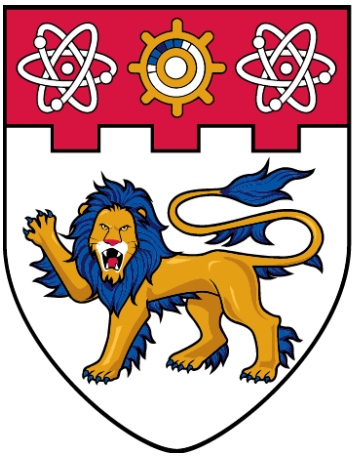


NANYANG TECHNOLOGICAL UNIVERSITY
SINGAPORE

EE4791 Database Systems

Assignment

Database Design and Implementation

Submitted by:

Too Xuanli Marcus	U1921035A	Equal Contributions
Chen ZengYao	U1922473B	
Loh Yan Wen	U1922721K	
Nur Khalisah Binte A Noh	U1922539H	
Tan Jit Hao, Jason	U1921545F	

School of Electrical & Electronic Engineering

25 March 2022

Table of Content

Scenarios for Database

The goal of this project is to create a database management system for a restaurant. The main focus of this project is targeted towards keeping track of the employees and virtualizing the process of serving the customers. Some possible scenarios and the corresponding query include:

1. **Finding employee that was hired before a particular date**

```
SELECT EmpName, HiredDate
FROM Employee
WHERE HiredDate < #insert date#;
```

2. **Retrieve foods that costs under 10 dollars**

```
SELECT FoodID, FoodName, FoodPrice
FROM FOOD
WHERE FoodPrice < 10;
```

3. **Find out how many tables with maximum 4 pax**

```
SELECT TableNo, Pax
FROM TABLES
WHERE Pax = 4;
```

4. **Find all customers who paid in cash**

```
SELECT CustName AS CashCustomers
FROM CUSTOMER c
WHERE EXISTS
(
    SELECT *
    FROM PAYMENT p
    WHERE c.CustID = p.CustID
    AND PaymentType = 'Cash'
);
```

5. **Which waiter earn the most tips**

```
SELECT EmpName, Tips
FROM EMPLOYEE e INNER JOIN WAITER w
ON e.EmpID = w.WaiterID
WHERE Tips = (
    SELECT MAX(Tips) FROM WAITER
);
```

6. **There is a discrepancy in a bill, find the employee accountable for this**

```
SELECT EmpName, p.BillID,  Amount
FROM ((EMPLOYEE AS e
    INNER JOIN PAYMENT AS p
    ON e.EmpID = p.CashierID)
    INNER JOIN BILL AS b
    ON p.BillID = b.BillID)
WHERE p.BillID = <insert bill id>;
```

7. **What is the most popular item on the menu?**

```
SELECT TOP 1 *
FROM (
    SELECT f.FoodID, f.FoodName as name, SUM(o.Qty) AS quantity
    FROM Orders AS o
    INNER JOIN Food AS f
    ON f.FoodID = o.FoodID
    GROUP BY f.FoodID, f.FoodName
    )
```

8. **List customers who ordered food over 30 dollars in total**

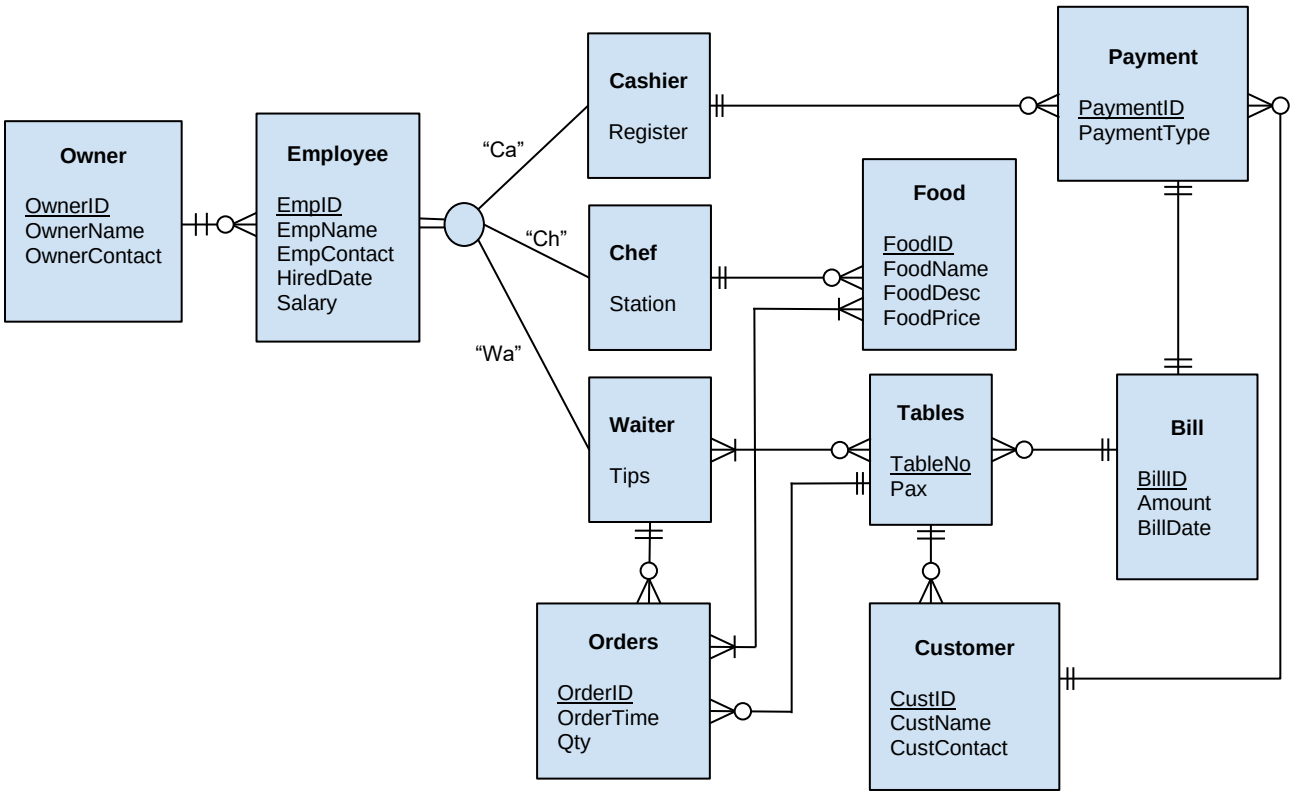
```
SELECT CUSTName
FROM CUSTOMER
WHERE CustID IN
(SELECT CustID
 FROM PAYMENT
 WHERE BillID IN
(SELECT BillID
 FROM BILL
 WHERE Amount > 30));
```

Results will return customer name and the amount they spent

```
SELECT c.CustName, b.Amount
FROM (CUSTOMER AS c INNER JOIN PAYMENT AS p ON c.CustID =
p.CustID) INNER JOIN BILL AS b ON p.BillID = b.BillID
WHERE (((b.Amount)>30));
```

ER Diagram

To specify data we store in the restaurant management database, an entity-relationship (ER) diagram is used to model the data stored in the database. The figure below shows the ER diagram for the restaurant management database.



As shown in the ER diagram, each entity and the corresponding attributes and relationships are being displayed. The key identifier of the attribute is underlined and the various relationships - one-to-one, one-to-many, or a many-to-many relationship, are properly indicated. The employee entity has a disjoint subtype of cashier, chef, and waiter.

The figure below shows the screen capture of the relationships of the entities in Microsoft Access.

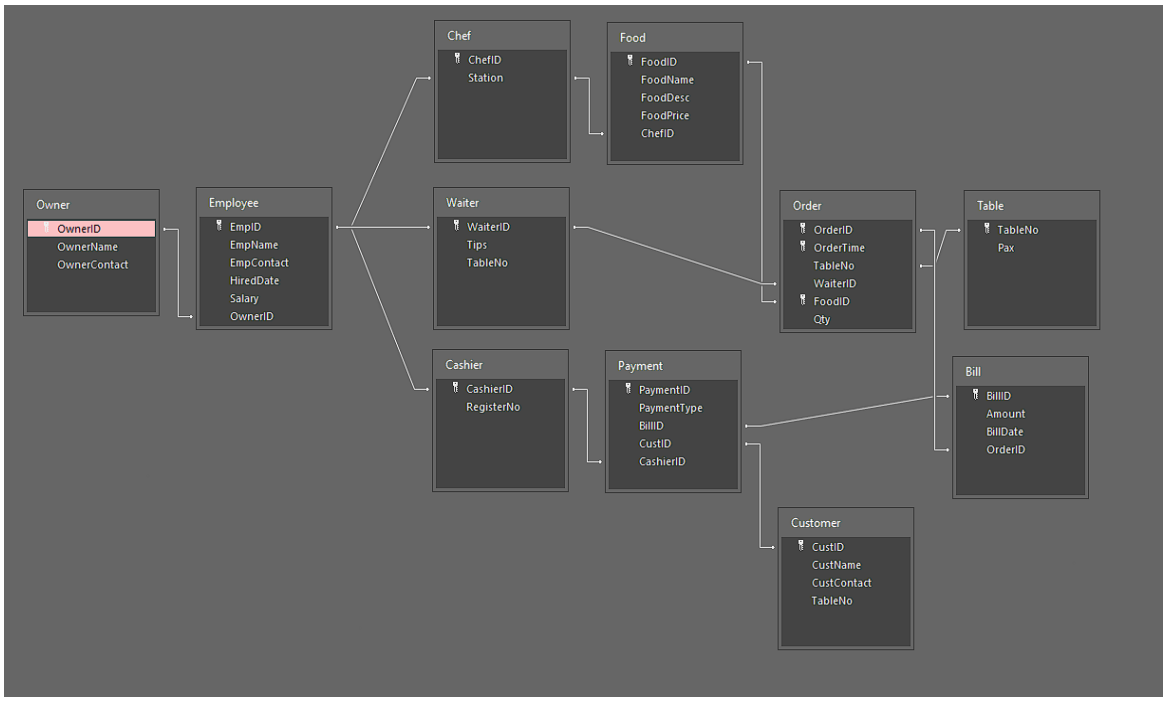


Table Structures(3NF)

With the ER diagram, a third normal form (3NF) relational schema is formed. Each primary key of the relation is underlined while each foreign key of the relation is underlined and italicised.

