

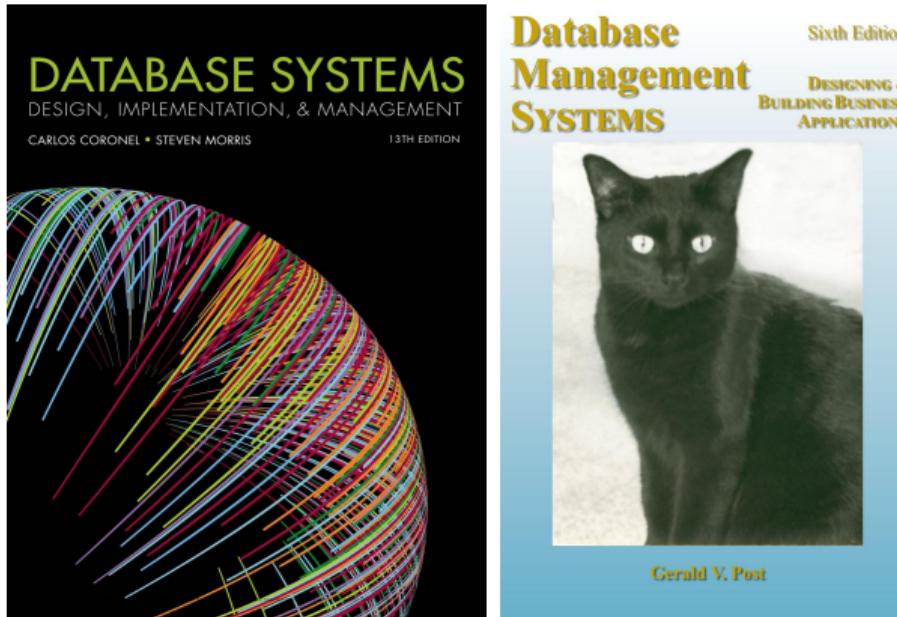
# Database Administration

## Lecture 02: What is Metadata?

Coronel, Morris & Post

February 2, 2026

# Database Administration: What is Metadata?.



Content has been extracted from *Database Systems: Design, Implementation, and Management.*, 13th Edition, by Carlos Coronel & Steven Morris. Cengage Learning. 2018. and *Database Management Systems: Designing & Building Business Applications.*, 6th Edition, by Gerald Post. McGraw-Hill/Irwin. 2014.

Visit <https://www.cengage.com/c/database-systems-design-implementation-management-13e-coronel/9781337627900PF/> and <https://www.jerrypost.com/database/DBBookSummary.html>.

# Plan

What is Metadata?

