: Employee

Child Entity: Feeding Activity

h. Post **MonitoringControl_ID** into **Pond** to model a 1..* **Monitored By** relationship.



Parent Entity: Monitoring and Control

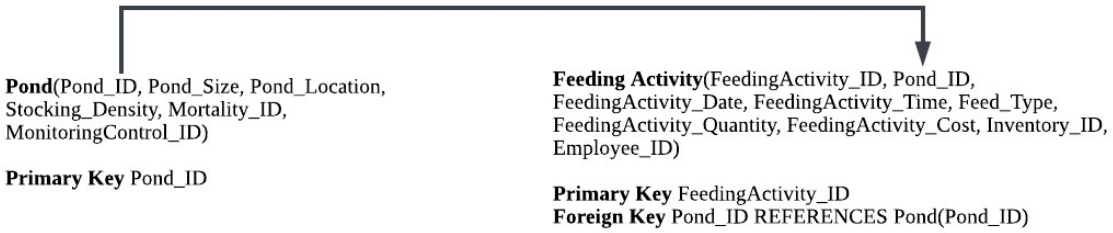
Child Entity: Pond

i. Post **Mortality_ID** into **Pond** to model a 1..* **Affects** relationship.

Parent Entity: Mortality

Child Entity: Pond

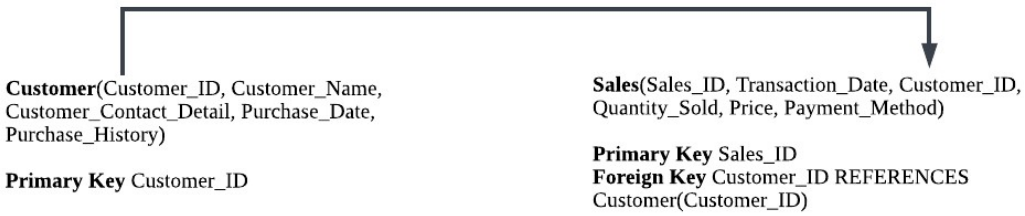
j. Post **Pond_ID** into **Feeding Activity** to model a 1..* **Occurs In** relationship.



Parent Entity: Pond

Child Entity: Feeding Activity

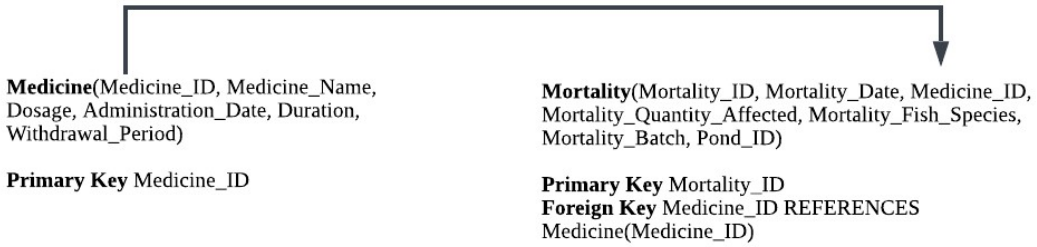
k. Post **Customer_ID** into **Sales** to model a 1..* **Purchased By** relationship.



Parent Entity: Customer

Child Entity: Sales

l. Post **Medicine_ID** into **Mortality** to model a 1..* **Treated With** relationship.



Parent Entity: Medicine

Child Entity: Mortality

2.5 Normalization

Since all the relations are normalized until the third normal form, further normalization is not required for all relations in this assignment.

