Normal Form

Below data is used to describe information of treatment for pets at a pet medical center. Using decomposition technique to model these data into relational model basing normal forms. You should start from 1NF to 3NF.

1. Healthy history report

PET ID	PET NAME	PET TYPE	PET AGE	OWNER	VISIT DATE	PROCEDURE
246	ROVER	DOG	12	SAM COOK	JAN 13/2002	01 - RABIES VACCINATION
					MAR 27/2002	10 - EXAMINE and TREAT WOUND
					APR 02/2002	05 - HEART WORM TEST
298	SPOT	DOG	2	TERRY KIM	JAN 21/2002	08 - TETANUS VACCINATION
					MAR 10/2002	05 - HEART WORM TEST
341	MORRIS	CAT	4	SAM COOK	JAN 23/2001	01 - RABIES VACCINATION
					JAN 13/2002	01 - RABIES VACCINATION
519	TWEEDY	BIRD	2	TERRY KIM	APR 30/2002	20 - ANNUAL CHECK UP
					APR 30/2002	12 - EYE WASH

1NF

A relation R is in first normal form (1NF) if and only if all underlying domains contain atomic values only.

In the table above, PET ID is the primary key. It's not 1NF because there are still repeating groups.

To make it 1NF, we create new rows so each cell contains only one value.

PET ID	PET NAME	PET TYPE	PET AGE	OWNER	VISIT DATE	PROCEDURE_ID	PROCEDURE_DESCRIPTION
246	ROVER	DOG	12	SAM COOK	Jan 13/2002	01	RABIES VACCINATION
246	ROVER	DOG	12	SAM COOK	Mar 27/2002	10	EXAMINE and TREAT WOUND
246	ROVER	DOG	12	SAM COOK	Apr 02/2002	05	HEART WORM TEST
298	SPOT	DOG	2	TERRY KIM	Jan 21/2002	08	TETANUS VACCINATION
298	SPOT	DOG	2	TERRY KIM	Mar 10/2002	05	HEART WORM TEST
341	MORRIS	CAT	4	SAM COOK	Jan 23/2001	01	RABIES VACCINATION
341	MORRIS	CAT	4	SAM COOK	**Jan 13/2002**	01	RABIES VACCINATION
519	TWEEDY	BIRD	2	TERRY KIM	**Apr 30/2002**	20	ANNUAL CHECK UP
519	TWEEDY	BIRD	2	TERRY KIM	**Apr 30/2002**	12	EYE WASH

But the PET ID no longer uniquely identifies each row. We now need to declare PET ID and PROCEDURE

ID together to uniquely identify each row. So the new key is PET ID and PROCEDURE ID .

2NF

A relation R is in second normal form (2NF) if and only if it is in 1NF and every non-key attribute is fully dependent on the primary key