Restaurant Management System (Database Tables - 3NF)

1. **Owner**(OwnerID, OwnerName, OwnerContact)
2. **Employee**(EmpID, EmpName, EmpContact, HiredDate, Salary, *OwnerID*)
3. **Waiter**(WaiterID, Tips)
4. **Chef**(ChefID, Station)
5. **Cashier**(CashierID, RegisterNo)
6. **Customer**(CustID, CustName, CustContact, *TableNo*)
7. **Tables**(TableNo, Pax, *WaiterID*)
8. **Payment**(PaymentID, PaymentType, *BillID*, *CustID*, *CashierID*)
9. **Bill**(BillID, Amount, BillDate, *OrderID*)
10. **Food**(FoodID, FoodName, FoodDesc, FoodPrice, *ChefID*)
11. **Orders**(OrderID, OrderTime, Qty, *FoodID*, *TableNo*, *WaiterID*)

Screen Captures of Table Designs (Design View & Data)

Owner Table

Owner

Field Name	Data Type
OwnerID	AutoNumber
OwnerName	Short Text
OwnerContact	Number

Owner Table with data

Owner

OwnerID	OwnerName	OwnerContact
1	John Doe	98765432

Employee Table

Employee

Field Name	Data Type
EmpID	AutoNumber
EmpName	Short Text
EmpContact	Number
HiredDate	Date/Time
Salary	Currency
OwnerID	Number

Employee Table with data

Employee

EmpID	EmpName	EmpContact	HiredDate	Salary	OwnerID
1	Marcus Two	98989898	6/26/2021	$2,500.00	1
2	Jason Tang	97979797	11/14/2021	$1,000.00	1
3	Yanni Lee	90909090	4/1/2021	$1,020.00	1
4	Nur Khalisha	93939393	4/1/2021	$1,280.50	1
5	Yeng Zao	91919191	12/25/2021	$2,100.00	1
6	Tek Hao	96969696	3/25/2021	$1,300.00	1
7	Kit Chan	87878787	3/12/2021	$2,100.00	1
8	Horatio Teo	83838380	1/15/2022	$2,500.00	1
9	Jack Neo	82736452	1/12/2022	$2,134.00	1
10	Grant Kim	89347461	1/21/2022	$1,234.00	1

Waiter Table

Waiter

Field Name	Data Type
WaiterID	Number
Tips	Currency
TableNo	Number

Waiter Table with data

Waiter

WaiterID	Tips	TableNo
2	$280.00	1
3	$190.00	2
4	$60.00	3
10	$70.00	4

Chef Table

Chef

Field Name	Data Type
ChefID	Number
Station	Number

Chef Table with data

Chef

ChefID	Station
1	1
8	2
9	3

Cashier Table

Cashier

Field Name	Data Type
CashierID	Number
RegisterNo	Number

Cashier Table with data

Cashier

CashierID	RegisterNo
5	1
6	2
7	3

Customer Table

Customer

Field Name	Data Type
CustID	AutoNumber
CustName	Short Text
CustContact	Number
TableNo	Number

Customer Table with data

Customer

CustID	CustName	CustContact	TableNo
1	Tylor Munro	91969760	1
2	Ricky Brett	89500193	1
3	Emelie Goddard	89394418	1
4	Lacy Betts	89045084	1
5	Abdullahi Zavala	90030117	2
6	Zacharias Forbes	88423661	2
7	Rima Mcnamara	89518490	4
8	Abdur-Rahman Patrick	89517987	4
9	Bertie Nieves	95203816	3
10	Shaquille Logan	90404677	3
11	Luqman Bruce	80349782	3
12	Ayisha Guzman	80208405	2
13	Aimee Searle	92688223	1
14	Gruffydd Castaneda	80516487	1
15	Jamelia Pike	89511519	5
16	Yousif Knott	91175699	5
17	Mahamed Fellows	89510349	6
18	Matteo Dickerson	93354830	6
19	Kaidan Haynes	89157149	7
20	Ella-Louise Valenzuela	80438934	7

Tables Table

Tables

Field Name	Data Type
TableNo	AutoNumber
Pax	Number

Tables Table with data

Tables

TableNo	Pax
1	4
2	2
3	3
4	2
5	2
6	2
7	2

Payment Table

Payment

Field Name	Data Type
PaymentID	AutoNumber
PaymentType	Short Text
BillID	Number
CustID	Number
CashierID	Number

Payment Table with data

Payment

PaymentID	PaymentType	BillID	CashierID	CustID
1	Master	1	5	2
2	Visa	2	5	6
3	Cash	3	7	8
4	Cash	4	7	9
5	Master	5	5	12
6	Master	6	7	14
7	Visa	7	6	15
8	Visa	8	6	17
9	Cash	9	6	20

Bill Table

Bill

Field Name	Data Type
BillID	AutoNumber
Amount	Currency
BillDate	Date/Time
OrderID	Number

Bill Table with data

Bill

BillID	Amount	BillDate	OrderID
1	$60.00	1/1/2022	1
2	$41.00	1/1/2022	2
3	$20.00	1/1/2022	3
4	$40.00	1/1/2022	4
5	$16.00	1/1/2022	5
6	$12.00	1/1/2022	6
7	$41.00	1/2/2022	7
8	$56.00	1/2/2022	8
9	$32.50	1/2/2022	9

Food Table

Food

Field Name	Data Type
FoodID	AutoNumber
FoodName	Short Text
FoodDesc	Long Text
FoodPrice	Currency
ChefID	Number

Food Table with data

Food

FoodID	FoodName	FoodDesc	FoodPrice	ChefID
1	Sirloin Steak	Grilled, succulent Sirloin topped with a dollop of roasted shallot compund butter	$20.00	1
2	Ribeye Steak	Marbled Ribeye, bursting with fresh, grilled flavor	$25.00	1
3	Single Rock Burger	Juicy, Char-Grilled Single Rock Beef Burger	$10.00	8
4	Double Rock Burger	Juicy, Char-Grilled Double Rock Beef Burger	$13.00	8
5	Chicken Chop	Served with grilled potato & beetroot yoghurt slaw	$10.00	1
6	Cheesy Chicken Chop	Grilled Chicken chop topped with melted cheese	$11.00	1
7	Sausage Platter	3 different chicken sausages served with mashed and salad with special spicy mustard	$7.00	1
8	Pilaf Rice	Basmati Rice Pilaf with Dried Fruits and Almonds	$5.00	8
9	Risotto	Italian Arborio rice cooked with grilled mushroom, zucchini, bell peppers and carrots	$6.00	8
10	Seafood Marinara	Seafood Marinara pasta with clams, squid and prawns tossed with tomato and white wine sauce	$13.00	8
11	Carbonara	Rich tangle of pasta with a robust cream sauce of eggs and italian pancetta	$12.00	8
12	Aglio Olio	Spaghetti with slices of fresh chilli, garlic and extra virgin olive oil	$8.00	8
13	Coca Cola	Carbonated, sweetened soft drink	$3.00	9
14	Sprite	Crisp, refreshing and clean tasting	$3.00	9
15	Iced Tea	Light, delicate flavour	$2.50	9
16	Iced Water	Refreshing Cold H2O	$0.50	9

Orders Table

Orders

Field Name	Data Type
OrderID	Number
OrderTime	Date/Time
TableNo	Number
WaiterID	Number
FoodID	Number
Qty	Number

Orders Table with data

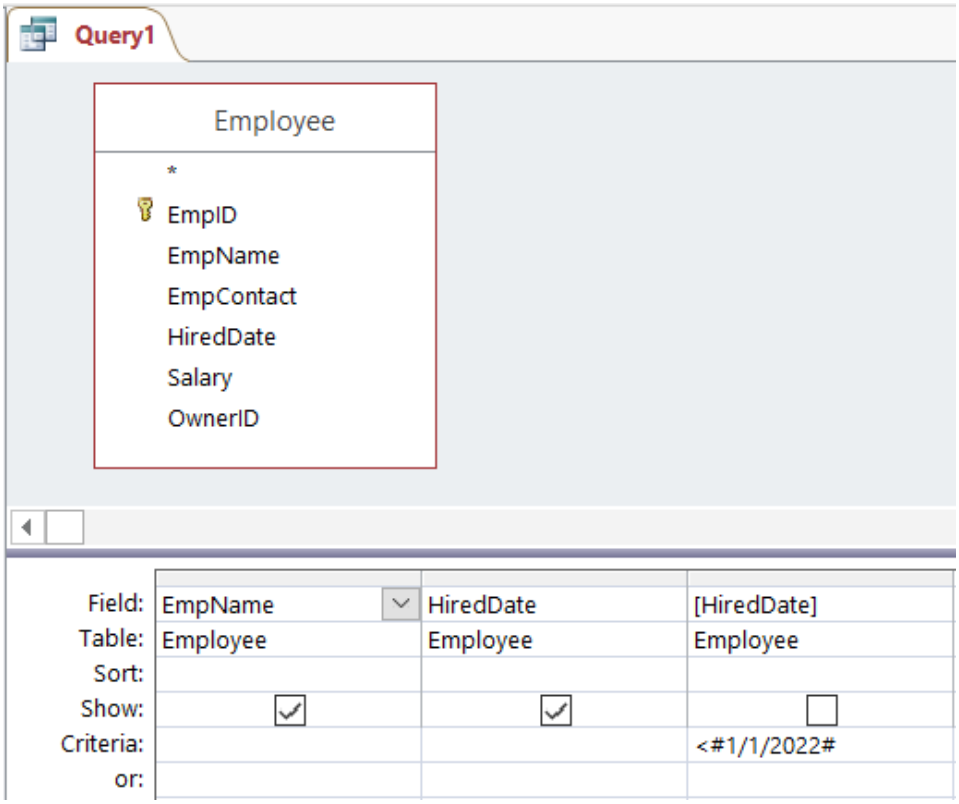
Orders

OrderID	OrderTime	TableNo	WaiterID	FoodID	Qty
1	10:40	1	2	1	1
1	10:40	1	2	2	1
1	10:40	1	2	3	1
1	10:40	1	2	4	1
1	10:41	1	2	13	2
1	10:41	1	2	14	2
2	11:00	2	3	1	2
2	11:00	2	3	16	2
3	12:01	4	2	11	1
3	12:01	4	2	12	1
4	12:01	3	3	1	1
4	12:01	3	3	3	1
4	12:01	3	3	5	1
5	12:03	2	3	4	1
5	12:03	2	3	14	1
6	12:05	1	2	9	2
7	17:03	5	10	1	2
7	17:03	5	10	16	2
8	17:40	6	4	2	2
8	17:40	6	4	13	2
9	18:00	7	10	10	2
9	18:00	7	10	14	2
9	18:20	7	4	16	1