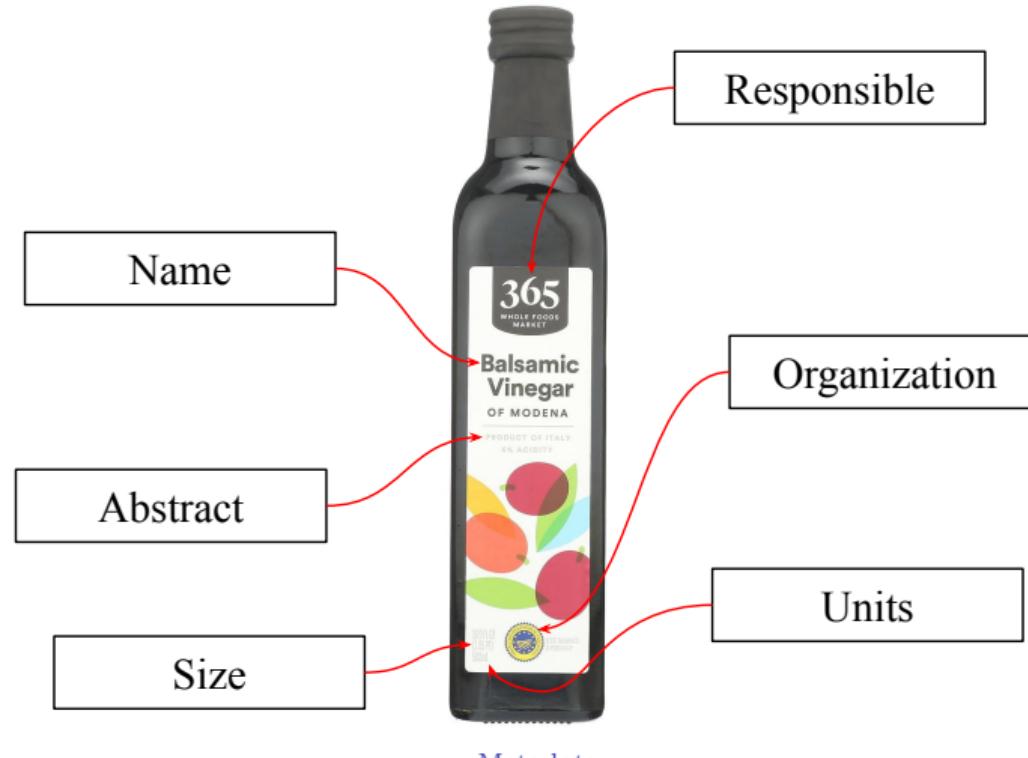
Metadata Examples

Database Administration Tools

Understanding PostgreSQL System Catalogs

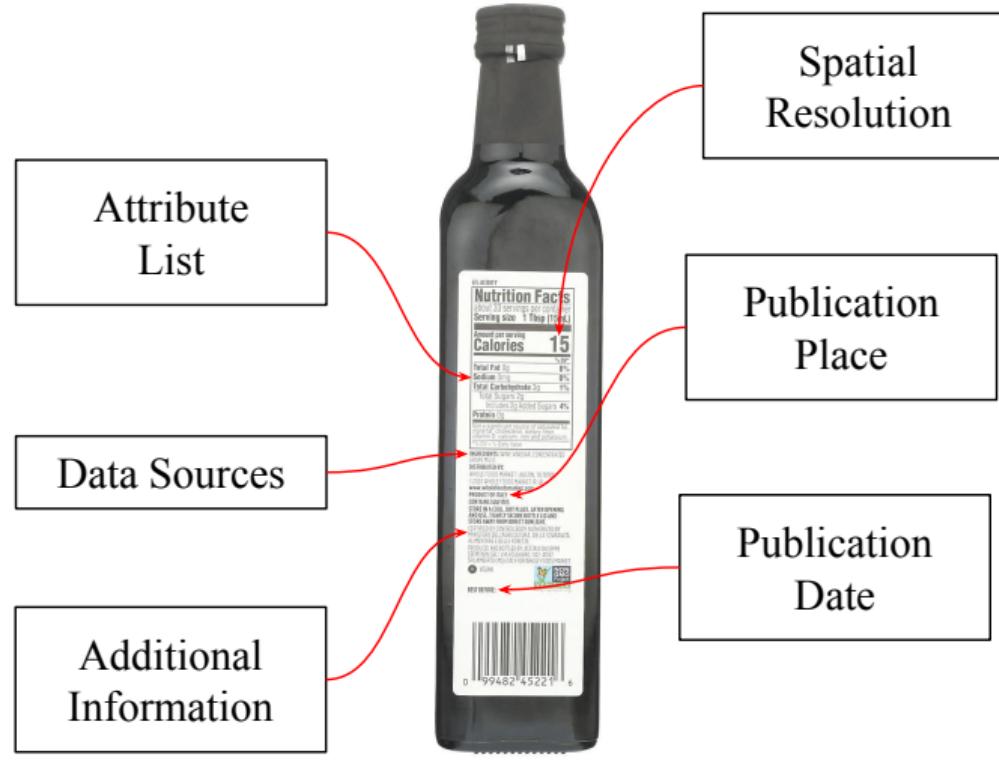
# Metadata

- Metadata is data about data. Data describing the properties or characteristics of the data: data types, size, domain, range, valid values, ...



