Database Normalization

A Quick Review

What is Database Normalization?

Database normalization is the process of restructuring and re-organizing your database in order to achieve a database form that has NO ANOMALY, REDUCED DATA REDUNDANCY and as a result have a database with HIGH DATA INTEGRITY.

Database Anomalies

- Insert Anomalies
- Update Anomalies
- Delete Anomalies

Insert Anomaly

delivery_id	item_name	date	branch
11234	Item 1	8/24/2019	Cebu
11235	Item 5	8/30/2019	Bohol
11236	Item 3	9/5/2019	Cebu
11237	Item 9	9/8/2019	Leyte

Considering this table, we cannot add a new branch until a delivery for the new branch will be recorded.

Update Anomaly

delivery_id	item_name	date	branch
11234	Item 1	8/24/2019	Cebu
11235	Item 5	8/30/2019	Bohol
11236	Item 3	9/5/2019	Cebu
11237	Item 9	9/8/2019	Leyte

The same table as earlier; Here if we need to update the name of a branch, e.g. Cebu to Mandaue, we need to update it in multiple places. If this database would be large enough, it will mean too many updates to perform.

Delete Anomaly

delivery_id	item_name	date	branch
11234	Item 1	8/24/2019	Cebu
11235	Item 5	8/30/2019	Bohol
11236	Item 3	9/5/2019	Cebu
11237	Item 9	9/8/2019	Leyte

If we are to close one branch and delete that branch from our database, all the deliveries to that branch will also be deleted.

Source Table (not normalized)

SIMPLE BOOK RENTAL DATABASE									
txn_id	**lname**	**fname**	**address**	**phone**	**title**	**category**	**date_borrowed**	**due_date**	**amount**
123	Jennings	Larry	#34 Kensington St.	8787656	Entries of the Getter	Adventure	08/01/20	08/03/20	40.00
124	Gardson	Michelle	#12 Huracan Ave.	8782236	Courier's Choice	Business	08/01/20	08/03/20	35.00
125	Watson	James	#12 Michigan St.	5695390	The Cursed Ball Ironclad Fist	Adventure Adventure	08/02/20	08/04/20	70.00
126	Lewis	John Tame	#24 Jacksonville St.	7892207	Simple Questions	Trivia	08/04/20	08/07/20	30.00
127	Sanders	Lory	#12 Hyacinth Ave.	8926673	Utterances of the Large	Horror	08/05/20	08/08/20	40.00
128	Ludwig	Sebastian	#11 Careful Park	8905781	Jaws of the Devil	Horror	08/06/20	08/09/20	40.00
129	Lewis	John Tame	#24 Jacksonville St.	7892207	Parking Guide	Manuals	08/08/20	08/11/20	30.00
130	Limper	Shawn Tup	#6 East Hill Ridge	5739978	Best Kept Secret Cooking	Recipes	08/08/20	08/11/20	30.00
131	Parkson	Patty	#90 Ericsson St.	1098749	Miracles of the Guise Fast Patch Mountains Fill Me Up with Gold	Adventure Adventure Business	08/09/20	08/12/20	120.00

First Normal Form (1NF)

- Each and every cell in the table should contain only ‘Atomic Data’
  Atomic Data means the data pertains only to a single fact not a composite of several facts.

Source Table (not normalized)

SIMPLE BOOK RENTAL DATABASE								
lname	**fname**	**address**	**phone**	**title**	**category**	**date_borrowed**	**due_date**	**amount**
Jennings	Larry	#34 Kensington St.	8787656	Entries of the Getter	Adventure	08/01/20	08/03/20	40.00
Gardson	Michelle	#12 Huracan Ave.	8782236	Courier's Choice	Business	08/01/20	08/03/20	35.00
Watson	James	#12 Michigan St.	5695390	The Cursed Ball Ironclad Fist	Adventure Adventure	08/02/20	08/04/20	70.00
Lewis	John Tame	#24 Jacksonville St.	7892207	Simple Questions	Trivia	08/04/20	08/07/20	30.00
Sanders	Lory	#12 Hyacinth Ave.	8926673	Utterances of the Large	Horror	08/05/20	08/08/20	40.00
Ludwig	Sebastian	#11 Careful Park	8905781	Jaws of the Devil	Horror	08/06/20	08/09/20	40.00
Lewis	John Tame	#24 Jacksonville St.	7892207	Parking Guide	Manuals	08/08/20	08/11/20	30.00
Limper	Shawn Tup	#6 East Hill Ridge	5739978	Best Kept Secret Cooking	Recipes	08/08/20	08/11/20	30.00
Parkson	Patty	#90 Ericsson St.	1098749	Miracles of the Guise Fast Patch Mountains Fill Me Up with Gold	Adventure Adventure Business	08/09/20	08/12/20	120.00

First Normal Form (1NF)