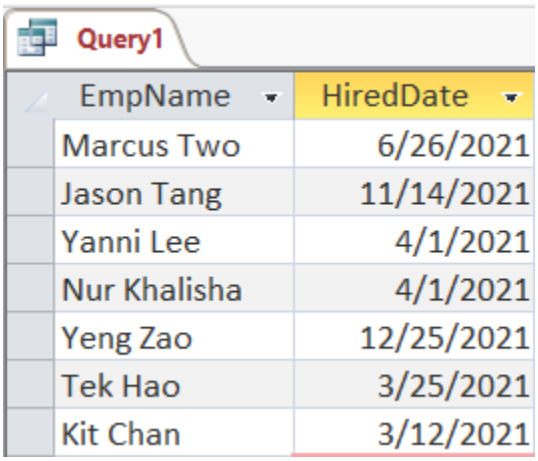
Screen Captures of Queries (Design View & Results)

Scenario 1: Finding employee that was hired before a particular date

Query Design View



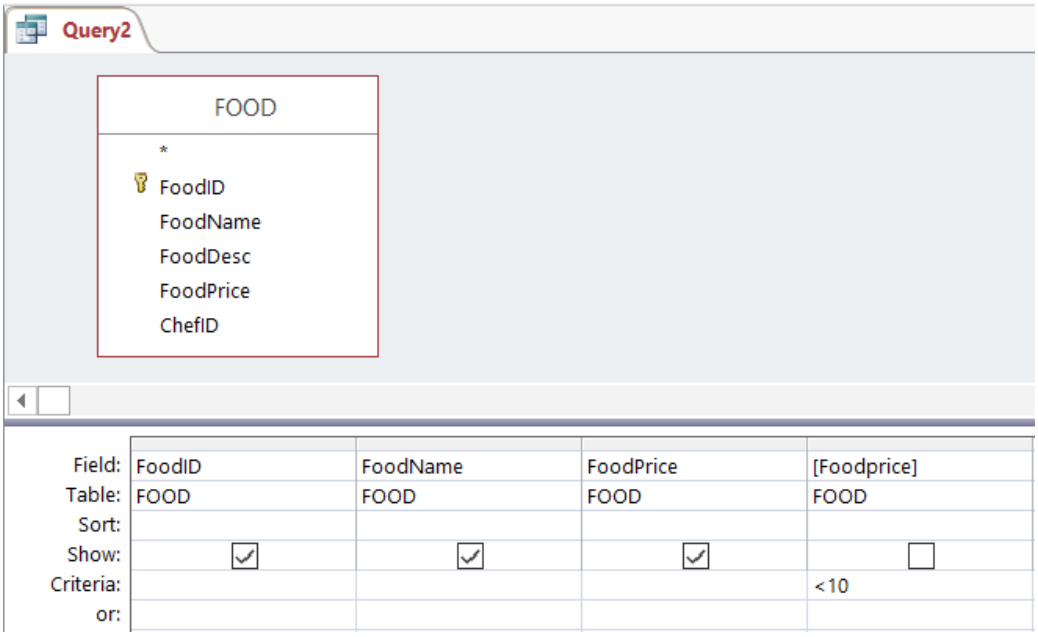
Results:



EmpName	HiredDate
Marcus Two	6/26/2021
Jason Tang	11/14/2021
Yanni Lee	4/1/2021
Nur Khalisha	4/1/2021
Yeng Zao	12/25/2021
Tek Hao	3/25/2021
Kit Chan	3/12/2021

Scenario 2: Retrieve foods that costs under 10 dollars

Query Design View



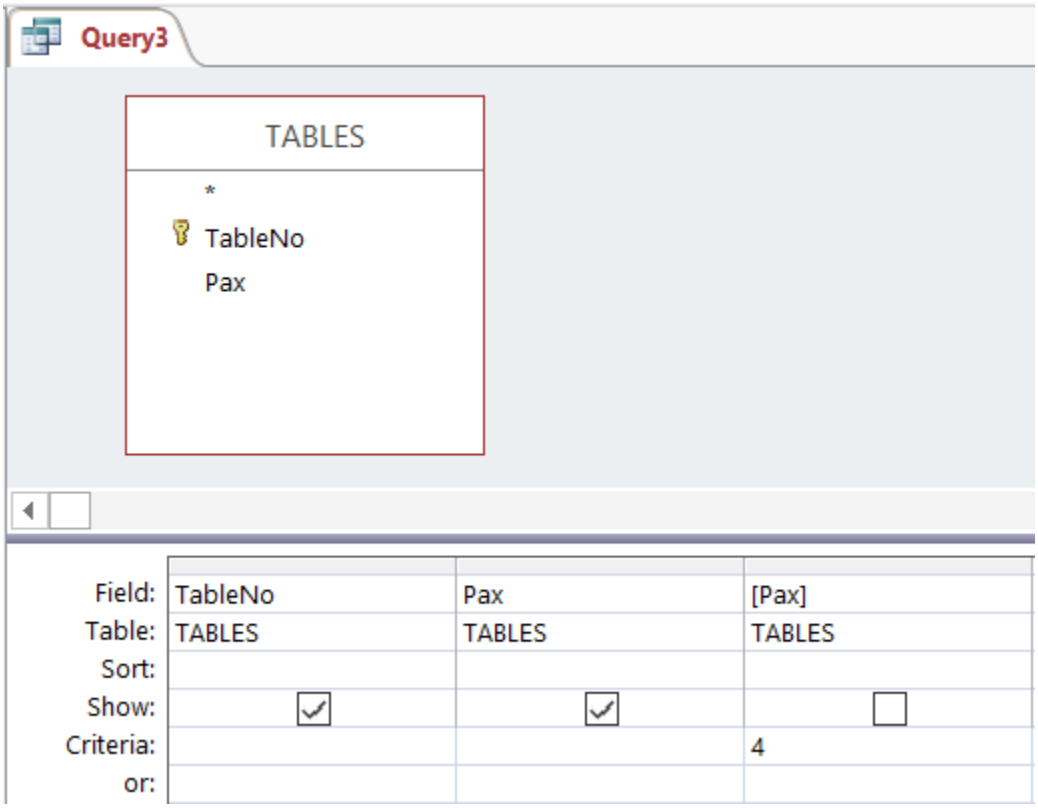
Results:

Query2

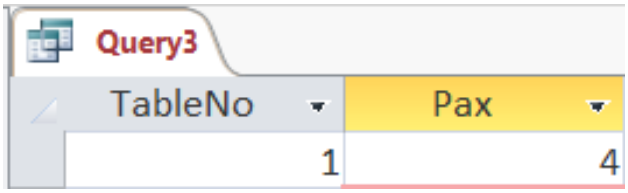
FoodID	FoodName	FoodPrice
7	Sausage Platter	$7.00
8	Pilaf Rice	$5.00
9	Risotto	$6.00
12	Aglio Olio	$8.00
13	Coca Cola	$3.00
14	Sprite	$3.00
15	Iced Tea	$2.50
16	Iced Water	$0.50

Scenario 3: Find out how many tables with maximum 4 pax

Query Design View

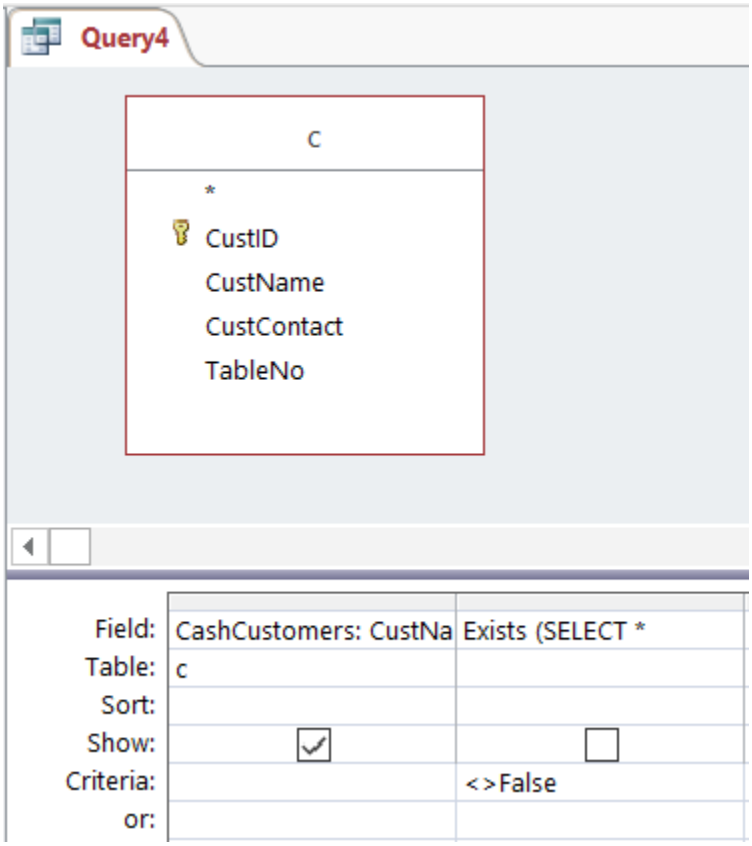


Results:

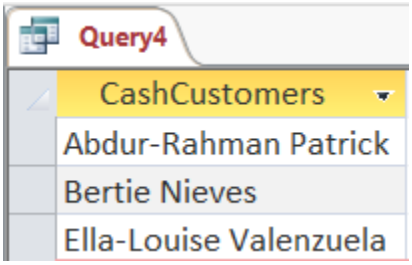


Scenario 4: Find all customers who paid in cash

Query Design View

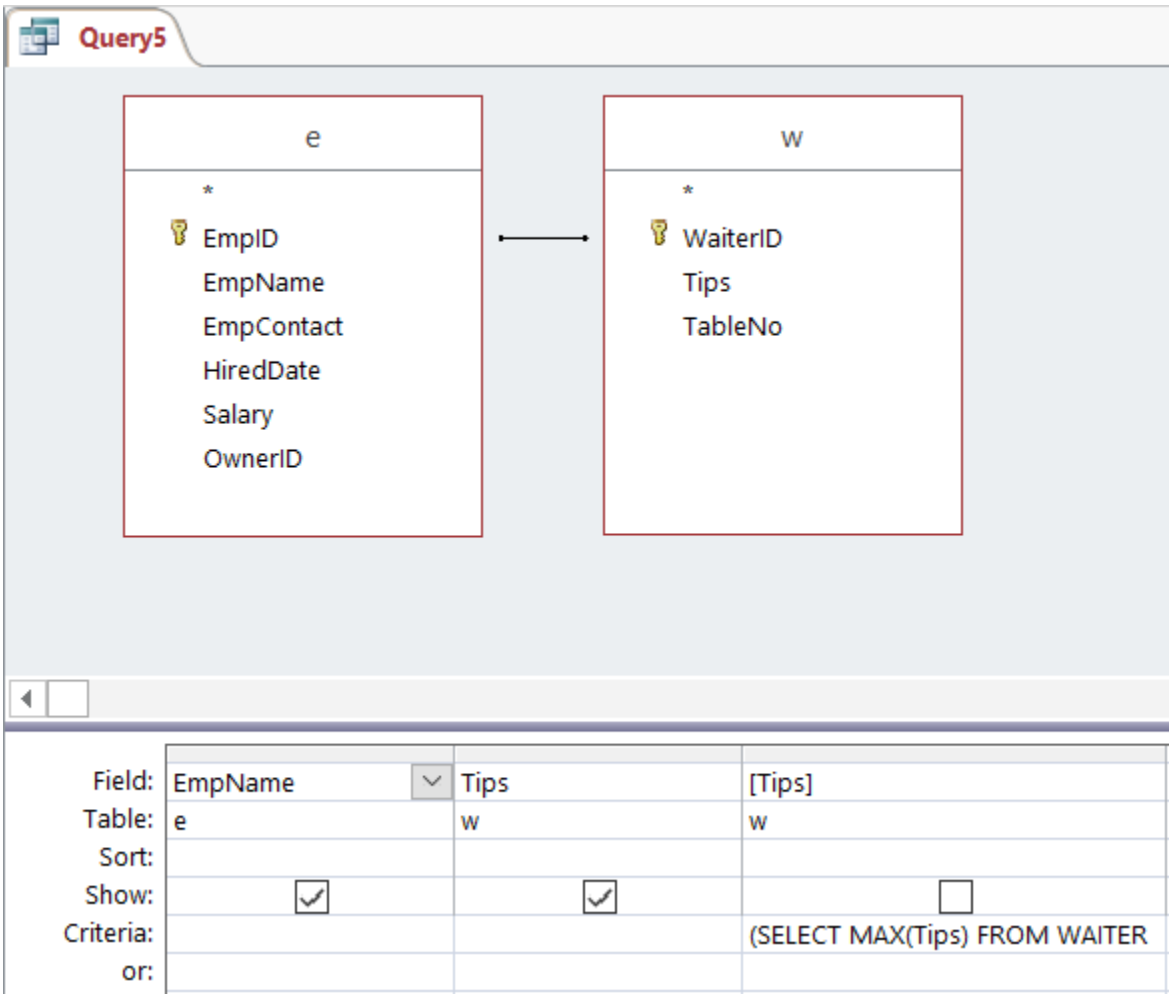


Results:

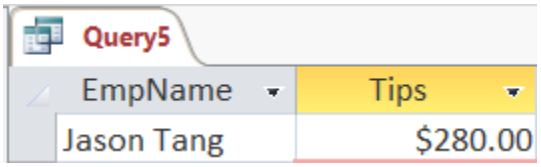


Scenario 5: Which waiter earn the most tips

Query Design View

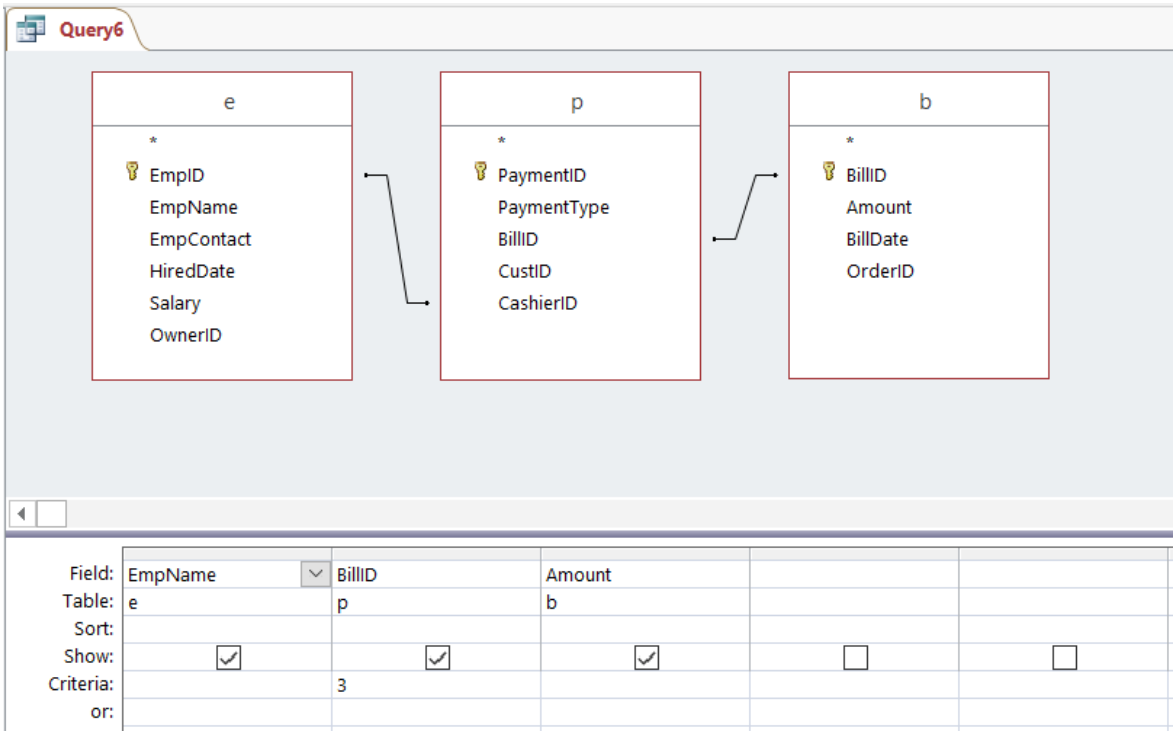


Results:

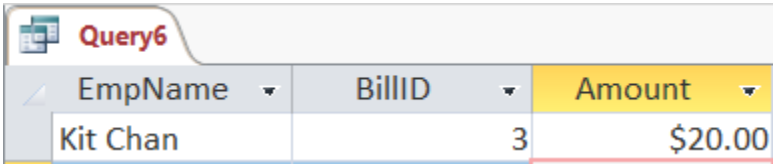


Scenario 6: There is a discrepancy in a bill, find the employee accountable for this

Query Design View

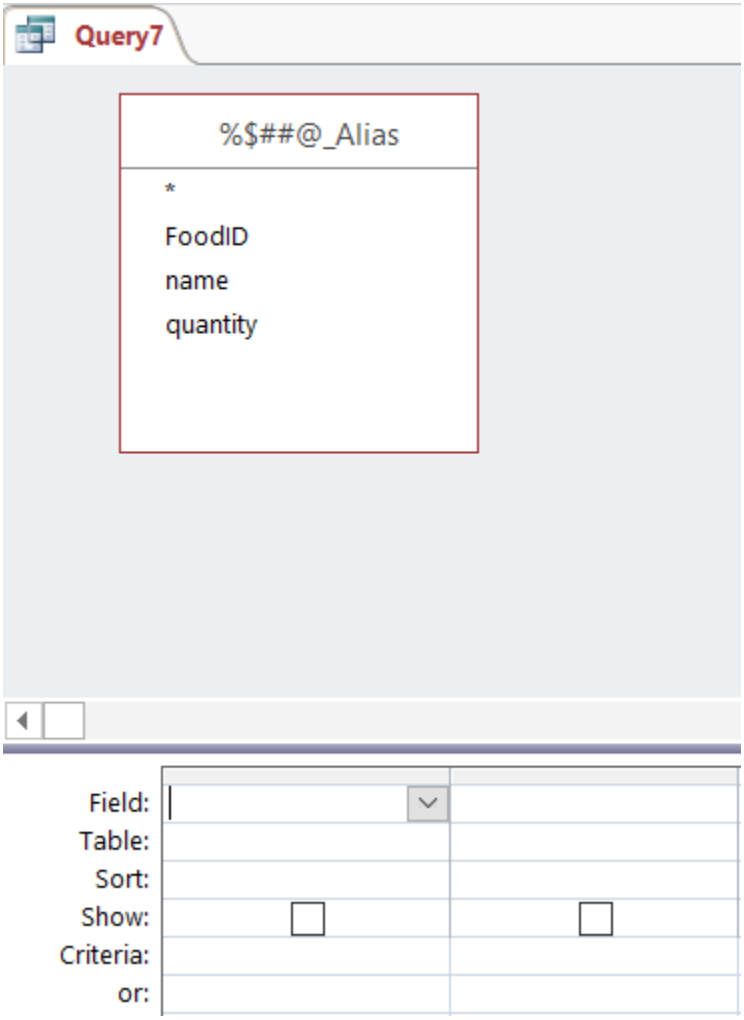


Results:

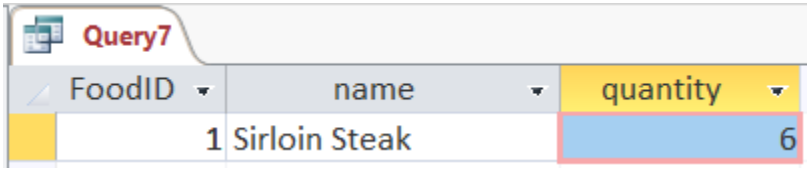


Scenario 7: What is the most popular item on the menu?

