

Relational Model

Customer (CustomerID, FirstName, LastName, Street, City, Postcode, PhoneNo, CustomerStatus)

PRIMARY KEY CustomerID

DriverStaff (StaffID, FirstName, LastName, Street,City, Postcode, TaxFileNo, BankCode, BankName, AccNo, PaymentRate, StaffStatus, Description, LicenceNo)

PRIMARY KEY StaffID

ALTERNATE KEY TaxFileNo, LicenceNo

InStoreStaff (StaffID, FirstName, LastName, Street,City, Postcode, TaxFileNo, BankCode, BankName, AccNo, PaymentRate, StaffStatus, Description)

PRIMARY KEY StaffID

ALTERNATE KEY TaxFileNo

Orders (OrderNo, CustomerID, StaffID, OrderDateTime, OrderTaken, OrderType, TotalAmount, PaymentMethod, PaymentApprovalNo, Status)

PRIMARY KEY OrderNo

ALTERNATE KEY PaymentApprovalNo

FOREIGN KEY CustomerID REFERENCES Customer (CustomerID) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY StaffID REFERENCES InStoreStaff (StaffID) ON UPDATE CASCADE ON DELETE NO ACTION

WalkInOrder (OrderNo, WalkInTime)

PRIMARY KEY OrderNo

FOREIGN KEY OrderNo REFERENCES Order (OrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

PhoneOrder (OrderNo, PhoneStarted, PhoneEnded)

PRIMARY KEY OrderNo

FOREIGN KEY OrderNo REFERENCES Order (OrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

MenuItem (ItemCode, ItemName, ItemSize, Description, ItemPrice)

PRIMARY KEY ItemCode

QMenuOrder (OrderNo, ItemCode, Quantity)

PRIMARY KEY OrderNo, ItemCode

FOREIGN KEY OrderNo REFERENCES Order (OrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY ItemCode REFERENCES MenuItem (ItemCode) ON UPDATE CASCADE ON DELETE NO ACTION

Ingredient (IngCode, IngName, IngSize, IngType, Description, StockLevel, StockTakeDate, SuggestedStockLevel, ReorderLevel)

PRIMARY KEY IngCode

QMenuIngredient (ItemCode, IngCode, Quantity)

PRIMARY KEY ItemCode, IngCode

FOREIGN KEY ItemCode REFERENCES MenuItem (ItemCode) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY IngCode REFERENCES Ingredient (IngCode) ON UPDATE CASCADE ON DELETE NO ACTION

IngredientOrder (IngOrderNo, IngOrderDate, ReceivedDate, TotalAmount, Status, Description)

PRIMARY KEY IngOrderNo

QIngredientHas2Order (IngCode, IngOrderNo, Price, Quantity)

PRIMARY KEY IngCode, IngOrderNo

FOREIGN KEY IngCode REFERENCES Ingredient (IngCode) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY IngOrderNo REFERENCES IngredientOrder (IngOrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

DriverShift (ShiftID, StaffID, SalaryID, StartDateTime, EndDateTime, ShiftType)

PRIMARY KEY ShiftID

FOREIGN KEY StaffID REFERENCES DriverStaff (StaffID) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY SalaryID REFERENCES DriverPay (SalaryID) ON UPDATE CASCADE ON DELETE NO ACTION

InStoreShift (ShiftID, StaffID, SalaryID, StartDateTime, EndDateTime, ShiftType)

PRIMARY KEY ShiftID

FOREIGN KEY StaffID REFERENCES InStoreStaff (StaffID) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY SalaryID REFERENCES InStorePay (SalaryID) ON UPDATE CASCADE ON DELETE NO ACTION

DriverPay (SalaryID, GrossSalary, TaxWithheld, TotalSalary, SalaryStartDate, SalaryEndDate)

PRIMARY KEY SalaryID

InStorePay (SalaryID, GrossSalary, TaxWithheld, TotalSalary, SalaryStartDate, SalaryEndDate)

PRIMARY KEY SalaryID

Delivery (OrderNo, DeliveryTime, ShiftID)

PRIMARY KEY OrderNo

FOREIGN KEY OrderNo REFERENCES PhoneOrder (OrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY ShiftID REFERENCES DriverShift (ShiftID) ON UPDATE CASCADE ON DELETE NO ACTION

Pickup (OrderNo, PickupTime)

PRIMARY KEY OrderNo

FOREIGN KEY OrderNo REFERENCES PhoneOrder (OrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

BCNF Normalization Process

Customer (CustomerID, FirstName, LastName, Street, City, Postcode, PhoneNo, CustomerStatus, PreviousOrder)

PRIMARY KEY CustomerID

- Customer is not in normalized form due to multi-valued attributes for PhoneNo.
- To get it into 1st Normal Form (1NF), need to decompose PhoneNo and PreviousOrder under separate tables
 - **Customer** (CustomerID, FirstName, LastName, Street, City, Postcode, CustomerStatus)
PRIMARY KEY CustomerID
 - **CPhone** (PhoneNo, CustomerID)
PRIMARY KEY PhoneNo
FOREIGN KEY CustomerID REFERENCES Customer (CustomerID) ON UPDATE CASCADE ON DELETE CASCADE
- The tables now are already in Boyce-Codd Normal Form (BCNF) since there is no partial dependencies and transitive dependencies, and every determinant is a candidate key.

