

Matthew Bagnall  
Normalization Assesses Lab

**1) Convert the above tables into relations in first normal form (1NF).**

**Order**

OrderNo	Date	CustNo	PartNo	Part_desc	No_Ordered	Quoted_Price
A123	10/3/2018	C19973	B79984	Air Filter	20	£200
A123	10/3/2018	C19973	B88904	Glow plugs	10	£20
A123	10/3/2018	C19973	B98743	Brake Pads	5	£300
A124	10/3/2018	C18893	B88904	Glow Plugs	15	£23
A124	10/3/2018	C18893	B66737	Head Bolts	20	£160
A125	10/4/2018	C19973	D88994	Headlight	10	£200
A125	10/4/2018	C19973	N49994	Radiator	2	£60

**Customer1**

Customer_no	Customer_name	Address	Salesrep_no	Salesrep_name
C19973	Andrea Milligan	4 St Bernard Court, Norwich	S312	John Brow
C18893	Peter Murdock	3 Gleebe Close, Gt Yarmouth	S314	Andy Swiss
C18865	Sally Cooper	16 A Livingston Street, Norwich	S312	John Brown
C18784	Micheal Wilmot	8 Nelson Street, Norwich	S317	Mary White

Any missing cells were added to the table to make sure that no null values are present. Every row of the tables are unique. All the data in the tables are related with a primary key.

**2) Draw up a list of functional dependencies for the 1NF defined data and thus convert the relation definitions into second normal form.**

Functional dependencies of 1NF table:

Order table:

OrderNo → Date

OrderNo → CustNo

PartNo → Part\_Description

{PartNo, OrderNo} → No\_ordered

{PartNo, OrderNo} → Quoted\_Price

Order table:

Customer\_No → Customer\_Name

Customer\_No → Salesrep\_no

Customer\_No → Address

Salesrep\_No → Salesrep\_Name

## 2NF

Order

OrderNo	Date	CustNo
A123	10/3/2018	C19973
A124	10/3/2018	C18893
A125	10/4/2018	C19973

PartNo	Part_Desc
B79984	Air Filter
B98743	Brake Pads
B88904	Glow plugs
B66737	Head Bolts
D88994	Headlights
N49994	Radiator

PartNo --> OrderNo	No_Ordered	Quoted_Price
B79984 --> A123	20	£200
B88904 --> A123	10	£20
B98743 --> A123	5	£300
B88904 --> A124	15	£23
B66737 --> A124	20	£160
D88994 --> A125	10	£200
N49994 --> A125	2	£60

Customer1

Customer_No	Customer_Name	Address	Salesrep_No	Salesrep_Name
C19973	Andrea Milligan	4 St Bernards Court, Norwich	S312	John Brown
C18893	Peter Murdock	3 Gleebe Close, Gt Yarmouth	S314	Andy Swiss
C18865	Sally Cooper	16 A Livingston Street, Norwich	S312	John Brown
C18784	Micheal Wilmot	8 Nelson Street, Norwich	S317	Mary White

### 3) Consider the 2NF definitions and describe any possible problems with update, insert or delete anomalies.

For a table to be in the second normal form, every non-key attribute must depend on the primary key in the table and the attributes in each table must relate to each other in a meaningful way. No partial dependencies can exist. Both tables now meet this requirement, however issues still come up when attempting to update the table.

## Anomalies:

### Order table:

No update, deletion or insertion anomalies were found at 2NF for this table

### Customer1 table:

Anomalies appear when trying to update data in the table. This would increase the level of redundant data.

Update anomalies appear when altering the salesrep number or salesrep name of an employee. If an employee no longer worked at this organization, when they are removed from the database, customer information will also be lost. This loss of data would likely be unintentional and happen because of poor database design. Updating the name of an employee would also cause problems as every name record of that employee in the customer table would need to be manually updated. This could happen if an employee get married and changed their last name.