Query Design View

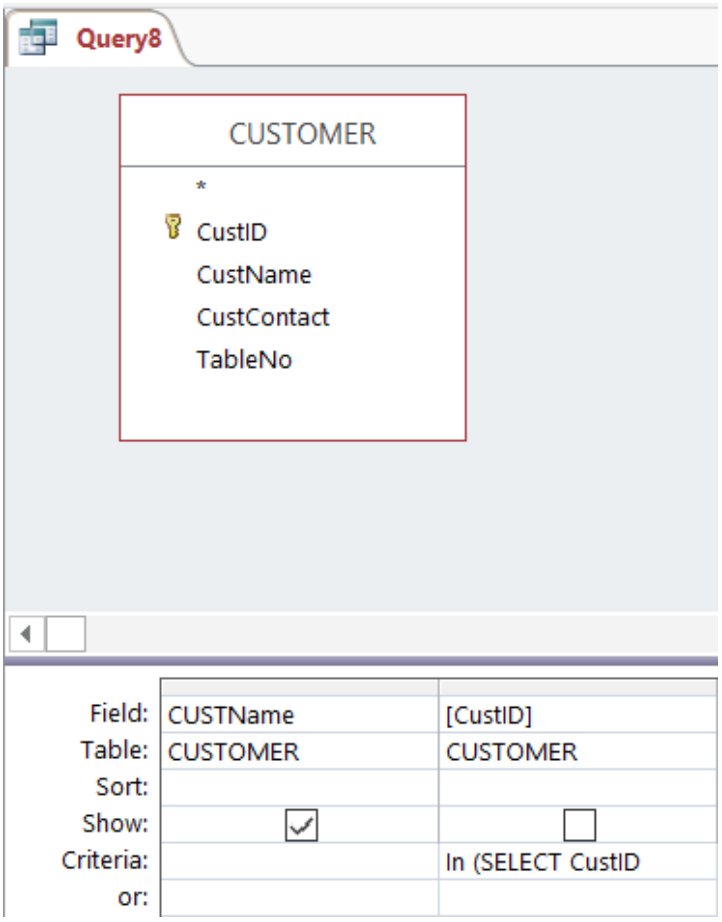


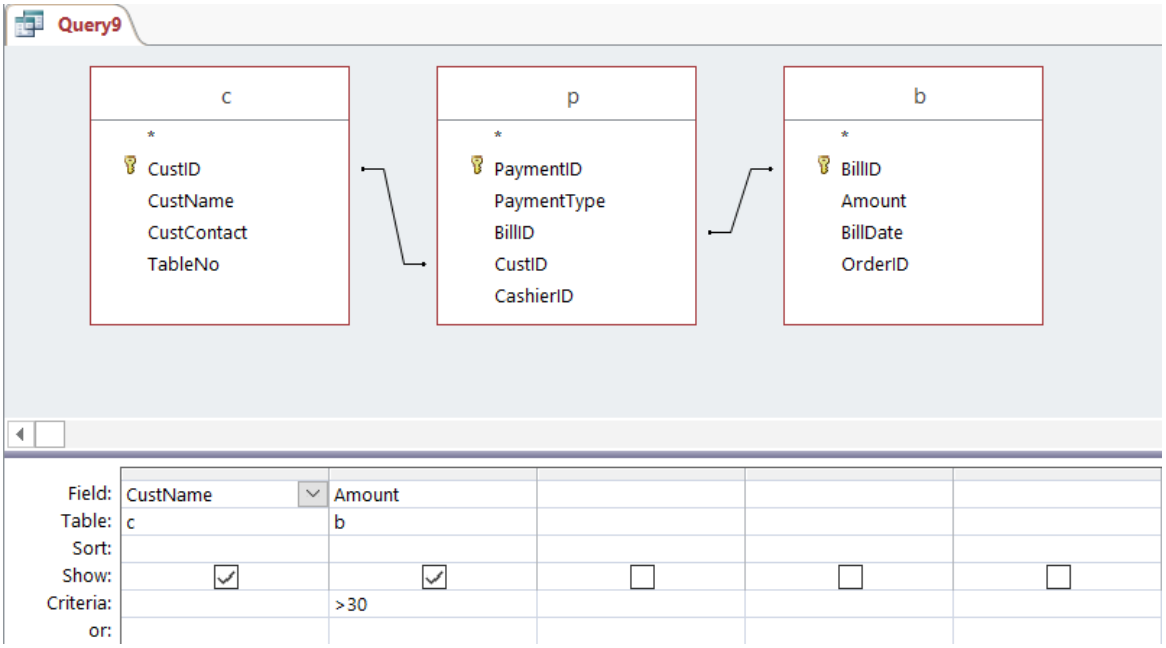
Results:



Scenario 8: List customers who ordered food over 30 dollars in total

Query Design View





Results:

Query8

CUSTName
Ricky Brett
Zacharias Forbes
Bertie Nieves
Jamelia Pike
Mahamed Fellows
Ella-Louise Valenzuela

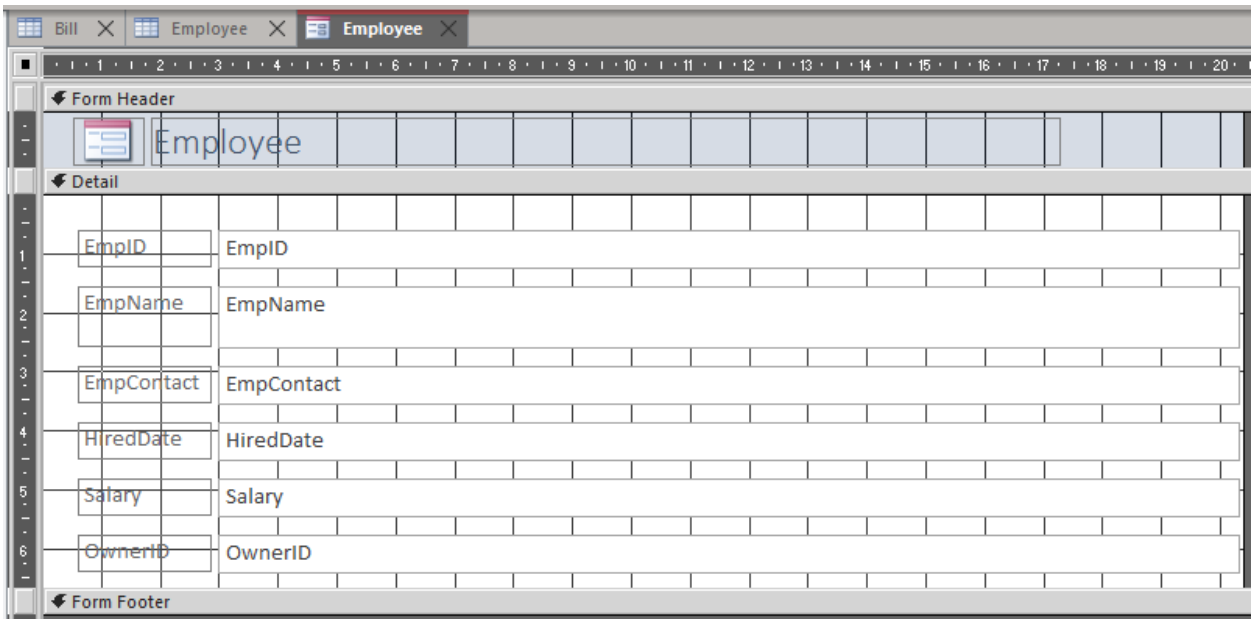
Query9

CustName	Amount
Ricky Brett	$60.00
Zacharias Forbes	$41.00
Bertie Nieves	$40.00
Jamelia Pike	$41.00
Mahamed Fellows	$56.00
Ella-Louise Valenzuela	$32.50

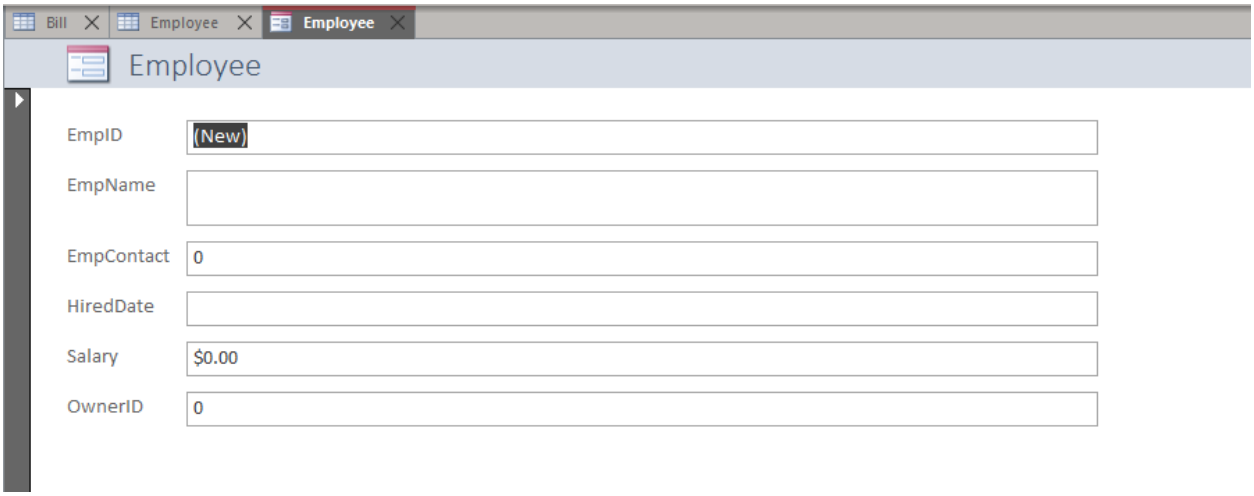
Screen Captures of Forms for Data Entry (Design View & Data Entry View)