2.6 Summary of Relation

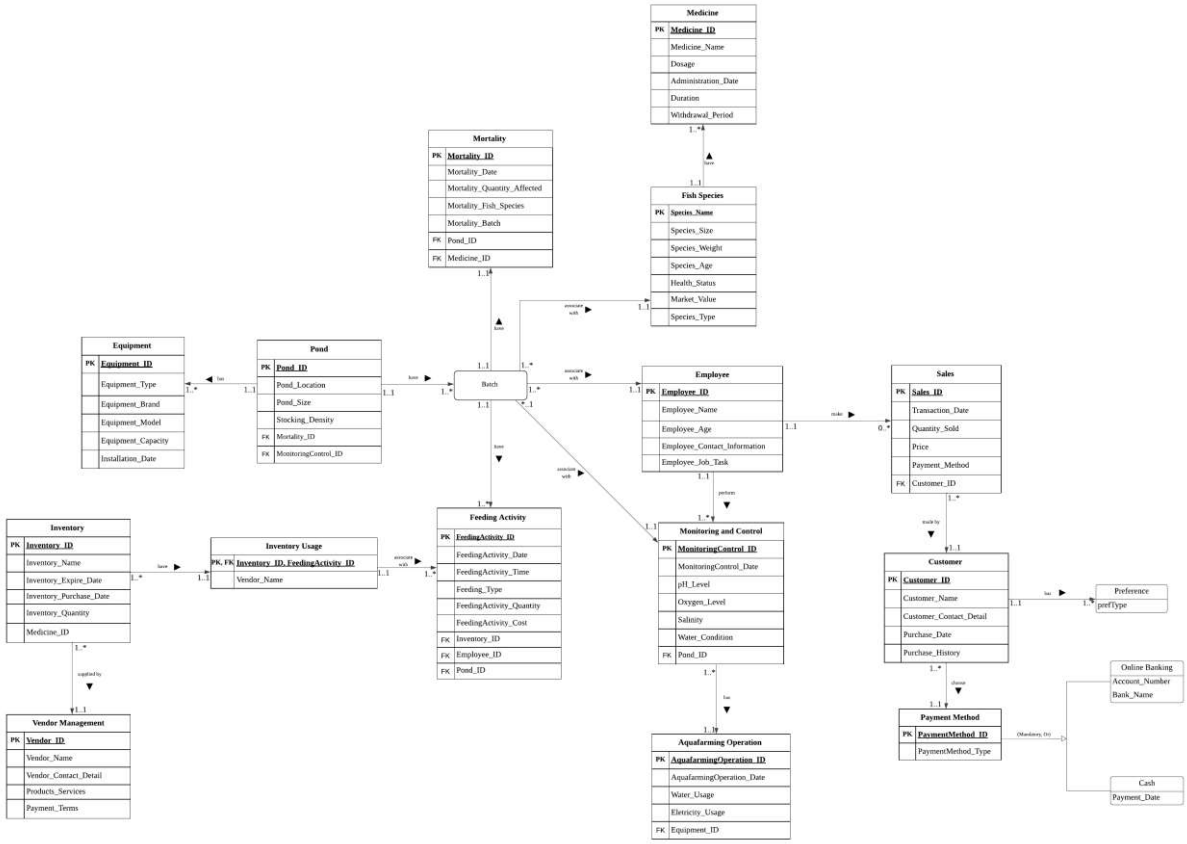
UNDERLINE = Primary Key

**ITALIC* = Foreign Key

Equipment(Equipment_ID, Equipment_Type, Equipment_Brand, Equipment_Model, Equipment_Capacity, Equipment_Date) **Primary Key** Equipment_ID
Pond(Pond_ID, Pond_Location, Pond_Size, Stocking_Density, *MonitoringControl_ID, Mortality_ID*) **Primary Key** Pond_ID **Foreign Key** *MonitoringControl_ID* REFERENCES Monitoring and Control(MonitoringControl_ID*)* **Foreign Key** *Mortality_ID* REFERENCES Mortality(Mortality_ID)
Inventory(Inventory_ID, Inventory_Name, Inventory_Expire_Date, Inventory_Purchase_Sate, Inventory_Quantity, *Medicine_ID*) **Primary Key** Inventory_ID **Foreign Key** *Medicine_ID* REFERENCES Medicine(Medicine_ID)
Vendor Management(Vendor_ID, Vendor_Name, Vendor_Contact_Detail, Product_Services, Payment_Terms) **Primary Key** Vendor_ID
Feeding Activity(FeedingActivity_ID, FeedingActicity_Date, FeedingActivity_Time, Feed_Type, FeedingActivity_Quantity, FeedingActivity_Cost, *Inventory_ID, Employee_ID, Pond_ID*) Primary key FeedingActivity_ID **Foreign Key** *Inventory_ID* REFERENCES Inventory(Inventory_ID) **Foreign Key** *Employee_ID* REFERENCES Employee(Employee_ID) **Foreign Key** *Pond_ID* REFERENCES Pond(Pond_ID)
Medicine(Medicine_ID, Medicine_Name, Dosage, Administration_Date, Duration, Withdrawal_Period) **Primary Key** Medicine_ID
Fish Species(Species_Name, Species_Size, Species_Age, Species_Weight, Health_Status, Market_Value, Species_Type) **Primary Key** Species_Name