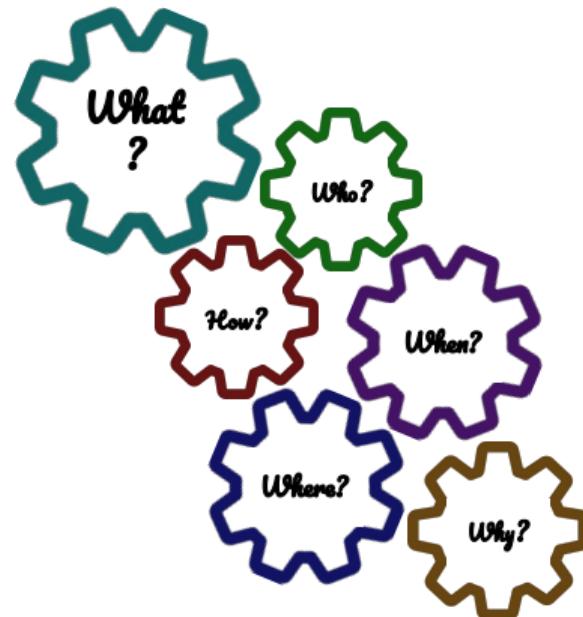
# Metadata

- Metadata is data about data. Data describing the properties or characteristics of the data: data types, size, domain, range, valid values, ...



# Metadata

- ▶ Metadata is data about data. Data describing the properties or characteristics of the data: data types, size, domain, range, valid values, ...



# Plan

What is Metadata?

Metadata Examples

Database Administration Tools

Understanding PostgreSQL System Catalogs

# Photos



# Photo Metadata

File info

File name  
twenty20\_6a15a8be-38e1-4ab7-a459-5470d0e29c82

Date taken  
November 29 2017  
1 16 PM

Size  
8.9 MB

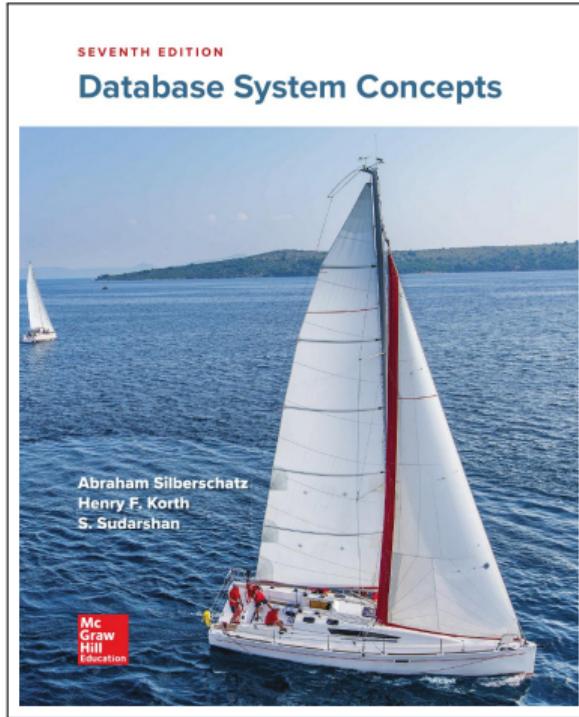
Dimensions  
4256 x 2832

Properties

Property	Value
Horizontal resolution	720 dpi
Vertical resolution	300 dpi
Bit depth	24
Compression	2
Resolution unit	sRGB
Compressed bits/pixel	
Camera	
Camera maker	NIKON CORPORATION
Camera model	NIKON D700
F-stop	f/2.5
Exposure time	1/800 sec.
ISO speed	ISO-200
Exposure bias	0 step
Focal length	28 mm
Max aperture	1.6
Metering mode	Pattern
Subject distance	



# Books



# Book Metadata

Edit metadata - Database System Concepts - [8 of 97]

Title: Database System Concepts  
Author(s): Abraham Silberschatz & Henry Korth & S. Sudarshan  
Series:

Title sort: Database System Concepts  
Author sort: Silberschatz, Abraham & Korth, Henry & Sudarshan, S.  
Number: 1.00

PDF (16.54 MB)

Change cover

Browse Remove Trim borders  
Download cover Generate cover

Comments

SEVENTH EDITION

**Database System Concepts**



Abraham Silberschatz  
Henry F. Korth  
S. Sudarshan

McGraw Hill Education

1107 x 1369

Billing: Not rated  
Tags: 7th Edition  
Id: isbn:9780078022159  
Date: 26 Jan 2025  
Published: Mar 2019  
Publisher:  
Languages:

What's New in the 7th Edition?