DriverStaff

- StaffID → (FirstName, LastName, Street, City, Postcode, TaxFileNo, BankCode, BankName, AccNo, PaymentRate, StaffStatus, Description, LicenceNo)
- BankCode → BankName [Transitive Dependency]
- DriverStaff is in 2nd Normal Form (2NF) but not in 3rd Normal Form (3NF) because of transitive dependency.
- Decompose into two tables based on the dependencies.
 - **DriverStaff** (StaffID, FirstName, LastName, Street, City, Postcode, TaxFileNo, AccNo, StaffStatus, Description, LicenceNo)
 - **Bank Details** (BankCode, BankName)
PRIMARY KEY AccNo
- The tables now are already in Boyce-Codd Normal Form (BCNF) since there is no partial dependencies and transitive dependencies, and every determinant is a candidate key.

InStoreStaff

- Normalization process is similar to DriverStaff.
 - **InStoreStaff** (StaffID, FirstName, LastName, Street, City, Postcode, TaxFileNo, BankCode, AccNo, PaymentRate, StaffStatus, Description)
 - **Bank Details** (BankCode, BankName)
PRIMARY KEY AccNo
- The tables now are already in Boyce-Codd Normal Form (BCNF) since there is no partial dependencies and transitive dependencies, and every determinant is a candidate key.

Order (OrderNo, OrderDateTime, OrderTaken, OrderType, TotalAmount, PaymentMethod, PaymentApprovalNo, Status)

PRIMARY KEY OrderNo

- OrderNo → OrderDateTime, OrderTaken, OrderType, TotalAmount, PaymentMethod, PaymentApprovalNo, Status
- PaymentApprovalNo → PaymentMethod, TotalAmount [Transitive Dependency]
- Order is in 2NF but not in 3NF because of transitive dependency.
- Therefore, Normalization Process:
 - **Orders** (OrderNo, OrderDateTime, OrderTaken, OrderType, PaymentApprovalNo, Status)
PRIMARY KEY OrderNo
FOREIGN KEY PaymentApprovalNo references OrderPayRecord (PaymentApprovalNo) ON UPDATE CASCADE ON DELETE CASCADE
 - **OrderPayment** (PaymentApprovalNo, PaymentMethod, TotalAmount)
PRIMARY KEY PaymentApprovalNo
- The tables now are already in Boyce-Codd Normal Form (BCNF) since there is no partial dependencies and transitive dependencies, and every determinant is a candidate key.

The following tables are already in BCNF Form:

- **WalkInOrder** (OrderNo, WalkInTime)
- **PhoneOrder** (OrderNo, PhoneStarted, PhoneEnded)
- **Delivery** (OrderNo, DeliveryTime, ShiftID)
- **Pickup** (OrderNo, PickupTime)
- **MenuItem** (ItemCode, ItemName, ItemSize, Description, ItemPrice)
- **QMenuOrder** (OrderNo, ItemCode, Quantity)
- **QMenuIngredient** (ItemCode, IngCode, Quantity)
- **Ingredient** (IngCode, IngName, IngSize, IngType, Description, StockLevel, StockTakeDate, SuggestedStockLevel, ReorderLevel)
- **IngredientOrder** (IngOrderNo, IngOrderDate, ReceivedDate, TotalAmount, Status)
- **QIngredientHas2Order** (IngCode, IngOrderNo, Price, Quantity)
- **DriverShift** (ShiftID, StartDateTime, EndDateTime, ShiftType)
- **InStoreShift** (ShiftID, StartDateTime, EndDateTime, ShiftType)
- **DriverPay** (SalaryID, GrossSalary, TaxWithheld, TotalSalary, SalaryStartDate, SalaryEndDate)
- **InStorePay** (SalaryID, GrossSalary, TaxWithheld, TotalSalary, SalaryStartDate, SalaryEndDate)

Final Normalized Relational Schema

Customer (CustomerID, FirstName, LastName, Street, City, Postcode, CustomerStatus)

PRIMARY KEY CustomerID

CPhone (PhoneNo, CustomerID)

PRIMARY KEY PhoneNo

FOREIGN KEY CustomerID REFERENCES Customer (CustomerID) ON UPDATE CASCADE ON DELETE CASCADE

BankDetails (BankCode, BankName)

