

Normalisation Exercises

Below are Normalisation exercises, which you should work through at your own pace. Show UNF, 1NF, 2NF and 3NF tabulated in columns. You could set your work out using a table in Word or Excel. Solutions are given for the exercises in a separate document.

1. Student Module Enrolment System

Students enrol on a number of modules. Normalise the sample data below.

Student Reg.No.	Student Name	Module Code	Module Title	Module Leader	Office
123456	Mary Wheeler	SOFT130	Info. Systems Requirements	Marco Palomino	PSQB307
123456	Mary Wheeler	SOFT132	Info. Systems Analysis & Design	Shirley Atkinson	PSQB309
137658	John Smith	SOFT105	Intro. to Info. Technology	Shirley Atkinson	PSQB309
145634	Harry Potter	MAGC311	Advanced Spells	Wizard of Oz	Cellar 02

2. Below is an example of a stock and sales record sheet for one style of shoe at one shoe shop branch.

Style Code: LHHI3				Branch: Cornwood			
Style Name: Italia				Address: New Street, Cornwood, Devon, PL21 8XX			
Type of Shoe: Ladies High Heel							
Product Code	Size	Colour	Stock Quantity	Weekly Sales			
				week beginning 6/10/03	week beginning 13/10/03	week beginning 20/10/03	week beginning 27/10/03
4BKLHHI3	4	Black	4	2	1	1	0
5BKLHHI3	5	Black	3	1	2	1	1
5RDLHHI3	5	Red	4	2	0	1	0
6BKLHHI3	6	Black	6	3	4	3	3
6RDLHHI3	6	Red	4	2	2	1	2
7BKLHHI3	7	Black	4	1	2	1	1
7RDLHHI3	7	Red	3	0	1	0	1

Tip - There is more than one candidate key in this example, e.g. Branch, Style or Product Code. Normalise separately using each as your initial key for UNF. Don't forget each shoe can be stocked and sold at more than one Branch. There is more than one set of multi-valued attributes (repeating data) so you will have more than two relations in First Normal Form.

3. A firm of Financial Advisors keeps records of clients' investments. Some examples are shown below.

Client	Title	Name	Address	Tel. No.	Company	Address	Fund	Type	Investment	Date
SM202	Mr.	John Smith	21 Fore St., Newton Bishop	0112 567890	New Union	Rainy St., Manchester, M2 0BC	NU Japan	Equity	£2100	1/11/00
SM202	Mr.	John Smith	21 Fore St., Newton Bishop	0112 567890	New Union	Rainy St., Manchester, M2 0BC	NU Safevest	Balanced	£3000	1/11/00
WH112	Ms.	Susan White	10 High St., Kingstown	0234 454533	Moon Alliance	Thread St., London, W1 1ZZ	MA UK	Equity	£5000	11/9/00
WH112	Ms.	Susan White	10 High St., Kingstown	0234 454533	New Union	Rainy St., Manchester, M2 0BC	NU Japan	Equity	£4000	21/3/01
DA327	Mrs.	Joanne Davis	21, Prideaux Rd. , Corntown	01752 837666	English Orphans	New St., Birmingham, B1 1XX	EO USA	Equity	£2500	31/1/02
DA328	Mr.	Joseph Davis	211, Dark Lane, Plympton	01752 888999	Moon Alliance	Thread St., London, W1 1ZZ	MA Base+	Tracker	£8000	21/2/02

Each Client has a unique code.

Each Fund is of one Type and is run by one Company.