Extensive coverage of Big Data systems, from the user perspective (Chapter 10), as well as from an internal perspective (Chapters 20 through 23). Updates to all the internal chapters to reflect current-generation technology, such as solid-state disks, main-memory databases, multi-core systems, and parallel and distributed databases. Coverage of semi-structured data management using JSON, RDF, and updated coverage of temporal data, data analytics, and advanced indexing techniques such as write-optimized indices. Reorganization and update of chapters to better support courses with a significant hands-on component, including use of current-generation application development tools and Big Data systems such as Apache Hadoop and Spark. New chapter on Blockchain Databases (Chapter 26) that introduces blockchain technology and its growing role in enterprise applications.

Download metadata

Normal view HTML source

Previous Next Cancel OK

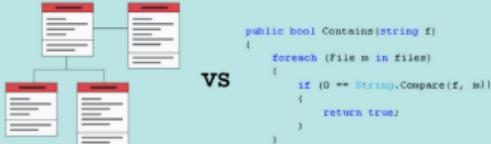
0 Data files

My account Book a demo Search

Dataedo Product Technologies Solutions Pricing Resources About Us Book a demo Try Dataedo

## Why It Is More Important to Document Database Than Application Code

Piotr Kononow 3rd August, 2017 Database Documentation · Software Development



The diagram illustrates the comparison between database documentation and application code. On the left, a hierarchical tree diagram represents a database schema, showing tables and their relationships. On the right, a vertical stack of four rectangular boxes represents application code, specifically C# code for a method named Contains. The code checks if a string 'z' is present in a list of files.

```
public bool Contains(string z)
{
    foreach (File m in files)
    {
        if (0 == String.Compare(z, m))
        {
            return true;
        }
    }
}
```

We all know (I hope) how important it is to comment code we develop and maintain. We do it to make it easier to scan and understand it. To be able to test and modify it. For our colleagues and ourselves when we get back to it a few months later.

I want to make a case that documenting data structures (tables and columns) in our applications databases is **more important**, but even more overlooked than documentation of code. Here are a few reasons why I believe so.

Database goes beyond implementation project  
More access points  
More users  
Users are more scattered: organizationally and geographically  
And in time

We all know (I hope) how important it is to comment code we develop and maintain. We do it to make it easier to scan and understand it. To be able to test and modify it. For our colleagues and ourselves when we get back to it a few months later.

I want to make a case that documenting data structures (tables and columns) in our applications databases is **more important**, but even more overlooked than documentation of code. Here are a few reasons why I believe so.

Database goes beyond implementation project

More access points

More users

Users are more scattered:  
organizationally and geographically  
And in time

# Blog Metadata

ⓘ 🔒 <https://dataedo.com/blog/why-it-is-more-important-to-document-database-than-application-code>

Metadata

Document  
Database Schema  
vs  
Application Code



## Why It Is More Important to Document Database Than Application Code

 Plotr Kononow ⏲ 1 year ago

Database Documentation · Software Development · Why

Metadata

We all know (I hope) how important it is to comment code we develop and maintain. We do it to make it easier to scan and understand it. To be able to test and modify it. For our colleagues and ourselves when we get back to it a few months later.

Data

I want to make a case that documenting data structures (tables and columns) in our applications databases is **more important**, but even more overlooked than documentation of code. Here are a few reasons why I believe so.

<https://dataedo.com/kb/data-glossary/what-is-metadata>

Metadata

13 / 44

# Emails

ETD Administrator etdadministrator@proquest.com

To andress.calderon@gmail.com 2/4/25, 21:22

Published to ProQuest: Scaling Spatial Overlay Operations and Flock Pattern Discovery

Dear Andres Calderon,

Congratulations! "Scaling Spatial Overlay Operations and Flock Pattern Discovery" has now been published to the ProQuest platform.

You may [view your work on ProQuest](#) or [order bound copies](#).

Regards,  
Your ProQuest team, part of Clarivate

---

A message from your team at ProQuest, part of Clarivate

CURRENT STATUS

**Published | ProQuest**



STATUS DESCRIPTION

The publishing optimization process is complete. "Scaling Spatial Overlay Operations and Flock Pattern Discovery" has been published to the ProQuest platform.

