Solutions to Normalisation Exercises

1. Student Module Enrolment System

UNF	1NF	2NF	3NF	Relation/Entity
Student Reg. No. Student Name (Module Code Module Title Module Leader Office)	Student Reg. No. Student Name	Student Reg. No. Student Name	Student Reg. No. Student Name	**STUDENT**
	Student Reg. No. Module Code Module Title Module Leader Office	Student Reg. No. Module Code	Student Reg. No. Module Code	**STUDENT on MODULE**
		Module Code Module Title Module Leader Office	Module Code Module Title *Module Leader	**MODULE**
			Module Leader Office	**MODULE LEADER**

2. Shoe shop sales

Using Branch as the initial key. Assuming Product code has only one style

UNF	1NF	2NF	3NF	
branch shop address (product code product size product colour style code style name type of shoe stock quantity (week Sales))	branch shop address	branch shop address	branch shop address	**BRANCH**
	branch product code product size product colour style code style name type of shoe stock quantity	branch product code stock quantity	branch product code stock quantity	**STOCK**
		product code style code style name type of shoe product size product colour	product code *style code product size product colour	**PRODUCT**
	branch product code week sales		style code style name type of shoe	**STYLE**
		branch product code week sales	product code branch week sales	**WEEKLY SALES**

Using Product code as the initial key. Assuming the Product code has only one style

UNF

product code
style code
style name
type of shoe
product size
product colour
(branch
shop address
stock quantity
(week
sales))

1NF

product code
style code
style name
type of shoe
product size
product colour

product code
branch
shop address
stock quantity

product code
branch
week
sales

2NF

product code
style code
style name
type of shoe
product size
product colour

product code
branch
stock quantity

branch
shop address

product code
branch
week
sales

3NF

product code
*style code
product size
product colour

style code
style name
type of shoe

product code
branch
stock quantity

branch
shop address

product code
branch
week
sales

Alternative Solution using Style Code as the initial key

Below is a normalisation of the shoe shops data that starts with Style Code as the initial key. It is more complicated than using Product Code but ends up with essentially the same 3NF although there is an extra table that only contains information that can be found from two other tables. However, in this case there are issues regarding dependancy between parts of a key that were not covered in the lecture on normalisation.

What this does illustrate is that your choice of initial key can be important if you are to avoid an overly complex normalisation process.

UNF

style code
style name
type of shoe
(branch
shop address
(product code
product size
product colour
stock quantity
(week
sales)))

1NF

style code
style name
type of shoe

style code
branch
shop address

style code
product code
branch
product size
product colour
stock quantity

style code
product code
branch
week
sales

2NF

style code
style name
type of shoe

style code
branch

branch
shop address

style code
product code
branch

product code
branch
stock quantity

product code
product size
product colour

style code
product code
branch
week

product code
branch
week
sales

3NF

style code
style name
type of shoe

style code
branch

branch
shop address

product code
branch

product code
*style code

product code
branch
stock quantity

product code
product size
product colour

product code
branch
week

product code
*style code

product code
branch
week
sales

OPTIMISED

style code
style name
type of shoe

style code
branch

branch
shop address

product code
*style code
product size
product colour

product code
branch
stock quantity

product code
branch
week
sales

3. Financial Advisor investments

UNF	1NF	2NF	3NF	
Client Code	Client Code	Client Code	Client Code	**CLIENT**
Title	Title	Title	Title	
Name	Name	Name	Name	
Client address	Client address	Client address	Client address	
Tel. No.	Tel. No.	Tel. No.	Tel. No.	
Company Name				
Company Address	Client Code	Client Code	Client Code	**INVESTMENT**
(Fund	Fund	Fund	Fund	
Fund Type	Fund Type	Investment	Investment	
Investment	Company Name	Date	Date	
Date)	Company Address			
	Investment	Fund	Fund	**FUND**
	Date	Fund Type	Fund Type	
		Company Name	*Company Name	
		Company Address		
			Company Name	**COMPANY**
			Company Address	

4. Cross Channel Airways

UNF	1NF	2NF	3NF	
Plan No.	Plan No.	Plan No.	Plan No.	**PLAN**
Flight Code	Flight Code	Flight Code	*Flight Code	
Destination	Destination	Destination	Date	
Date	Date	Date	*Aircraft reg.	
(Crew code	Aircraft type	Aircraft type		
Job Title	Aircraft reg.	Aircraft reg.	Flight Code	**FLIGHT**
Crew name)			Destination	
Aircraft type	Plan No.	Plan No.		
Aircraft reg.	Crew code	Crew code	Aircraft reg.	**AIRCRAFT**
(Journey No.	Job Title		Aircraft type	
Depart	Crew name	Crew code		
Depart time		Job Title	Plan No.	**CREW**
Arrive	(Plan No.)	Crew name	Crew code	**ALLOCATION**
Arrive time)	(Journey No.)			
	Depart	(Plan No.)	Crew code	**CREW**
	Depart time	(Journey No.)	Job Title	
	Arrive	Depart	Crew name	
	Arrive time	Depart time		
		Arrive	(Plan No.)	**JOURNEY**
		Arrive time	(Journey No.)	
			Depart	
			Depart time	
			Arrive	
			Arrive time	