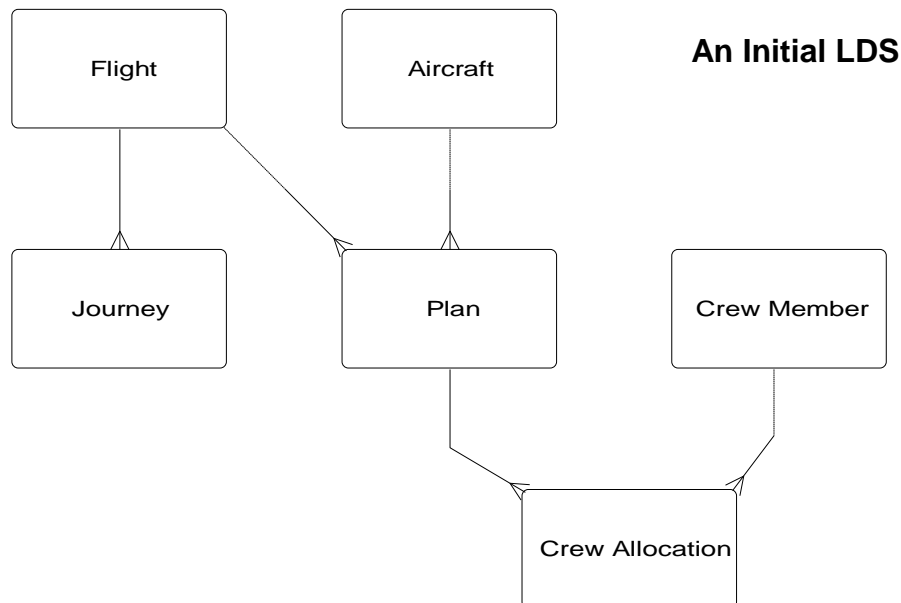
Clients may have many investments in different Investment Funds with various Companies, but can have only one investment in one Fund.

Each investment has an amount, which was invested in the Fund on a specific date.

Draw an initial Entity Relationship Diagram before attempting the Normalisation.

Tip There is more than one candidate key in this example. Think carefully about the one you should choose for your initial primary key and also for the additional key attribute for the new relation you create in Second Normal Form.

4. Cross Channel Airways operates **aircraft** on a number of **flights**. Each flight consists of at least one **journey** (also known as a flight sector). The same flight may occur many times but only once on any given day. The aircraft can be used on various flights. For each occasion of a flight CLA records a flight **plan**, which identifies the particular aircraft being used and the **crew allocation**.



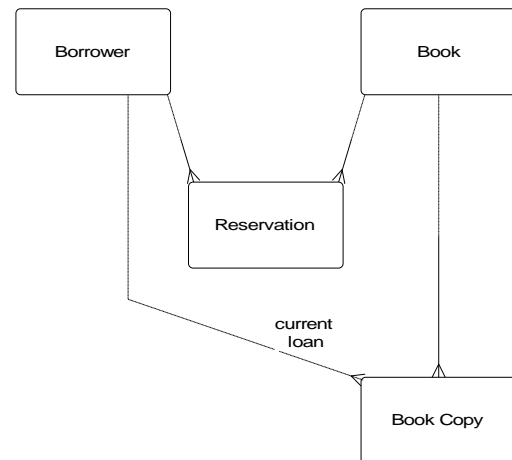
Below is an example of a Flight Plan, which has a unique Flight Plan Number. The same Flight Code, which always has the same destination and journeys, may be used on another Plan. However, a Flight Code is used no more than once per day.

Cross Channel Airways - Flight Plan				
Flight Plan Number:		00018672		
Flight Code:		CC145		
Destination:		Bristol		
Date of flight:		14 June 2002		
Crew members:		FC161	Captain	C. Hawk
		FC212	Second Officer	A. Falcon
		FC133	Flight Engineer	G. Wing
		FS221	Chief Steward	F. Trolley
		FS232	Steward	A. Dish
Aircraft type:		HS Dash-7		
Aircraft Registration No:		G-SALM		

Journey Number	Depart	Time	Arrive	Time
1	Guernsey	10:00	Jersey	10:15
2	Jersey	10:45	Plymouth	12:00
3	Plymouth	13:15	Bristol	14:10

5. This exercise involves two documents and you should normalise them separately then merge the two sets of 3NF relations into a single set.