SIMPLE BOOK RENTAL DATABASE								
lname	**fname**	**address**	**phone**	**title**	**category**	**date_borrowed**	**due_date**	**amount**
Jennings	Larry	#34 Kensington St.	8787656	Entries of the Getter	Adventure	08/01/20	08/03/20	40.00
Gardson	Michelle	#12 Huracan Ave.	8782236	Courier's Choice	Business	08/01/20	08/03/20	35.00
Watson	James	#12 Michigan St.	5695390	The Cursed Ball	Adventure	08/02/20	08/04/20	40.00
Watson	James	#12 Michigan St.	5695390	Ironclad Fist	Adventure	08/02/20	08/04/20	30.00
Lewis	John Tame	#24 Jacksonville St.	7892207	Simple Questions	Trivia	08/04/20	08/07/20	30.00
Sanders	Lory	#12 Hyacinth Ave.	8926673	Utterances of the Large	Horror	08/05/20	08/08/20	40.00
Ludwig	Sebastian	#11 Careful Park	8905781	Jaws of the Devil	Horror	08/06/20	08/09/20	40.00
Lewis	John Tame	#24 Jacksonville St.	7892207	Parking Guide	Manuals	08/08/20	08/11/20	30.00
Limper	Shawn Tup	#6 East Hill Ridge	5739978	Best Kept Secret Cooking	Recipes	08/08/20	08/11/20	30.00
Parkson	Patty	#90 Ericsson St.	1098749	Miracles of the Guise	Adventure	08/09/20	08/12/20	40.00
Parkson	Patty	#90 Ericsson St.	1098750	Fast Patch Mountains	Adventure	08/10/20	08/13/20	40.00
Parkson	Patty	#90 Ericsson St.	1098751	Fill Me Up with Gold	Business	08/11/20	08/14/20	40.00

Second Normal Form (2NF)

- Should be in First Normal Form
- Every data in the table must be directly related to the primary key. Meaning no attribute should depend on any non-key attribute.
- If there are data that cannot be directly related to the primary key, it should be placed in a separate table with its own primary key and relate them together using a foreign key.

Second Normal Form (2NF)

SIMPLE BOOK RENTAL DATABASE								
lname	**fname**	**address**	**phone**	**title**	**category**	**date_borrowed**	**due_date**	**amount**
Jennings	Larry	#34 Kensington St.	8787656	Entries of the Getter	Adventure	08/01/20	08/03/20	40.00
Gardson	Michelle	#12 Huracan Ave.	8782236	Courier's Choice	Business	08/01/20	08/03/20	35.00
Watson	James	#12 Michigan St.	5695390	The Cursed Ball	Adventure	08/02/20	08/04/20	40.00
Watson	James	#12 Michigan St.	5695390	Ironclad Fist	Adventure	08/02/20	08/04/20	30.00
Lewis	John Tame	#24 Jacksonville St.	7892207	Simple Questions	Trivia	08/04/20	08/07/20	30.00
Sanders	Lory	#12 Hyacinth Ave.	8926673	Utterances of the Large	Horror	08/05/20	08/08/20	40.00
Ludwig	Sebastian	#11 Careful Park	8905781	Jaws of the Devil	Horror	08/06/20	08/09/20	40.00
Lewis	John Tame	#24 Jacksonville St.	7892207	Parking Guide	Manuals	08/08/20	08/11/20	30.00
Limper	Shawn Tup	#6 East Hill Ridge	5739978	Best Kept Secret Cooking	Recipes	08/08/20	08/11/20	30.00
Parkson	Patty	#90 Ericsson St.	1098749	Miracles of the Guise	Adventure	08/09/20	08/12/20	40.00
Parkson	Patty	#90 Ericsson St.	1098750	Fast Patch Mountains	Adventure	08/10/20	08/13/20	40.00
Parkson	Patty	#90 Ericsson St.	1098751	Fill Me Up with Gold	Business	08/11/20	08/14/20	40.00

Second Normal Form (2NF)