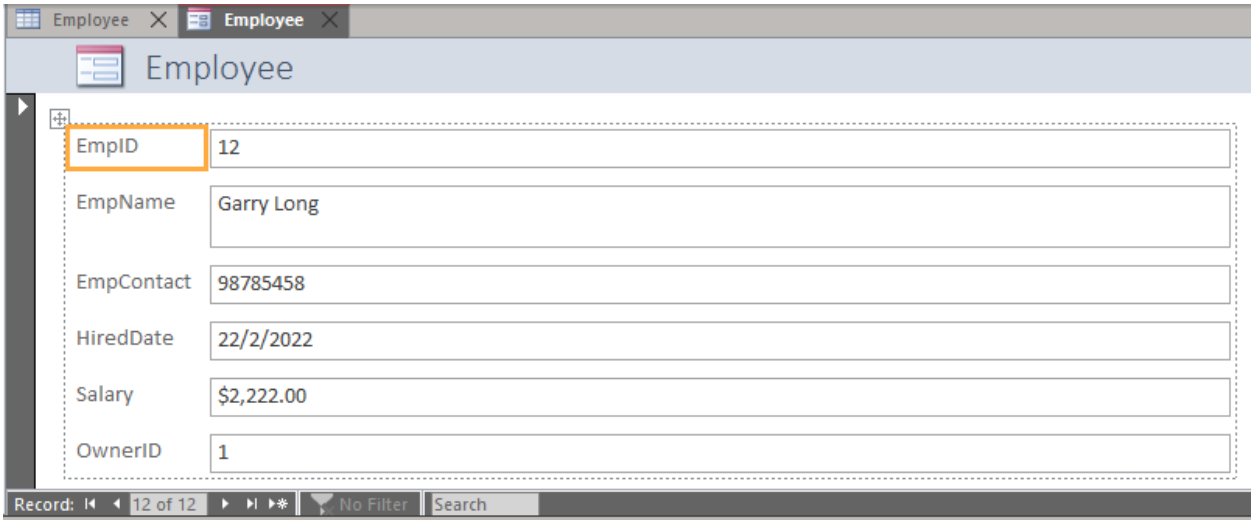
The Form Data Entry view allows us to insert a new entry easily, for e.g. Inserting new entry into Employee table:

Employee Table Design View



Employee Table Data Entry View





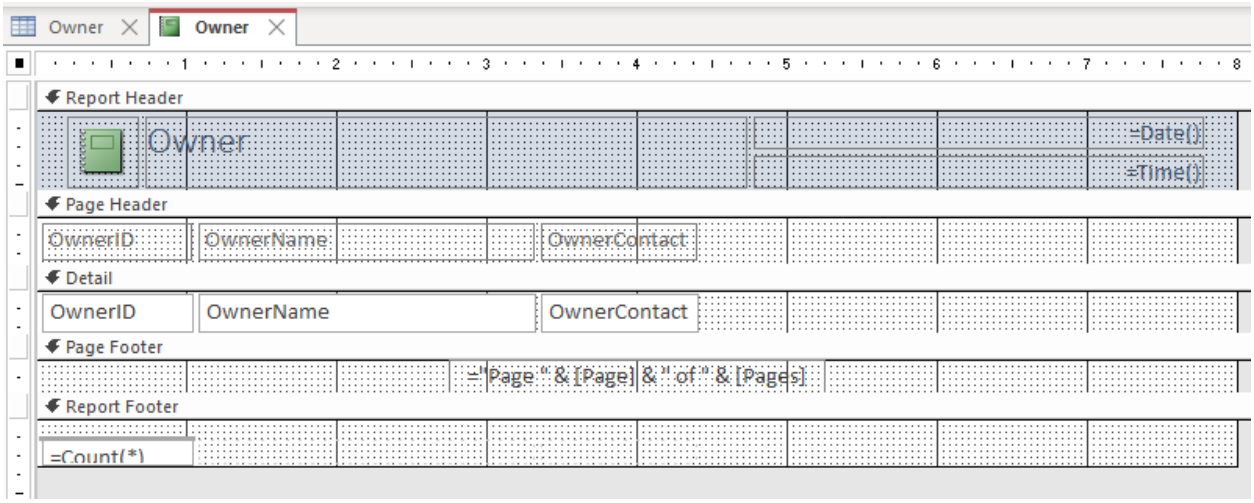
Updated Employees Table:

Bill | Employee | Employee

EmpID	EmpName	EmpContact	HiredDate	Salary	OwnerID	Click to Add
1	Marcus Two	98989898	26/6/2021	$2,500.00	1	
2	Jason Tang	97979797	14/11/2021	$1,000.00	1	
3	Yanni Lee	90909090	1/4/2021	$1,020.00	1	
4	Nur Khalisha	93939393	1/4/2021	$1,280.50	1	
5	Yeng Zao	91919191	25/12/2021	$2,100.00	1	
6	Tek Hao	96969696	25/3/2021	$1,300.00	1	
7	Kit Chan	87878787	12/3/2021	$2,100.00	1	
8	Horatio Teo	83838380	15/1/2022	$2,500.00	1	
9	Jack Neo	82736452	12/1/2022	$2,134.00	1	
10	Grant Kim	89347461	21/1/2022	$1,234.00	1	
11	Henry Kart	90120394	3/1/2022	$1,110.00	1	
12	Garry Long	98785458	22/2/2022	$2,222.00	1	
(New)		0		$0.00	0	

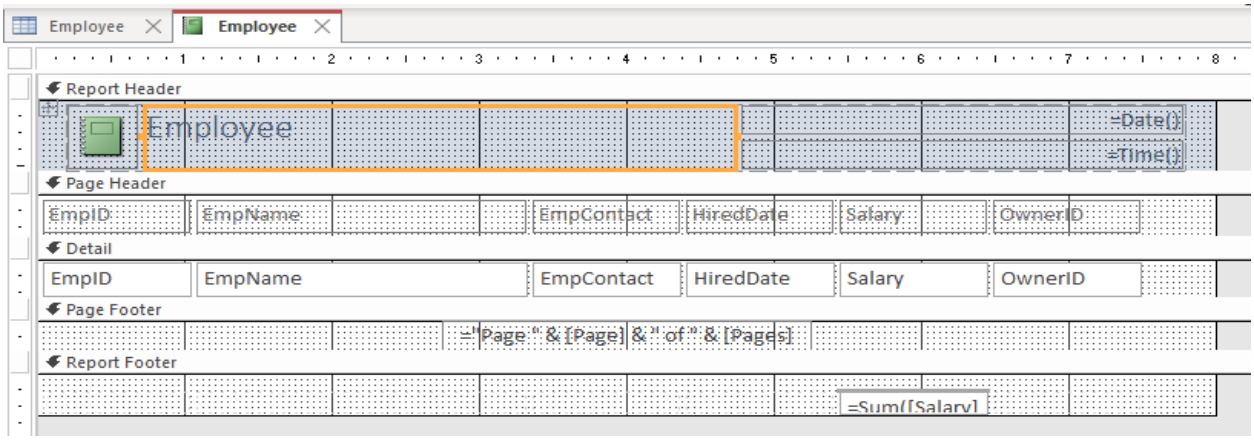
Screen Captures of Access Reports (Design View & Report Results)

Owner Table Design View



Owner Table Report Results

Employee Table Design View

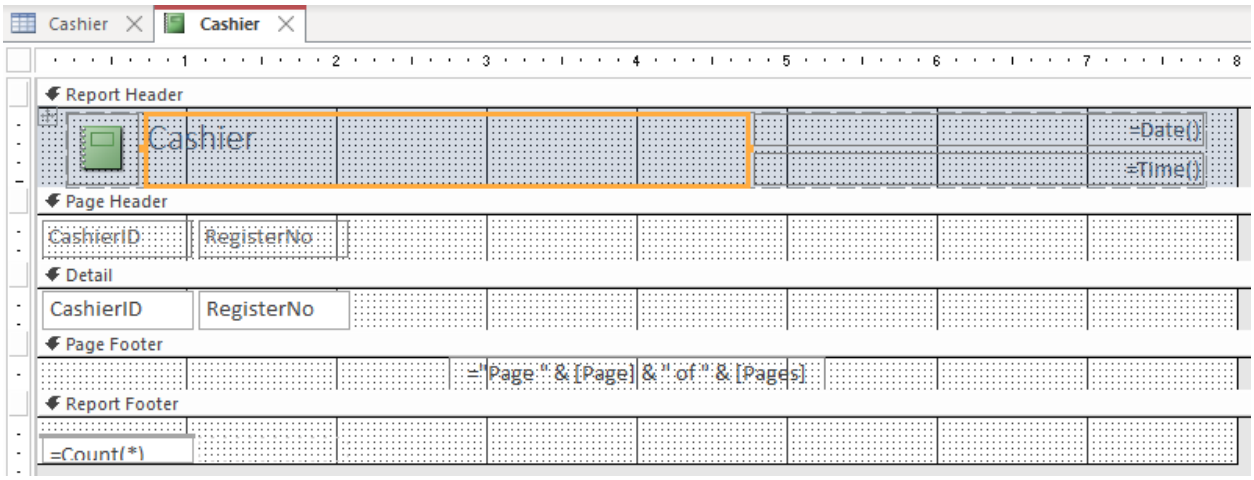


Employee Table Report Results

Employee

EmpID	EmpName	EmpContact	HiredDate	Salary	OwnerID
1	Marcus Two	98989898	26/6/2021	$2,500.00	1
2	Jason Tang	97979797	14/11/2021	$1,000.00	1
3	Yanni Lee	90909090	1/4/2021	$1,020.00	1
4	Nur Khalisha	93939393	1/4/2021	$1,280.50	1
5	Yeng Zao	91919191	25/12/2021	$2,100.00	1
6	Tek Hao	96969696	25/3/2021	$1,300.00	1
7	Kit Chan	87878787	12/3/2021	$2,100.00	1
8	Horatio Teo	83838380	15/1/2022	$2,500.00	1
9	Jack Neo	82736452	12/1/2022	$2,134.00	1
10	Grant Kim	89347461	21/1/2022	$1,234.00	1