Employee(Employee_ID, Employee_Name, Employee_Age, Employee_Contact_Information, Employee_Job_Task) **Primary Key** Employee_ID
Monitoring and Control(MonitoringControl_ID, MonitoringControl_Date, pH_Level, Oxygen_Level, Salinity, Water_Condition, *Pond_ID*) **Primary Key** MonitoringControl_ID **Foreign Key** *Pond_ID* REFERENCES Pond(Pond_ID)
Aquafarming Operation(AquafarmingOperation_ID, AquafarmingOperation_Date, Water_Usage, Electricity_Usage, *Equipment_ID*) **Primary Key** AquafarmingOperation_ID **Foreign Key** *Equipment_ID* REFERENCES Equipment(Equipment_ID)
Mortality(Mortality_ID, Mortality_Date, Mortality_Quantity_Affected, Mortality_Fish_Species, Morality_Batch, *Medicine_ID*, *Pond_ID*) **Primary Key** Morality_ID **Foreign Key** *Medicine_ID* REFERENCES Medicine(Medicine_ID) **Foreign Key** *Pond_ID* REFERENCES Pond(Pond_ID)
Payment Method(PaymentMethod_ID, PatmentMethod_Type) **Primary Key** PaymentMethod_ID
Sales(Sales_ID, Transaction_Date, Quantity_Sold, Price, Payment_Method, *Customer_ID*) **Primary Key** Sales_ID **Foreign Key** *Customer_ID* REFERENCES Customer(Customer_ID)
Customer(Customer_ID, Customer_Name, Customer_Contact_Detail, Purchase_Date, Purchase_History) **Primary Key** Customer_ID
Inventory Usage(*FeedingActivity_ID, Inventory_ID*, Quantity_Used) Primary Key (FeedingActivity_ID, Inventory_ID) Foreign Key *FeedingActivity_ID REFERENCES* Feeding Activity(FeedingActivity_ID) Foreign Key *Inventory_ID REFERENCES* Inventory(Inventory_ID)

2.7 Logical ER Diagram



2.8 Data Dictionary

Table Name: Employee

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
Employee_ID	Unique identification for all employees of HIT Sdn Bhd	VARCHAR2	5	Yes	-	-
Employee_Name	Employee's full name	VARCHAR2	30	-	-	-
Employee_Age	Employee's age	NUMBER	3	-	-	-
Employee_Contact_Information	Employee's phone number	NUMBER	15	-	-	-
Employee_Job_Task	Identify employee's job task	VARCHAR2	50	-	-	-

Table Name: Pond

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
Pond_ID	Unique identification for all ponds	NUMBER	5	Yes	-	-
Pond_Size	Size of the pond	VARCHAR2	50	-	-	-
Pond_Location	Location of the pond	VARCHAR2	100	-	-	-
Stocking_Density	Identify the stocking density	VARCHAR2	100	-	-	-
Mortality_ID	Identifier for mortality event	NUMBER	5	-	Yes	Mortality
MonitoringControl_ID	Identifier for monitoring and control	NUMBER	5	-	Yes	Monitoring and Control

Table Name: Mortality

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
Mortality_ID	Unique identification for mortality events	NUMBER	5	Yes	-	-
Mortality_Date	Date of mortality event	DATE	-	-	-	-
Mortality_Quantity_Affected	Identify the quantity of fish that affected	NUMBER	100	-	-	-
Mortality_Fish_Species	Species affected by mortality event	VARCHAR2	50	-	-	-
Mortality_Batch	Batch affected by mortality event	NUMBER	100	-	-	-
Pond_ID	Identifier for pond	NUMBER	5	-	Yes	Pond
Medicine_ID	Identifier for medicine administered	NUMBER	5	-	Yes	Medicine

Table Name: Feeding Activity

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
FeedingActivity_ID	Unique identification for feeding activities	NUMBER	6	Yes	-	-
FeedingActivity_Date	Identify the feeding activities date	DATE	-	-	-	-
FeedingActivity_Time	Identify the feeding activities time	TIME	-	-	-	-
Feeding_Type	Identify the feed type for the fish	VARCHAR2	30	-	-	-
FeedingActivity_Quantity	Identify the feeding activities quantity	NUMBER	5	-	-	-
FeedingActivity_Cost	Identify the feeding activities quantity	DECIMAL	10, 2	-	-	-
Inventory_ID	Identifier for inventory used	NUMBER	5	-	Yes	Inventory
Employee_ID	Identifier for employee responsible	NUMBER	5	-	Yes	Employee
Pond_ID	Identifier for pond where feeding occurred	NUMBER	5	-	Yes	Pond

Table Name: Inventory

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
Inventory_ID	Unique identifier for inventory items	NUMBER	5	Yes	-	-
Inventory_Name	Identify what are the inventory products name	VARCHAR2	100	-	-	-
Inventory_Expire_Date	Able to check the products expire date	DATE	-	-	-	-
Inventory_Purchase_Date	Able to check the products purchase date	DATE	-	-	-	-
Inventory_Quantity	Quantity of the inventory item	NUMBER	100	-	-	-
Medicine_ID	Identifier for medicine	NUMBER	5	-	Yes	Medicine

Table Name: Vendor Management

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
Vendor_ID	Unique identifier for vendors	NUMBER	6	Yes	-	-
Vendor_Name	Name of the vendor	VARCHAR2	30	-	-	-
Vendor_Contact_Detail	Vendor's contact number	NUMBER	15	-	-	-
Products_Services	Products or services offered by the vendors	VARCHAR2	100	-	-	-
Payment_Terms	Check the payment terms	VARCHAR2	100	-	-	-