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Borrower & Current Loans

Borrower ID No. 45632				Address 10 New St. Crownhill Plymouth	
Name George Jones					
Current Loans					
Issue date	Return due	No. of renewals	Accession No.	ISBN	Title
3/12/04	17/12/04	0	678956	0077099745	Software System Development
3/12/04	17/12/04	0	815642	0077095855	Database Design
22/11/04	20/12/04	1	823124	0201708574	Database Systems

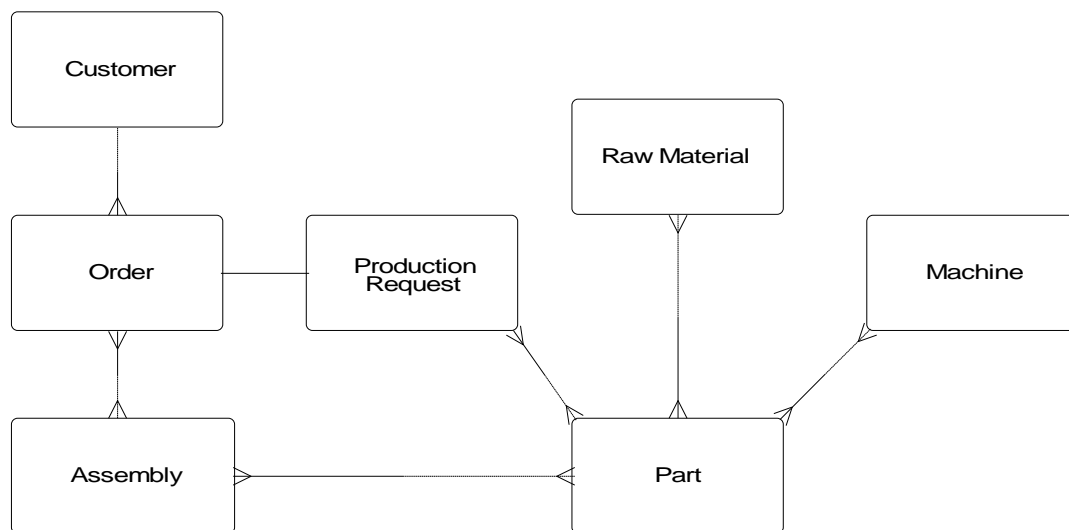
Book, Copies and Reservations

ISBN 0077099745		Publisher McGraw Hill		No. of copies held 2	
Title Software System Development					
Author(s) Britton C, Doake J					
Copies					
Accession No.		Supplier		Date Acquired	
678956		Amazon		28/1/03	
773421		The Bookseller		12/7/04	
Reservations					
Date Requested		Date Issued	Borrower ID	Borrower Name	
28/2/05			55347	Mary Williams	
30/9/04		7/10/04	51231	Terry Potter	
18/12/03		4/1/04	49113	Julie Garland	
3/3/03		10/3/03	50289	John Lennox	