Cashier Table Design View



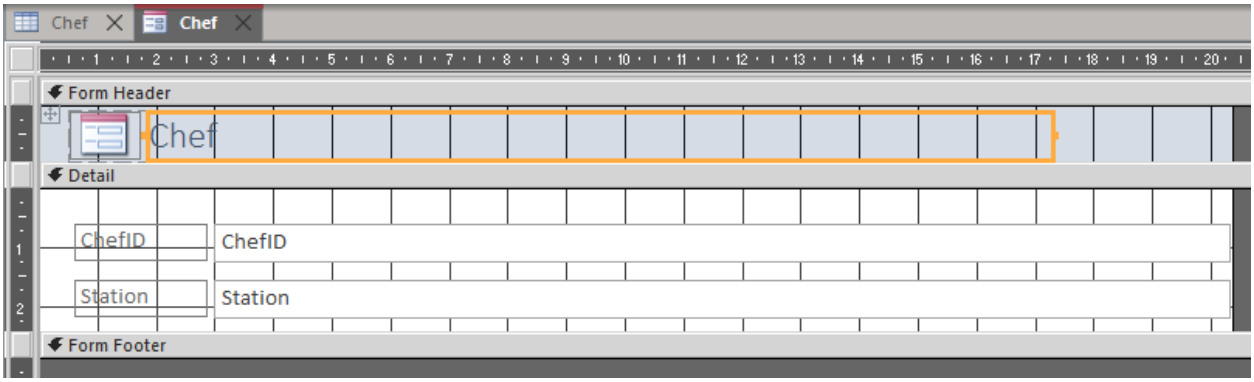
Cashier Table Report Results

Cashier

CashierID	RegisterNo
5	1
6	2
7	3

Tuesday, March 22, 2022 Page 1 of 1

Chef Table Design View



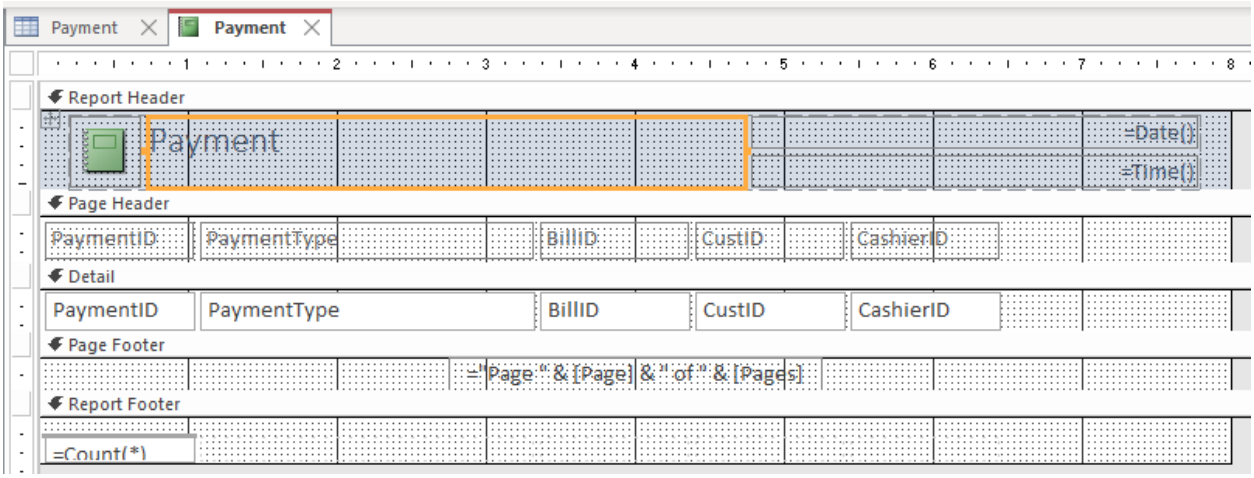
Chef Table Report Results

Chef

ChefID	Station
1	1
8	2
9	3

Tuesday, March 22, 2022 Page 1 of 1

Payment Table Design View



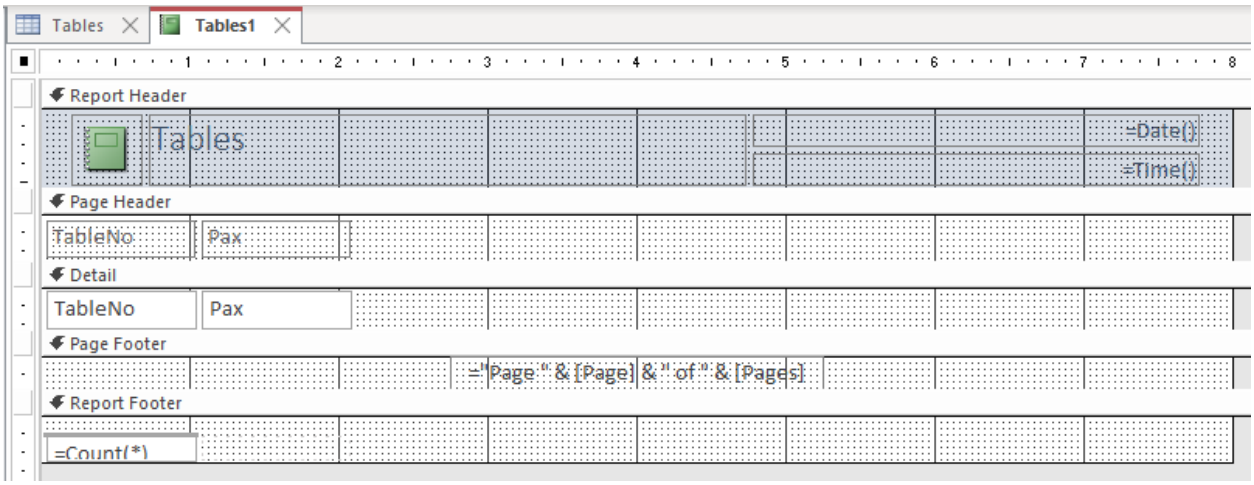
Payment Table Report Results

Payment

PaymentID	PaymentType	BillID	CustID	CashierID
1	Master	1	2	5
2	Visa	2	6	5
3	Cash	3	8	7
4	Cash	4	9	7
5	Master	5	12	5
6	Master	6	14	7
7	Visa	7	15	6
8	Visa	8	17	6
9	Cash	9	20	6