# Email Metadata

The screenshot illustrates the concept of Email Metadata. It shows an email message from Dataedo Store (dataedo@dataedo.com) with the subject "Your Dataedo order 2018/718". The message body contains a Dataedo logo, a thank you note, and order details. A red box highlights the "Properties" window, which is overlaid on the message body. The "Properties" window contains sections for "Settings", "Security", "Tracking options", "Delivery options", and "Internet headers". Labels "Data" and "Metadata" are present: "Data" points to the main message body, and "Metadata" points to the "Properties" window.

13.09.2018 19:10

Dataedo Store <dataedo@dataedo.com>

Your Dataedo order 2018/718

Do  dataedo@dataedo.com

 Dataedo\_invoice\_2018-D-461.pdf 792 KB

 Dataædo

Thank you for choosing Dataedo. We are sure you will find it useful.  
You will find your keys below and invoice in attachment of this email.  
If you need any information or assistance respond to this email.

**Order details**

Order #:	2018/718
Order date:	2018/09/13
Status:	Paid
Payment method:	PayPal

**Items**

Product	Price
Dataedo Pro - 1 Year Subscription	\$468

**Grand Total**

**Your key**

**Dataedo Pro - 1 Year Subscription (1 user)**

ENJELJEDJDNLBMDHADENADDODPHOMLJI  
LHNFKANHKJBEEAPEOIIAAODBLGFBMOFHD  
NKGLNIPPHMDIMDBPLELKRFMFDNCMAHBP  
BCGGNCBMJPNHFLIKGMDCCNAMKRPJHGHN  
FHADBEHIOKFDFGEONIJFCLLJIMADANLENHLI  
PDKBNPPFJDDIEGNLCLMJFFPMRMIGGAAO  
NKGLNIPPHMDIMDBPLELKKFMFDNCMAHBP  
BCGGNCBMJPNHPLIKGMDCCNAMKRPJHGHN

**Properties**

**Settings**

Importance: Normal  
Sensitivity: Normal

Encrypt message contents and attachments  
 Add digital signature to outgoing message  
 Request S/MIME receipt for this message  
 Do not AutoArchive this item

**Tracking options**

Request a delivery receipt for this message  
 Request a read receipt for this message

**Delivery options**

Have replies sent to:   
 Expires after:  None  12:00 AM

**Contacts...**   
**Categories**:  None

**Internet headers**

```
Received: from 124135.cloudwaysapps.com (104.131.29.249) (HELO dataedo.com)
by server1307517.home.pl (188.128.181.235) with SMTP (lideaSmtpServer
0.83.148)
id 05e24d77096d7dee; Thu, 13 Sep 2018 19:10:22 +0200
Reply-To: <jm@dataedo.com>
From: "Dataedo Store" <dataedo@dataedo.com>
```

**Data**

**Metadata**

# Documents

The screenshot shows a LibreOffice Writer document window. The title of the document is "Capítulo\_Núñez\_Calderón\_Díaz\_Sierra\_Vásquez.odt - LibreOffice Writer". The main content of the document is as follows:

**Potencial de la Inteligencia Artificial en Teledetección para el Desarrollo Sostenible y la Gestión Ambiental**

Haydennar Núñez<sup>1</sup>, Andrés Calderón<sup>3</sup>, Nicolás Díaz<sup>1</sup>, Rocío Sierra<sup>2</sup>, David Vásquez<sup>1</sup>

<sup>1</sup>Departamento de Ingeniería de Sistemas y Computación. Universidad de los Andes.

<sup>2</sup>Departamento de Ingeniería Química y Alimentos. Universidad de los Andes

<sup>3</sup>Department of Computer Science, University of California

La teledetección ha emergido como una valiosa herramienta para la observación y comprensión de nuestro entorno terrestre a través de la captura de datos con sensores remotos. Debido a la complejidad de los procesos relacionados con esta tecnología, en los últimos años se han venido utilizando técnicas de inteligencia artificial (IA) para el análisis e interpretación de imágenes satelitales. La combinación de teledetección e inteligencia artificial mejora nuestro entendimiento de los cambios ambientales a escala global, regional y local, y apoya las acciones favorables al desarrollo sostenible y la gestión efectiva de recursos naturales. Utilizando

Page 1 of 24     6,309 words, 43,493 characters     Default Page Style     Spanish (Colombia)     140%