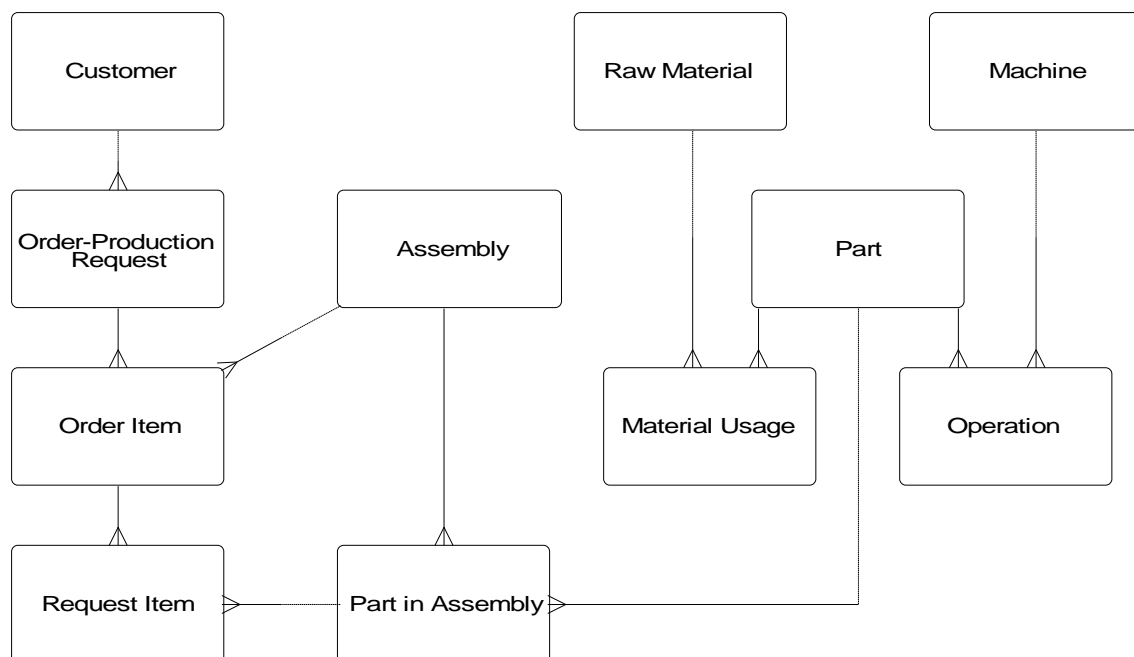
6. This exercise is more complex and involves two documents.

A manufacturing company builds pneumatics assemblies from parts that it manufactures. The parts, which may be used in more than one assembly, are made using various factory machines. A number of operations on one or more machines may be required to make each part. Each part may also require a number of raw materials. When an order for various assemblies is received from a customer, the Production Control Department gives the factory a Production Request document that covers all the components that must be manufactured for the order. The factory also uses Manufacturing Plan documents. Each Plan identifies the raw materials required for one part and the manufacturing operations and machines needed to make the part.

First attempt at LDS



Initial LDS with relationships resolved



Production Request

The customer's account code uniquely identifies the customer name and address. Each Production Request covers a number of component parts, which are listed by their unique Part Nos. The same parts may appear on other Production Requests. Each assembly (which has a unique code) is built from a number of components, which may be used in more than one assembly.

Request No.: 9673 Date: 16/7/02	Account Code: ROB01 Customer: Roberts Automation Address: New Mill Industrial Estate Plymouth
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COMPONENT (required for assembly)				
PART NO.	DESCRIPTION	QTY.	ASSY.	ASSEMBLY DESCRIPTION
CA352	cylinder casing	5	CYL35	short stroke cylinder
EP217	cylinder end	10	CYL35	short stroke cylinder
PN106	piston	5	CYL35	short stroke cylinder
SW201A	knurled widget	10	CYL35	short stroke cylinder
SW201A	knurled widget	2	VAL12	control valve
CV116	valve casing	3	VAL12	control valve
GV116	valve gate	3	VAL12	control valve
GG116	valve gear	3	VAL12	control valve

Manufacturing Plan

Parts are manufactured by a set of numbered operations always starting with Operation No. 1. Each operation may involve a different machine (m/c), which may be used for other operations.

PART No. : SW201A	PART : Knurled Widget
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RAW MATERIALS REQUIRED PER PART		
CODE	DESCRIPTION	QTY. (Lengths in cm)
SR25	stainless 25 mm rod	6.5
SS1003	100mm x 3mm stainless strip	3.5
SP002	20mm stainless split pin	2

MANUFACTURING OPERATIONS PER PART			
OP. No.	M/C	M/C TYPE	OP. DESCRIPTION
1	PS1	saw	cut rod to length
2	PS1	saw	cut strip to length
3	ND2	drill	drill plate as per drawing SW201A/4
4	NL1	CNC lathe	machine using program SW201A/2
5	CM2	capstan	mill rod as per drawing SW201A/6
6	ASS	manual	slot strip into rod and retain with pins