PRIMARY KEY BankCode

DriverStaff (StaffID, FirstName, LastName, Street, City, Postcode, TaxFileNo, BankCode, AccNo, StaffStatus, PaymentRate, Description, LicenceNo)

PRIMARY KEY StaffID

ALTERNATE KEY TaxFileNo, LicenceNo

FOREIGN KEY BankCode references BankDetails (BankCode) ON UPDATE CASCADE ON DELETE CASCADE

InStoreStaff (StaffID, FirstName, LastName, Street, City, Postcode, TaxFileNo, BankCode, AccNo, StaffStatus, PaymentRate, Description)

PRIMARY KEY StaffID

ALTERNATE KEY TaxFileNo

FOREIGN KEY BankCode references BankDetails (BankCode) ON UPDATE CASCADE ON DELETE CASCADE

OrderPayment (PaymentApprovalNo, PaymentMethod, TotalAmount)

PRIMARY KEY PaymentApprovalNo

Orders (OrderNo, CustomerID, StaffID, OrderDateTime, OrderTaken, OrderType, PaymentApprovalNo, Status)

PRIMARY KEY OrderNo

FOREIGN KEY CustomerID references Customer (CustomerID) ON UPDATE CASCADE ON DELETE CASCADE

FOREIGN KEY StaffID references Staff(StaffID) ON UPDATE CASCADE ON DELETE CASCADE

FOREIGN KEY PaymentApprovalNo references OrderPayRecord (PaymentApprovalNo) ON UPDATE CASCADE ON DELETE CASCADE

WalkInOrder (OrderNo, WalkInTime)

PRIMARY KEY OrderNo

FOREIGN KEY OrderNo REFERENCES Order (OrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

PhoneOrder (OrderNo, PhoneStarted, PhoneEnded)

PRIMARY KEY OrderNo

FOREIGN KEY OrderNo REFERENCES Order (OrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

DriverPay (SalaryID, StaffID, GrossSalary, TaxWithheld, TotalSalary, SalaryStartDate, SalaryEndDate)

PRIMARY KEY SalaryID

InStorePay (SalaryID, StaffID, GrossSalary, TaxWithheld, TotalSalary, SalaryStartDate, SalaryEndDate)

PRIMARY KEY SalaryID

DriverShift (ShiftID, StartDate, StartTime, EndDate, EndTime, ShiftType)

PRIMARY KEY ShiftID

FOREIGN KEY StaffID REFERENCES DriverStaff (StaffID) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY SalaryID REFERENCES DriverPay (SalaryID) ON UPDATE CASCADE ON DELETE NO ACTION

InStoreShift (ShiftID, StartDate, StartTime, EndDate, EndTime, ShiftType)

PRIMARY KEY ShiftID

FOREIGN KEY StaffID REFERENCES InStoreStaff (StaffID) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY SalaryID REFERENCES InStorePay (SalaryID) ON UPDATE CASCADE ON DELETE NO ACTION

Delivery (OrderNo, DeliveryTime, ShiftID)

PRIMARY KEY OrderNo

FOREIGN KEY OrderNo REFERENCES PhoneOrder (OrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

Pickup (OrderNo, PickupTime)

PRIMARY KEY OrderNo

FOREIGN KEY OrderNo REFERENCES PhoneOrder (OrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

MenuItem (ItemCode, ItemName, ItemSize, Description, ItemPrice)

PRIMARY KEY ItemCode

QMenuOrder (OrderNo, ItemCode, Quantity)

PRIMARY KEY OrderNo, ItemCode

FOREIGN KEY OrderNo REFERENCES Order (OrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY ItemCode REFERENCES MenuItem (ItemCode) ON UPDATE CASCADE ON DELETE NO ACTION

Ingredient (IngCode, IngName, IngSize, IngType, Description, StockLevel, StockTakeDate, SuggestedStockLevel, ReorderLevel)

PRIMARY KEY IngCode

QMenuIngredient (ItemCode, IngCode, Quantity)

PRIMARY KEY ItemCode, IngCode

FOREIGN KEY ItemCode REFERENCES MenuItem (ItemCode) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY IngCode REFERENCES Ingredient (IngCode) ON UPDATE CASCADE ON DELETE NO ACTION

IngredientOrder (IngOrderNo, IngOrderDate, ReceivedDate, TotalAmount, Status)

PRIMARY KEY IngOrderNo

QIngredientHas2Order (IngCode, IngOrderNo, Price, Quantity)

PRIMARY KEY IngCode, IngOrderNo

FOREIGN KEY IngCode REFERENCES Ingredient (IngCode) ON UPDATE CASCADE ON DELETE NO ACTION

FOREIGN KEY IngOrderNo REFERENCES IngredientOrder (IngOrderNo) ON UPDATE CASCADE ON DELETE NO ACTION