Tuesday, March 22, 2022 Page 1 of 1

Tables Table Design View



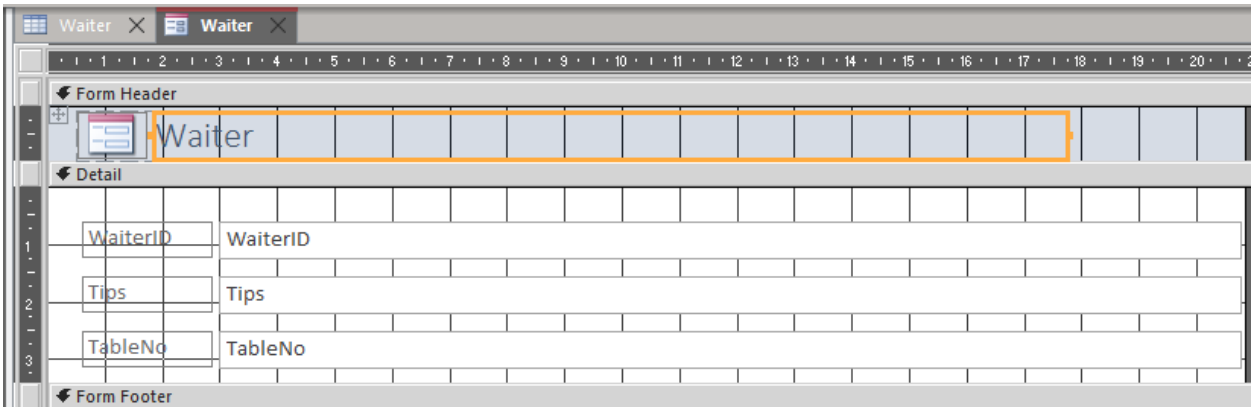
Tables Table Report Results

Tables

TableNo	Pax
1	4
2	2
3	3
4	2
5	2
6	2
7	2

Tuesday, March 22, 2022 Page 1 of 1

Waiter Table Design View



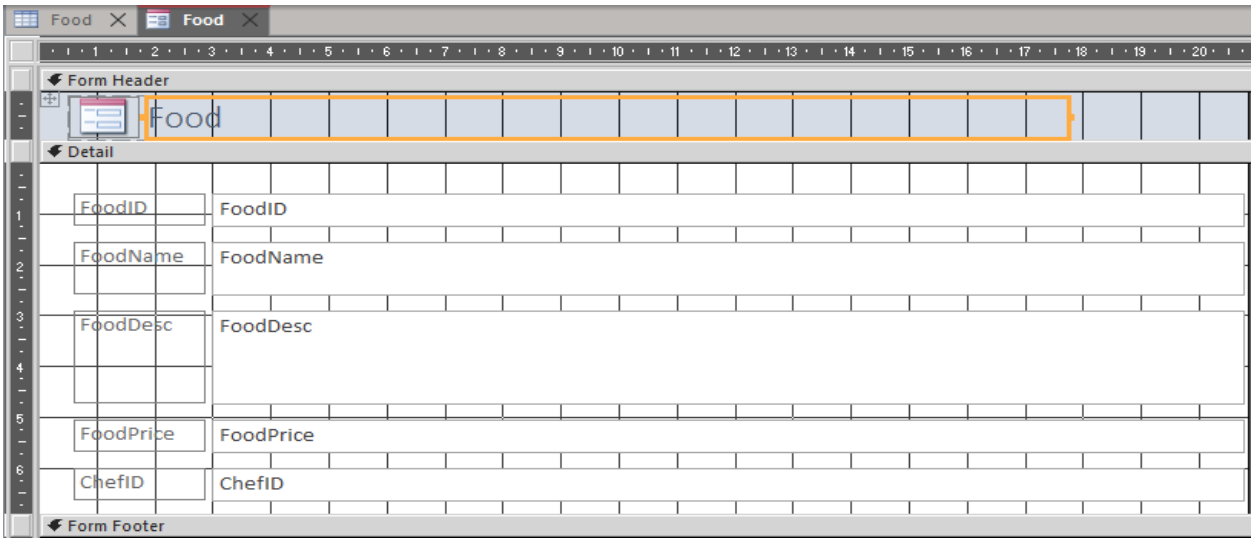
Waiter Table Report Results

Waiter

WaiterID	Tips	TableNo
2	$280.00	1
3	$190.00	2
4	$60.00	3
10	$70.00	4

Tuesday, March 22, 2022 Page 1 of 1

Food Table Design View



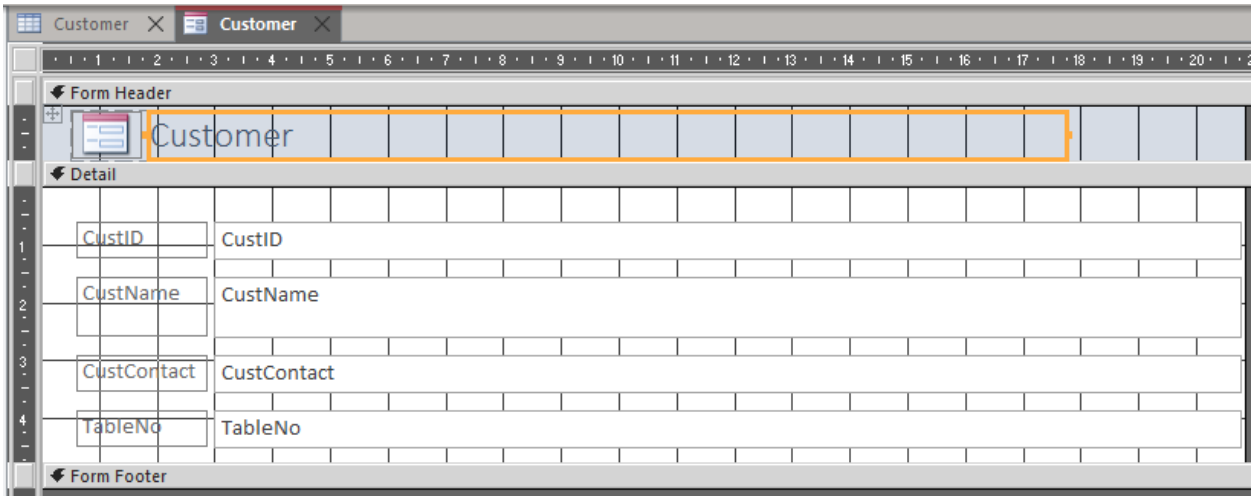
Food Table Report Results

Food

FoodID	FoodName	FoodPrice	ChefID	FoodDesc
1	Sirloin Steak	$20.00	1	Grilled, succulent Sirloin topped with a dollop of roasted shallot compund butter
2	Ribeye Steak	$25.00	1	Marbled Ribeye, bursting with fresh, grilled flavor
3	Single Rock Burger	$10.00	8	Juicy, Char-Grilled Single Rock Beef Burger
4	Double Rock Burger	$13.00	8	Juicy, Char-Grilled Double Rock Beef Burger
5	Chicken Chop	$10.00	1	Served with grilled potato & beetroot yoghurt slaw
6	Cheesy Chicken Chop	$11.00	1	Grilled Chicken chop topped with melted cheese
7	Sausage Platter	$7.00	1	3 different chicken sausages served with mashed and salad with special spicy mustard
8	Pilaf Rice	$5.00	8	Basmati Rice Pilaf with Dried Fruits and Almonds
9	Risotto	$6.00	8	Italian Arborio rice cooked with grilled mushroom, zucchini, bell peppers and carrots
10	Seafood Marinara	$13.00	8	Seafood Marinara pasta with clams, squid and prawns tossed with tomato and white wine sauce
11	Carbonara	$12.00	8	Rich tangle of pasta with a robust cream sauce of eggs and italian pancetta
12	Aglio Olio	$8.00	8	Spaghetti with slices of fresh chilli, garlic and extra virgin olive oil
13	Coca Cola	$3.00	9	Carbonated, sweetened soft drink
14	Sprite	$3.00	9	Crisp, refreshing and clean tasting
15	Iced Tea	$2.50	9	Light, delicate flavour
16	Iced Water	$0.50	9	Refreshing Cold H2O

Tuesday, 22 March 2022 Page 1 of 1

Customers Table Design View



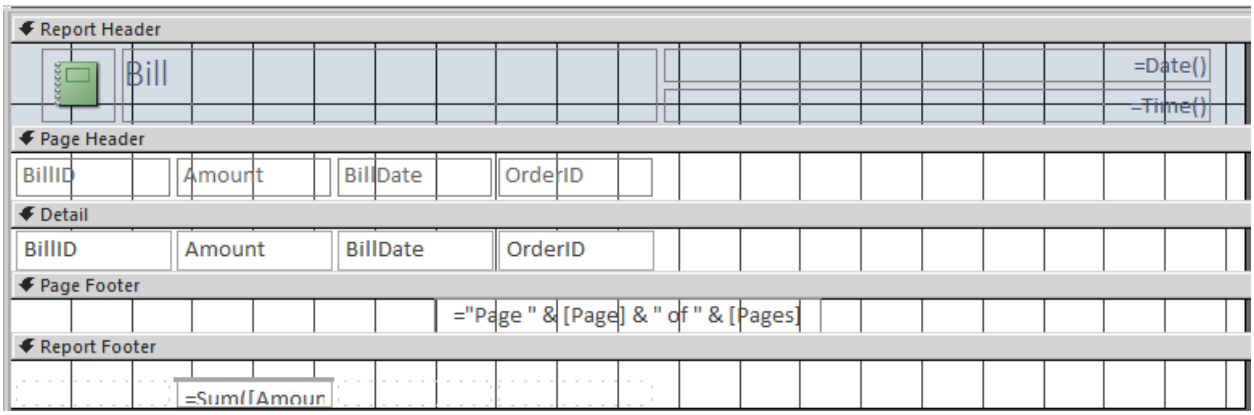
Customers Table Report Results

Customer

CustID	CustName	CustContact	TableNo
1	Tylor Munro	91969760	1
2	Ricky Brett	89500193	1
3	Emelie Goddard	89394418	1
4	Lacy Betts	89045084	1
5	Abdullahi Zavala	90030117	2
6	Zacharias Forbes	88423661	2
7	Rima Mcnamara	89518490	4
8	Abdur-Rahman Patrick	89517987	4
9	Bertie Nieves	95203816	3
10	Shaquille Logan	90404677	3
11	Luqman Bruce	80349782	3
12	Ayisha Guzman	80208405	2
13	Aimee Searle	92688223	1
14	Gruffydd Castaneda	80516487	1
15	Jamelia Pike	89511519	5
16	Yousif Knott	91175699	5
17	Mahamed Fellows	89510349	6
18	Matteo Dickerson	93354830	6
19	Kaidan Haynes	89157149	7
20	Ella-Louise Valenzuela	80438934	7

Tuesday, March 22, 2022 Page :

Bill Table Design View

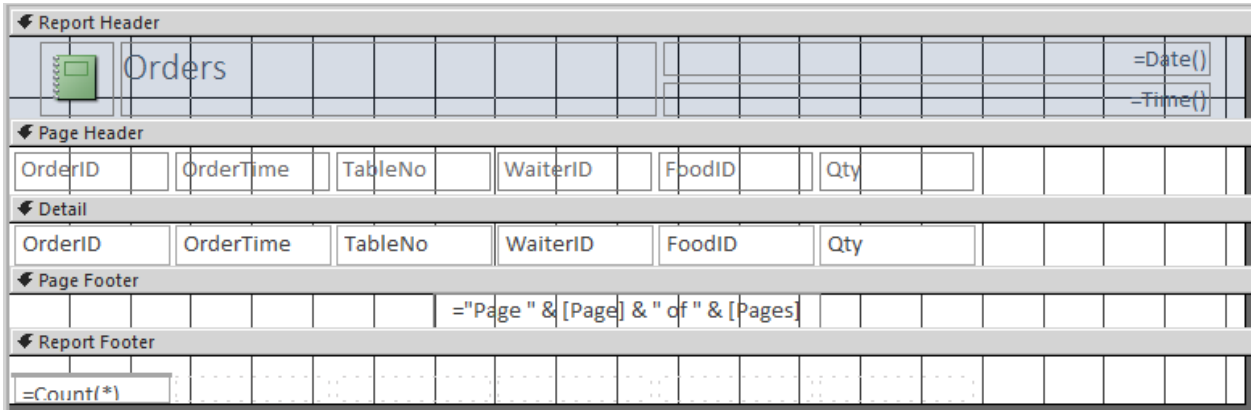


Bill Table Report Results

Bill

BillID	Amount	BillDate	OrderID
1	$60.00	1/1/2022	1
2	$41.00	1/1/2022	2
3	$20.00	1/1/2022	3
4	$40.00	1/1/2022	4
5	$16.00	1/1/2022	5
6	$12.00	1/1/2022	6
7	$41.00	2/1/2022	7
8	$56.00	2/1/2022	8
9	$32.50	2/1/2022	9

Orders Table Design View



Orders Table Report Results

Orders

OrderID	OrderTime	TableNo	WaiterID	FoodID	Qty
1	10:40	1	2	1	1
1	10:40	1	2	2	1
1	10:40	1	2	3	1
1	10:40	1	2	4	1
1	10:41	1	2	13	2
1	10:41	1	2	14	2
2	11:00	2	3	1	2
2	11:00	2	3	16	2
3	12:01	4	2	11	1
3	12:01	4	2	12	1
4	12:01	3	3	3	1
4	12:01	3	3	5	1
4	12:01	3	3	1	1
5	12:03	2	3	14	1
5	12:03	2	3	4	1
6	12:05	1	2	9	2
7	17:03	5	10	1	2
7	17:03	5	10	16	2
8	17:40	6	4	13	2
8	17:40	6	4	2	2
9	18:00	7	10	10	2
9	18:00	7	10	14	2
9	18:20	7	4	16	1

Database Integration

Database integration refers to combining information from 2 or more databases for a consolidated view. This makes the information more accessible, and users can easily edit data without the need to duplicate or move data around.

However, DBMS teams face several challenges:

- Growing complexity in the system
- Data security
- Limits on scalability

The growing complexity in the system stems from the ever-evolving database market, this results in the difficulty to evaluate and choose a specific type of database. Data security is important especially in a corporate setting, without the prevention of data loss through unauthorized access, damages such as financial loss and damage of reputation would occur. Limits on scalability refers to the limitation of the database servers as the data capacity increases, in order to support the changing usage of the application.

Our Approach

In the case the business expands into multiple branches, we may introduce Database Integration which refers to the process of combining data from different sources into a single unified view.

Without data integration, we would have no way of accessing the data gathered in one system in another. Manually synchronizing massive amounts of data with high variability generated from various sources may compromise the integrity of the data.

There can be a single database (for e.g Sales) that contains multiple databases from each different restaurant. This allows the enterprise to systematically consolidate data from a variety of sources. The integration of data allows the analytics tools to produce actionable insights and business intelligence. This reduces delay and data refreshness (the time in which an update occurs when information is changed in the database).

Our approach manages database growth well as it allows quick retiring of old or unnecessary data, by only keeping essential data in the database this keeps the database input to a bare minimum. In a smaller database, queries will execute much faster, as demonstrated by the fact that our database currently executes each query less than 1 seconds. As a result, we can conclude that the database is efficient, cost-effective, and practical.