# Document Metadata

The screenshot shows a LibreOffice Writer window with the title bar "Capítulo\_Núñez\_Calderon\_Díaz\_Sierra\_Vasquez.odt - LibreOffice Writer". The main menu bar includes File, Edit, View, Insert, Format, Styles, Table, Form, Tools, Window, and Help. A toolbar with various icons for text, tables, and graphics is visible above the document area. The document content area contains several paragraphs of text. A properties dialog box is open in the foreground, titled "Properties of 'Capítulo\_Núñez\_Calderon\_Díaz\_Sierra\_Vasquez'". The "General" tab is selected, displaying the following information:

Property	Value
Type	OpenDocument Text
Location	/home/and/downloads
Size	4.54 MB (4,757,295 Bytes)
Created	00/00/0000, 00:00:00
Modified	(no value)
Template	(no value)
Digitally signed	(no value)
Last printed	(no value)
Total editing time	00:00:00
Revision number	0

Below these fields are two checkboxes: "Apply user data" (checked) and "Save preview image with this document" (checked). At the bottom of the dialog box are "Help", "Reset", "OK", and "Cancel" buttons.

At the bottom of the LibreOffice interface, status bars show "Page 1 of 24", "6,309 words, 43,493 characters", "Default Page Style", "Spanish (Colombia)", and zoom controls at "140%".

# Spreadsheets

Diccionario\_Datos\_Niveles\_Variables\_MGN\_CNPV2018int.xlsx

File Edit View Insert Format Data Tools Help

Menus 100% \$ .0 .00 123 Quadrat... 7 B I A F G H I J K L M N O P Q E3 fx: Categoría original

**DANE**  
INFORMACIÓN PARA TODOS

**Atributos y variables nivel departamento**

VARIABLE	TIPO	LARGÜDAD	DESCRIPCIÓN	Categoría original
DPD_CODIGO	Text	2	Código del departamento	
DPD_CHMBS	Text	250	Nombrer del departamento	
VERSION	Long Integral		Mólo la vigencia de la información del departamento	
AREA	Double		Área del Departamento en metros cuadrados (Sistema de coordenadas planas MOLNI, Colombia, Regional)	
LATITUD	Double		Coordenada de latitud central del departamento	
LONGITUD	Double		Coordenada de longitud central del departamento	
FECHACENSA	Double		Fecha de Encuesta CNPV 2018	
MPV_1_M	Double		Cantidad de encuestas que reportaron estar en territorio-Méico	
MPV_2_M	Double		Cantidad de encuestas que reportaron no estar en territorio-Méico	
MPV_B	Double		Cantidad de encuestas que reportaron estar en territorio étnico, Pueblos indígenas	Pueblos Indígenas
MPV_TCN	Double		Cantidad de encuestas que reportaron estar en territorio étnico Territorio colectivo de comunidades negras	TCCN
MPV_LSP	Double		Cantidad de encuestas que reportaron estar en áreas protegidas	Áreas protegidas
MPV_ZNEQ	Double		Cantidad de encuestas que reportaron no estar en áreas protegidas	
STP1_1_M	Double		Cuentas de unidades con uso vivienda	Vivienda
STP1_2_M	Double		Cuentas de unidades con uso-misto	Misto Espacio independiente y separado que combina vivienda con otro uso no residencial
STP1_3_M	Double		Cuentas de unidades con uso no-residencial	Uso(es) NO Residencial (Espacio independiente y separado con uso diferente a vivienda)
STP1_4_M	Double		Cuentas de unidades con uso UEA	Espacio especial de alojamiento (UEA)
STP1_2_2_M	Double		Cuentas de unidades mixtas con uso no-residencial industria	Industria
STP1_2_3_M	Double		Cuentas de unidades mixtas con uso no-residencial comercio	Comercio
STP1_2_3_M	Double		Cuentas de unidades mixtas con uso no-residencial servicios	Servicios
STP1_2_4_M	Double		Cuentas de unidades mixtas con uso no-residencial agrícola, agroindustrial, forestal	Agrícola/agroindustrial/forestal
STP1_2_5_M	Double		Cuentas de unidades mixtas con uso no-residencial sin información	Sin información
STP1_3_1_N	Double		Cuentas de unidades no-residenciales con uso Industria	Industria
STP1_3_1_N	Double		Cuentas de unidades no-residenciales con uso Comercio	Comercio
STP1_3_2_N	Double		Cuentas de unidades no-residenciales con uso Servicios	Servicios
STP1_3_3_N	Double		Cuentas de unidades no-residenciales con uso Agrícola	Agrícola
STP1_3_3_N	Double		Cuentas de unidades no-residenciales con uso Agroindustrial, Agroindustrial/Forestal	Agrícola/agroindustrial/forestal
STP1_3_4_N	Double		Cuentas de unidades no-residenciales con uso Institucional	Institucional
STP1_3_5_N	Double		Cuentas de unidades no-residenciales con uso Lote/Parcela en construcción	Lote/Parcela en construcción
STP1_3_7_N	Double		Cuentas de unidades no-residenciales con uso Parque/Zone Verde	Parque/Zone Verde
STP1_3_8_N	Double		Cuentas de unidades no-residenciales con uso Minero-Energética	Minero-Energética
STP1_3_9_N	Double		Cuentas de unidades no-residenciales con uso Protección/Comunicación ambiental	Protección/Conservación ambiental
STP1_3_10_N	Double		Cuentas de unidades no-residenciales con uso Protección/Comunicación ambiental	Protección/Comunicación ambiental