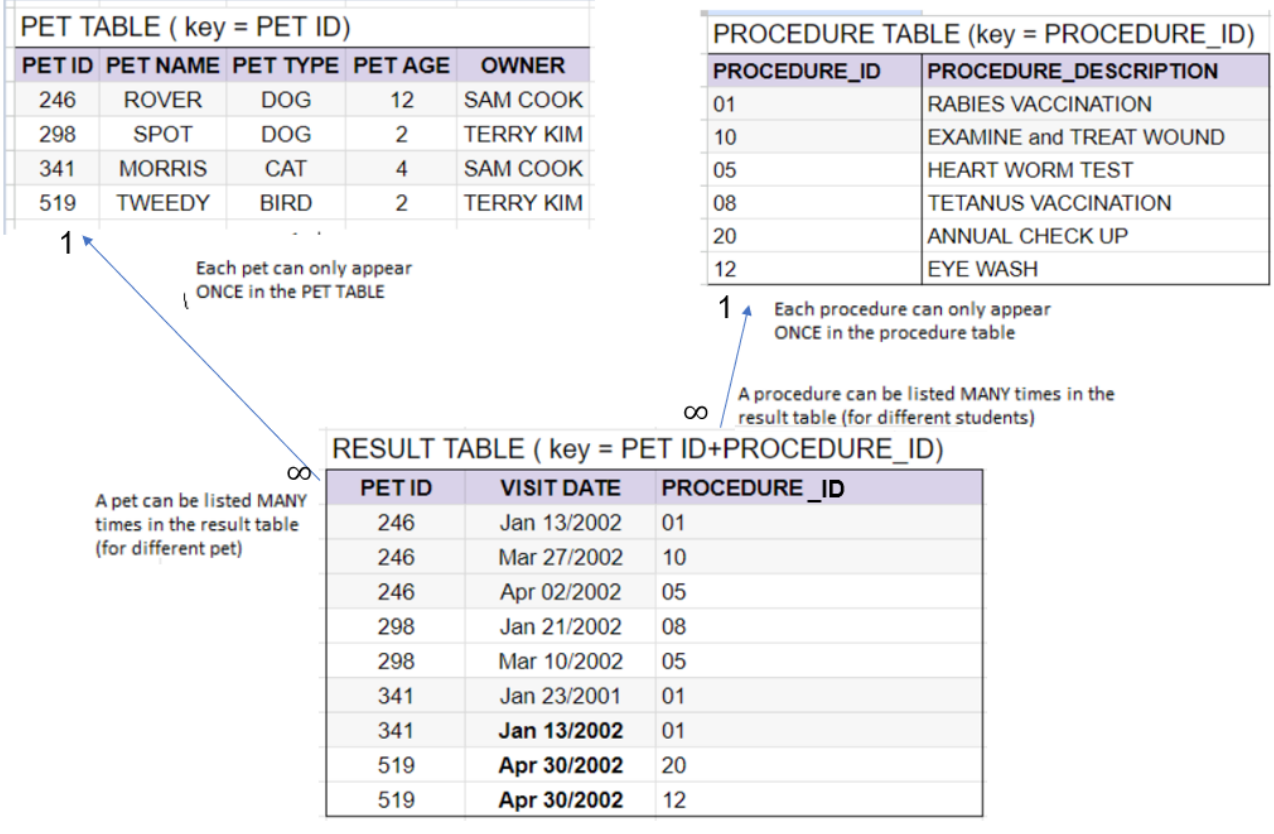
PET NAME, PET TYPE, PET AGE, OWNER are dependent on PET ID (which is part of the key)

But they are not dependent on VISIT DATE (the other part of the key)

==> So it's not 2NF

To fix it, we:

- Make a new table for each primary key field
- Give each new table its own primary key
- Move columns from the original table to the new table that matches their primary key.



So it is 2NF.

3NF

A relation R is in third normal form (3NF) if and only if it is in 2NF and every non-key attribute is non-transitively dependent on the primary key.

PET TABLE (key = PET ID)

PET ID	PET NAME	PET TYPE	PET AGE	OWNER
246	ROVER	DOG	12	SAM COOK
298	SPOT	DOG	2	TERRY KIM
341	MORRIS	CAT	4	SAM COOK
519	TWEEDY	BIRD	2	TERRY KIM

1

Each pet can only appear ONCE in the PET TABLE

PROCEDURE TABLE (key = PROCEDURE_ID)

PROCEDURE_ID	PROCEDURE_DESCRIPTION
01	RABIES VACCINATION
10	EXAMINE and TREAT WOUND
05	HEART WORM TEST
08	TETANUS VACCINATION
20	ANNUAL CHECK UP
12	EYE WASH

1

Each procedure can only appear ONCE in the procedure table

∞

A procedure can be listed MANY times in the result table (for different students)

∞

A pet can be listed MANY times in the result table (for different pet)

RESULT TABLE (key = PET ID+PROCEDURE_ID)

PET ID	VISIT DATE	PROCEDURE _ID
246	Jan 13/2002	01
246	Mar 27/2002	10
246	Apr 02/2002	05
298	Jan 21/2002	08
298	Mar 10/2002	05
341	Jan 23/2001	01
341	**Jan 13/2002**	01
519	**Apr 30/2002**	20
519	**Apr 30/2002**	12

2. Invoice

1NF

Primary key = PET ID + INVOICE ID

PET ID	PET NAME	PROCEDURE	AMOUNT	INVOICE ID	INVOICE DATE	OWNER	OWNER ADDRESS	POSTAL CODE
1	ROVER	RABIES VACCINATION	30	987	Jan 13/2002	MR. RICHARD COOK	123 THIS STREET - MY CITY, ONTARIO	Z5Z 6G6
2	MORRIS	RABIES VACCINATION	24	987	Jan 13/2002	MR. SAM COOK	123 THIS STREET - MY CITY, ONTARIO	Z5Z 6G6

2NF

INVOICE TABLE (KEY = INVOICE ID)

INVOICE ID	INVOICE DATE	OWNER	OWNER ADDRESS	POSTAL CODE
987	Jan 13/2002	MR. RICHARD COOK	123 THIS STREET - MY CITY, ONTARIO	Z5Z 6G6
987	Jan 13/2002	MR. RICHARD COOK	123 THIS STREET - MY CITY, ONTARIO	Z5Z 6G6