CUSTOMERS

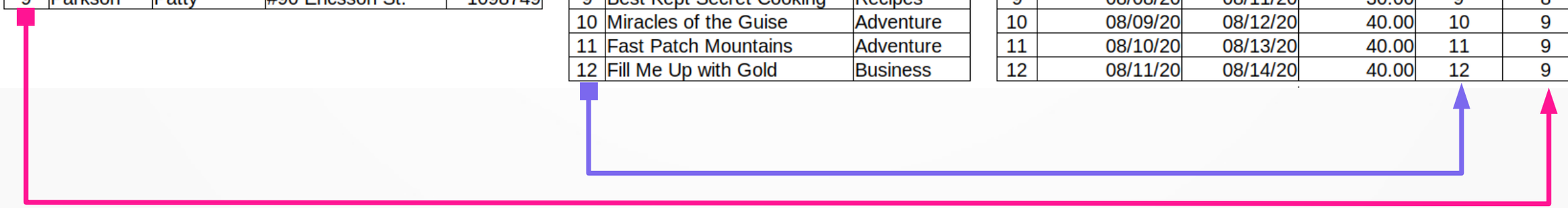
id	lname	fname	address	phone
1	Jennings	Larry	#34 Kensington St.	8787656
2	Gardson	Michelle	#12 Huracan Ave.	8782236
3	Watson	James	#12 Michigan St.	5695390
4	Lewis	John Tame	#24 Jacksonville St.	7892207
5	Sanders	Lory	#12 Hyacinth Ave.	8926673
6	Ludwig	Sebastian	#11 Careful Park	8905781
7	Lewis	John Tame	#24 Jacksonville St.	7892207
8	Limper	Shawn Tup	#6 East Hill Ridge	5739978
9	Parkson	Patty	#90 Ericsson St.	1098749

BOOKS

id	title	category
1	Entries of the Getter	Adventure
2	Courier's Choice	Business
3	The Cursed Ball	Adventure
4	Ironclad Fist	Adventure
5	Simple Questions	Trivia
6	Utterances of the Large	Horror
7	Jaws of the Devil	Horror
8	Parking Guide	Manuals
9	Best Kept Secret Cooking	Recipes
10	Miracles of the Guise	Adventure
11	Fast Patch Mountains	Adventure
12	Fill Me Up with Gold	Business

TRANSACTIONS

id	date_borrowed	due_date	amount	book_id	cust_id
1	08/01/20	08/03/20	40.00	1	1
2	08/01/20	08/03/20	35.00	2	2
3	08/02/20	08/04/20	40.00	3	3
4	08/02/20	08/04/20	30.00	4	3
5	08/04/20	08/07/20	30.00	5	4
6	08/05/20	08/08/20	40.00	6	5
7	08/06/20	08/09/20	40.00	7	6
8	08/08/20	08/11/20	30.00	8	7
9	08/08/20	08/11/20	30.00	9	8
10	08/09/20	08/12/20	40.00	10	9
11	08/10/20	08/13/20	40.00	11	9
12	08/11/20	08/14/20	40.00	12	9



Third Normal Form (3NF)

- The table has to be in second normal form
- There must be no transitive dependency

Transitive dependence – is when a column's value rely on another column's value through an intermediate column

Column A --> Column B -->Column C

Customer ID --> Customer City -->CustomerPostalCode

Third Normal Form (3NF)

CUSTOMERS

id	lname	fname	address	phone
1	Jennings	Larry	#34 Kensington St.	8787656
2	Gardson	Michelle	#12 Huracan Ave.	8782236
3	Watson	James	#12 Michigan St.	5695390
4	Lewis	John Tame	#24 Jacksonville St.	7892207
5	Sanders	Lory	#12 Hyacinth Ave.	8926673
6	Ludwig	Sebastian	#11 Careful Park	8905781
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8	Limper	Shawn Tup	#6 East Hill Ridge	5739978
9	Parkson	Patty	#90 Ericsson St.	1098749

BOOKS

id	title	category
1	Entries of the Getter	Adventure
2	Courier's Choice	Business
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5	Simple Questions	Trivia
6	Utterances of the Large	Horror
7	Jaws of the Devil	Horror
8	Parking Guide	Manuals
9	Best Kept Secret Cooking	Recipes
10	Miracles of the Guise	Adventure
11	Fast Patch Mountains	Adventure
12	Fill Me Up with Gold	Business

TRANSACTIONS

id	date_borrowed	due_date	amount	book_id	cust_id
1	08/01/20	08/03/20	40.00	1	1
2	08/01/20	08/03/20	35.00	2	2
3	08/02/20	08/04/20	40.00	3	3
4	08/02/20	08/04/20	30.00	4	3
5	08/04/20	08/07/20	30.00	5	4
6	08/05/20	08/08/20	40.00	6	5
7	08/06/20	08/09/20	40.00	7	6
8	08/08/20	08/11/20	30.00	8	7
9	08/08/20	08/11/20	30.00	9	8
10	08/09/20	08/12/20	40.00	10	9
11	08/10/20	08/13/20	40.00	11	9
12	08/11/20	08/14/20	40.00	12	9

Third Normal Form (3NF)

emp_id	emp_name	emp_zip	emp_town	emp_province
1	Sean Gibbons	6329	Tubigon	Bohol
2	Daryl Deel	6330	Clarin	Bohol
3	Cora Peekah	6328	Calape	Bohol

emp_id	emp_name	emp_zip
1	Sean Gibbons	6329
2	Daryl Deel	6330
3	Cora Peekah	6328

emp_zip	emp_town	emp_province
6329	Tubigon	Bohol
6330	Clarin	Bohol
6328	Calape	Bohol

Normalize until it hurts,
denormalize until it works!