5. Public library

Borrower & Current Loans

UNF	1NF	2NF	3NF	Optimised 3NF
Borrower ID No.	**Borrower ID No.**	**Borrower ID No.**	**Borrower ID No.**	**Borrower ID No.**
Name	Name	Name	Name	Name
Address	Address	Address	Address	Address
(Issue date				
Return due	**Borrower ID No.**	**Borrower ID No.**	**Accession No.**	**Accession No.**
No. of renewals	**Accession No.**	**Accession No.**	*Borrower ID No.	*Borrower ID No.
Accession No.	Issue date			Issue date
ISBN	Return due	**Accession No**	**Accession No**	Return due
Title)	No. of renewals	Issue date	Issue date	No. of renewals
	ISBN	Return due	Return due	*ISBN
	Title	No. of renewals	No. of renewals	
		ISBN	*ISBN	**ISBN**
		Title		Title
			ISBN	
			Title	

Book, Copies and Reservations

UNF	1NF	2NF	3NF	Optimised 3NF
ISBN	**ISBN**	**ISBN**	**ISBN**	**ISBN**
Title	Title	Title	Title	Title
Author	Author	Author	Author	Author
Publisher	Publisher	Publisher	Publisher	Publisher
No of Copies	No of Copies	No of Copies	No of Copies	No of Copies
(Accession No.				
Supplier	**ISBN**	**ISBN**	**Accession No**	**Accession No**
Date acquired	**Accession No.**	**Accession No.**	*ISBN	*ISBN
Cost)	Supplier			Supplier
(Date requested	Date acquired	**Accession No.**	**Accession No.**	Date acquired
Date issued	Cost	Supplier	Supplier	Cost
Borrower ID No		Date acquired	Date acquired	
Borrower Name)	**ISBN**	Cost	Cost	**ISBN**
	Date requested			**Date requested**
	Borrower ID No	**ISBN**	**ISBN**	**Borrower ID No**
	Borrower Name	**Date requested**	**Date requested**	Date issued
	Date issued	**Borrower ID No**	**Borrower ID No**	
		Date issued	Date issued	**Borrower ID No**
				Borrower Name
		Borrower ID No	**Borrower ID No**	
		Borrower Name	Borrower Name	

Note that the compoound key **ISBN**, **Date requested**, **Borrower ID No** is needed because a borrower may make reservations for the same book on more than one occasion. Other borrowers may also reserve the same book.

Merged 3NF	**Relation/Entity**
Borrower ID No. Name Address	**BORROWER**
ISBN Title Author Publisher No of Copies	**BOOK**
Accession No *ISBN Supplier Date acquired Cost *Borrower ID No. Issue date Return due	**BOOK COPY**
ISBN Date requested Borrower ID No Date issued	**RESERVATION**

6. Manufacturing assembly

Production Request

UNF	1NF	2NF	3NF	Relation\Entity
<u>Request No.</u> Date A/C Code Customer Address ((Part No. Part Desc. Qty). Assy. No. Assy. Desc)	<u>Request No.</u> Date A/C Code Customer Address <u>Request No.</u> <u>Assy. No.</u> Assy. Desc. <u>Request No.</u> <u>Assy. No.</u> <u>Part No.</u> Part Desc Qty.	<u>Request No.</u> Date A/C Code Customer Address <u>Request No.</u> <u>Assy. No.</u> <u>Assy. No.</u> Assy. Desc. <u>Request No.</u> <u>Assy. No.</u> <u>Part No.</u> Qty. <u>Part No.</u> Part Desc.	<u>Request No.</u> Date *A/C Code <u>A/C Code</u> Customer Address <u>Request No.</u> <u>Assy. No.</u> <u>Assy. No.</u> Assy. Desc. <u>Request No.</u> <u>Assy. No.</u> <u>Part No.</u> Qty. <u>Part No.</u> Part Desc.	**PRODUCTION REQUEST** **CUSTOMER** **REQUEST ASSEMBLY** **ASSEMBLY** **REQUEST ITEM** **PART**

NB Request Assembly contains no attributes that are not in Request Item and the table is therefore redundant and may be removed.

Manufacturing Plan

UNF	1NF	2NF	3NF	Relation\Entity
<u>Part No.</u> Part Name (Mat. Code Mat. Desc. Mat. Qty.) (Op. No. M/C Code M/C Type Op. Desc.)	<u>Part No.</u> Part Name <u>Part No.</u> <u>Mat. Code</u> Mat. Desc. Mat. Qty. <u>(Part No.)</u> <u>(Op. No.)</u> M/C Code M/C Type Op. Desc.	<u>Part No.</u> Part Name <u>Part No.</u> <u>Mat. Code</u> Mat. Qty. <u>Mat. Code</u> Mat. Desc. <u>(Part No.)</u> <u>(Op. No.)</u> M/C Code M/C Type Op. Desc.	<u>Part No.</u> Part Name <u>Part No.</u> <u>Mat. Code</u> Mat. Qty. <u>Mat. Code</u> Mat. Desc. <u>(Part No.)</u> <u>(Op. No.)</u> * M/C Code Op. Desc. <u>M/C Code</u> M/C Type	**PART** **MATERIAL USAGE** **RAW MATERIAL** **OPERATION** **MACHINE**

Merged 3NF	RELATION/ENTITY
Request No. Date *A/C Code	**PRODUCTION REQUEST**
A/C Code Customer Address	**CUSTOMER**
Request No. Part No. Assy. No. Qty.	**REQUEST ITEM**
Assy. No. Assy. Desc.	**ASSEMBLY**
Part No. Part Name	**PART**
Part No. Mat. Code Mat. Qty.	**MATERIAL USAGE**
Mat. Code Mat. Desc.	**RAW MATERIAL ENTITY**
(Part No.) (Op. No.) * M/C Code Op. Desc.	**OPERATION**
M/C Code M/C Type	**MACHINE**

Now draw the partial ERD for each of the examples