1

Each invoice can only appear ONCE in the invoice table

PET TABLE (KEY = PET ID)

PET ID	PET NAME
1	ROVER
2	MORRIS

Each pet can only appear ONCE in the pet table

1

∞

A invoice can be listed MANY times in the result table (for different invoice)

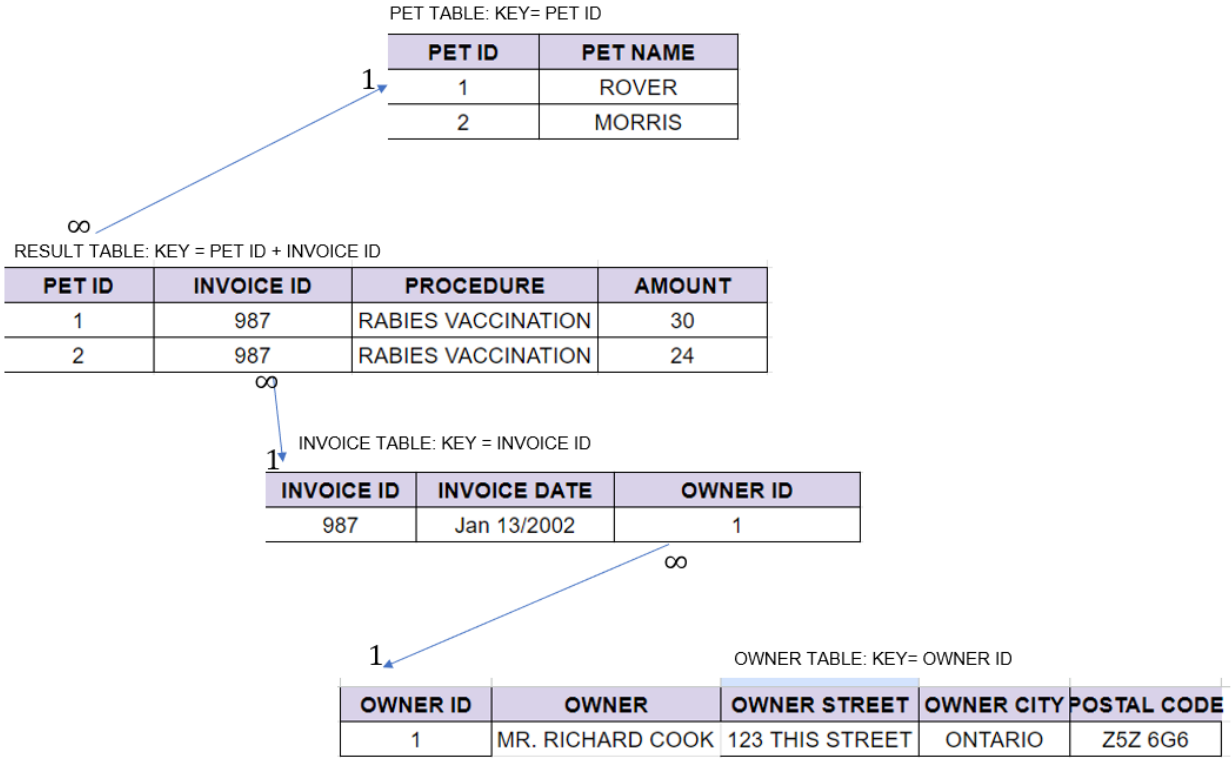
∞

A pet can be listed MANY times in the result table (for different pet)

RESULT TABLE (KEY = PET ID + INVOICE ID)

PET ID	INVOICE ID	PROCEDURE	AMOUNT
1	987	RABIES VACCINATION	30
2	987	RABIES VACCINATION	24

3NF


PET TABLE: KEY= PET ID
PET ID
PET NAME
1
ROVER
2
MORRIS
1
∞
RESULT TABLE: KEY = PET ID + INVOICE ID
PET ID
INVOICE ID
PROCEDURE
AMOUNT
1
987
RABIES VACCINATION
30
2
987
RABIES VACCINATION
24
∞
1
INVOICE TABLE: KEY = INVOICE ID
INVOICE ID
INVOICE DATE
OWNER ID
987
Jan 13/2002
1
∞
1
OWNER TABLE: KEY= OWNER ID
OWNER ID
OWNER
OWNER STREET
OWNER CITY
POSTAL CODE
1
MR. RICHARD COOK
123 THIS STREET
ONTARIO
Z5Z 6G6