Table Name: Medicine

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
Medicine_ID	Unique identifier for medicines	NUMBER	5	Yes	-	-
Medicine_Name	Name of the medicine	VARCHAR2	100	-	-	-
Dosage	Identify how many dosages has been taken for each pond	DECIMAL	5, 2	-	-	-
Administration_Date	Date of medicine administration	DATE	-	-	-	-
Duration	Identify the duration of withdrawal period	VARCHAR2	5	-	-	-
Withdrawal_Period	Duration of time after medication administration	NUMBER	10	-	-	-

Table Name: Fish Species

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
Species_Name	Name of the fish species	VARCHAR2	30	Yes	-	-
Species_Size	Size of the fish species	NUMBER	10	-	-	-
Species_Weight	Weight of the fish species	DECIMAL	10, 2	-	-	-
Species_Age	Age of the fish species	NUMBER	10	-	-	-
Species_Type	Type of the fish species	VARCHAR2	30	-	-	-
Health_Status	Health status of the fish species	VARCHAR2	30	-	-	-
Market_Value	Record the fish species market value	DECIMAL	20, 2	-	-	-

Table Name: Equipment

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
Equipment_ID	Unique identifier of all equipment	NUMBER	5	Yes	-	-
Equipment_Type	Identify the equipment type	VARCHAR2	30	-	-	-
Equipment_Brand	Identify the equipment brand	VARCHAR2	30	-	-	-
Equipment_Model	Identify the equipment model	VARCHAR2	30	-	-	-
Equipment_Capacity	Identify the equipment capacity	NUMBER	100	-	-	-
Equipment_Date	Identify the equipment date	DATE	-	-	-	-

Table Name: Monitoring and Control

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
MonitoringControl_ID	Unique identification for monitoring and control	NUMBER	5	Yes	-	-
MonitoringControl_Date	Date of monitoring and control	DATE	-	-	-	-
pH_Level	Identify the pH level of each pond	DECIMAL	10, 2	-	-	-
Oxygen_Level	Identify the pH Identify the salinity of each pond of each pond	DECIMAL	10, 2	-	-	-
Salinity	Identify the salinity of each pond	DECIMAL	10, 2	-	-	-
Water_Condition	Identify each pond's water condition	VARCHAR2	100	-	-	-
Pond_ID	Identifier of pond	NUMBER	5	-	Yes	Pond

Table Name: Aquafarming Operation

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
AquafarmingOperation_ID	Unique identification for aquafarming operation	NUMBER	5	Yes	-	-
AquafarmingOperation_Date	Date of aquafarming operation	DATE	-	-	-	-
Water_Usage	Identify the water usage for each pond	DECIMAL	10, 2	-	-	-
Electricity_Usage	Identify the electricity usage for each pond	DECIMAL	10, 2	-	-	-
Equipment_ID	Identifier of equipment used	NUMBER	5	-	Yes	Equipment

Table Name: Payment Method

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
PaymentMethod_ID	Unique identifier of patment method	NUMBER	5	Yes	-	-
PaymentMethod_Type	Employee's full Identify the payment method type	VARCHAR2	100	-	-	-

Table Name: Sales

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
Sales_ID	Unique identification for sales	NUMBER	5	Yes	-	-
Transaction_Date	Identify the transaction date	DATE	-	-	-	-
Quantity_Sold	Identify the quantity of fish sold	NUMBER	100	-	-	-
Price	Employee's Identify the price of the fish number	DECIMAL	10, 2	-	-	-
Payment_Method	Identify the customer payment method	VARCHAR2	100	-	-	-
Customer_ID	Identifier for customer who made the purchase	NUMBER	5	-	Yes	Pond

Table Name: Customer

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
Customer_ID	Unique identifier for customers	NUMBER	5	Yes	-	-
Customer_Name	Customer's name	VARCHAR2	30	-	-	-
Customer_Contact_Detail	Customer's contact number	NUMBER	15	-	-	-
Purchase_Date	Identify the customer purchase date	DATE	-	-	-	-
Purchase_History	Identify the customer purchase history include the fish quantity	VARCHAR2	100	-	-	-

Table Name: Inventory Usage

Column Name	Description	Data Type	Size	Primary Key?	Foreign Key?	FK Referenced Table
FeedingActicity_ID	Unique identification of feeding activity	NUMBER	6	Yes	Yes	Feeding Activity
Inventory_ID	Unique identification of inventory item	NUMBER	5	Yes	Yes	Inventory
Quantity_Used	Quantity of inventory item used	NUMBER	100	-	-	-