



The National University of Computer and Emerging Sciences

**Class Participation:
Database Systems**

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INVOICE

HILLTOP ANIMAL HOSPITAL
INVOICE # 987

DATE: JAN 13/2002

MR. RICHARD COOK
123 THIS STREET
MY CITY, ONTARIO
Z5Z 6G6

<u>PET</u>	<u>PROCEDURE</u>	<u>AMOUNT</u>
ROVER	RABIES VACCINATION	30.00
MORRIS	RABIES VACCINATION	24.00
TOTAL		54.00
TAX (8%)		<u>4.32</u>
AMOUNT OWING		<u>58.32</u>

Unnormalized Form (UNF):

UNF refers to a state where data is organized in no particular order or structure. It's essentially the starting point before any normalization process has been applied. The data at this point is disorganized and is inefficient. The Schema is as below:

- **Invoice [invoice_no, invoice_date, cust_name, cust_addr, (pet_name, procedure, amount)]**

Here (pet_name, procedure, amount) are composite attributes. In case if we fill data into table:

<u>invoice_no</u>	invoice_date	cust_name	cust_addr	(pet_name, procedure, amount)
987	Jan 13/2002	Mr.Richard Cook	123 This Street, My City, Ontario	Rover, Rabies Vaccination, 30.00
				Morris, Rabies Vaccination, 24.0

Here **invoice_no** is a Primary Key (as shown by the underline).

First Normal Form (1NF):

1NF requires that the table structure be flat, meaning each column should contain only atomic values (single valued attributes). No composite attributes (such as the (**pet_name, procedure, amount**) values) given in the previous UNF. Moreover, each column must have a unique name but the order doesn't matter. We divide the table into 2 different tables (that are connected using foreign keys). The Schema is as Under:

- **Invoice** [**invoice_no**, **invoice_date**, **cust_name**, **cust_addr**]
- **Invoice_Pet** [**invoice_no**, **pet_id**, **pet_name**, **procedure**, **amount**]

Here **invoice_no** in **Invoice_Pet** table is a Foreign Key of **invoice_no** in **Invoice** table. The tables with data are as under:

<u>invoice_no</u>	invoice_date	cust_name	cust_addr
987	Jan 13/2002	Mr. Richard Cook	Ontario

<u>invoice_no</u>	<u>pet_id</u>	pet_name	procedure	amount
987	001	Rover	Rabies Vaccination	30.00
987	002	Morris	Rabies Vaccination	24.00

Underlined columns are Primary Keys. In the 2nd table, **invoice_no** and **pet_id** make a Composite Key.

Note: **pet_id** was chosen as a good as ky because **pet_name** is a string and thus not a good key candidate.

Second Normal Form (2NF):

2NF builds upon 1NF and eliminates partial dependencies. A table is in 2NF if it is in 1NF and all non-prime attributes are fully functionally dependent on the primary key. The schema is below:

- **Invoice** [**invoice_no**,**invoice_date**, **cust_name**, **cust_addr**]
- **Invoice_Pet** [**invoice_no**, **pet_id**, **procedure**, **amount**]
- **Pet** [**pet_id**, **pet_name**]

The filled tables are as below:

<u>invoice_no</u>	invoice_date	cust_name	cust_addr
987	Jan 13/2002	Mr. Richard Cook	Ontario

<u>invoice_no</u>	<u>pet_id</u>	procedure	amount
987	001	Rabies Vaccination	30.00
987	002	Rabies Vaccination	24.00

<u>pet_id</u>	pet_name
001	Rover
002	Morris

Here all Underlined are Primary Keys, but if more than one is underlined in table, it makes Composite Key with others.

Third Normal Form (3NF):

3NF builds upon 2NF and eliminates transitive dependencies. A table is in 3NF if it is in 2NF and no non-prime attribute is transitively dependent on the primary key. Transitive dependency means that a non-prime attribute is functionally dependent on another non-prime attribute, which is itself functionally dependent on the primary key. The Schema is as Under:

- Invoice [invoice_no, invoice_date, cust_no (FK)]
- Invoice_Pet [invoice_no (FK), pet_id (FK), procedure, amount]
- Pet [pet_id, pet_name]
- Customer [cust_no, cust_name, cust_street, cust_city, cust_pstlcd]

Here FK means that the Column is a Foreign Key of another Tables Column. **cust_no (FK)** is a Foreign Key to **cust_no** in **Customer** Table. Similarly, other Keys are Foreign Keys of Similarly named columns in other Tables. The data filled tables are below:

<u>invoice_no</u>	invoice_date	Cust_no (FK)
987	Jan 13/2002	1

<u>Invoice_no</u> (FK)	<u>Pet_id</u> (FK)	procedure	amount
987	001	Rabies Vaccination	30.00
987	002	Rabies Vaccination	24.00

<u>pet_id</u>	pet_name
001	Rover

002	Morris
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<u>cust_no</u>	cust_name	street	cust_city	cust_pstcd
1	Mr. Richard Cook	123 This Street	Ontario	