Functional dependecis:

Customer\_no --> Customer Name

Customer\_no --> Salesrep

Customer\_no --> Address

salesrep no --> salesrep name

### Parts1

#### 4) Convert the relation definitions into 3NF.

Order: (no change)

Order1

OrderNo	Date	CustNo
A123	10/3/2018	C19973
A124	10/3/2018	C18893
A125	10/4/2018	C19973

PartNo	Part_Desc
B79984	Air Filter
B98743	Brake Pads
B88904	Glow plugs
B66737	Head Bolts
D88994	Headlights
N49994	Radiator

OrderInformation

PartNo --> OrderNo	No_Ordered	Quoted_Price
B79984 --> A123	20	£200
B88904 --> A123	10	£20
B98743 --> A123	5	£300
B88904 --> A124	15	£23
B66737 --> A124	20	£160
D88994 --> A125	10	£200
N49994 --> A125	2	£60

Customer1:

*CustomerInformation*

Customer_No	Customer_Name	Salesrep_No	Address
C19973	Andrea Milligan	S312	4 St Bernards Court, Norwich
C18893	Peter Murdock	S314	3 Gleebe Close, Gt Yrmouth
C18865	Sally Cooper	S312	16 A Livingston Street, Norwich
C18784	Micheal Wilmot	S317	8 Nelson Street, Norwich

*CustomerName*

Salesrep_No	Salesrep_Name
S312	John Brown
S314	Andy Swiss
S317	Mary White

There are now no transitive functional dependencies present. Before, Salesrep\_Name was dependent on the Salesrep\_No, and salesrep\_No was dependent on CustNo. After the table was split in 3NF, these transitive functional dependencies were removed.

**5) What is the difference between 3NF and Boyce-Codd Normal Form? Are the 3NF relations produced in 4) above in BCNF?**

In a BCNF table, the prime attributes of a table must not depend on non-prime attributes in the table. In other words, the only functional dependencies that can exist must be where the primary key determines all other attributes in the table.

Order tables:

The 3NF Order and Customer tables meet the BCNF standard as in each table, the non-primary attribute are all dependent on one primary key, the primary key is not dependent on any other attributes and no attribute can be determined by anything other than the primary key. So no further separation is required to meet the BCNF standard. As seen below from the functional dependencies identified from each table:

Order Tables:

OrderNo → Date	PartNo → Part_Desc	{PartNo, OrderNo} → No_Ordered
OrderNo → CustNo		{PartNo, OrderNo} → Quoted_Price

Customer table:

Customer\_No → Customer\_Name

Salesrep\_No → Salesrep\_Name

Customer\_No → Salesrep\_No

Customer\_No → Address

6) Now imagine a different scenario where a customer may have many delivery addresses and many different mobile phone numbers. The addresses and phone numbers are not related.

Customer_No	Customer_Name	Address	Mobile
D20205	Peter Milligan	4 St Bernards Court, Norwich	07934 848488
D20205	Peter Milligan	4 St Bernards Court, Norwich	07345 988383
D20205	Peter Milligan	15 The Avenues, Wymondham	07934 848488
D20205	Peter Milligan	15 The Avenues, Wymondham	07345 988383
C20848	Sally Black	3 Gleebe Close, Gt Yarmouth	0732 9399872
C20848	Sally Black	3 Gleebe Close, Gt Yarmouth	0745 8716283

Identify any Multi-Valued Dependencies (MVD) and functional dependencies and convert Customer2 to 4NF.

**Multi-Valued Dependencies:**

Customer\_No → → Mobile

Customer\_No → → Address

**Functional dependencies:**

Customer No → Customer\_Name

*CustomerName*

Customer_No	Customer_Name
D20205	Peter Milligan
C20848	Sally Black

*CustomerInformation*

Customer_No	Street	City
D20205	4 St Bernards Court	Norwich
D20205	15 The Avenues	Wymondham
C20848	3 Gleebe Close	Gt Yarmouth

*CustomerContactInformation*

Customer_No	Mobile
D20205	07934 848488
D20205	07345 988383
C20848	0732 9399872
C20848	0745 8716283