Convert to table

Andres Calderon -- 4:57 PM Today  
Provienre del linaje de datos

Departamento Municipio Municipio Clase Sector rural Sección rural Zona Urbana Sector urbano Sección urbana Manzana

# Spreadsheets Metadata

Diccionario\_Datos\_Niveles\_Variables\_MGN\_CNPV2018Int.xlsx

File Edit View Insert Format Data Tools Help

Menus 100% \$ .00 123 Quattro... 7 + B I A F G H I J K L M N O P Q E3 fx! Categoría original

**DANE**  
INFORMACIÓN PARA TODOS

**Atributos y variables nivel departamento**

**Document details**

Andres Calderon ...  
4:57 PM Today  
Propietario del linaje de datos

Location: SHP\_MGN2018\_INTGRD\_MPIO

Owner: me

Modified: 4:57 PM by Andres Calderon Romero

Created: Sep 12, 2022

Convert to table

VARIABLE	TIPO	LARGITUD	DESCRIPCIÓN	Categoría original
DPDO_CODIGO	Ent	2	Código del departamento	
DPDO_CHMNR	Ent	250	Nombre del departamento	
MEDISON	Long double		Altura de la vigencia de la información del departamento	
AREA	Double		Área del departamento en metros cuadrados (Sistema de coordenadas planas MAFNA, Colombia, Bogotá)	
LATITUD	Double		Coordenada de latitud central del departamento	
LONGITUD	Double		Coordenada de longitud central del departamento	
ESTCNTRICAS	Double		Cantidad de Encuestas CNPV 2018	
STPI_1_SI	Double		Cantidad de encuestas que reportaron estar en territorio étnico	
STPI_2_NO	Double		Cantidad de encuestas que reportaron no estar en territorio étnico	
STPI_3_SI	Double		Cantidad de encuestas que reportaron estar en territorio étnico Resguardos indígenas	Resguardos Indígenas
STPI_4_TDN	Double		Cantidad de encuestas que reportaron estar en territorio étnico Territorio colectivo de comunidades negras	TCCN
STPI_4_1_SI	Double		Cantidad de encuestas que reportaron estar en áreas protegidas	Áreas protegidas
STPI_4_2_NO	Double		Cantidad de encuestas que reportaron no estar en áreas protegidas	
STPI_5_1_SI	Double		Cuentas de unidades con uso vivienda	Vivienda
STPI_5_2_NO	Double		Cuentas de unidades con uso resto	Mundo Espacio Independiente
STPI_6_1_SI	Double		Cuentas de unidades con uso no residencial	Unidad NO Residencial
STPI_6_1_1_SI	Double		Cuentas de unidades con uso no LEIA	Lugar importante del trabajo
STPI_6_2_M	Double		Cuentas de unidades mixtas con uso no residencial industria	Industria
STPI_6_2_1_M	Double		Cuentas de unidades mixtas con uso no residencial comercio	Comercio
STPI_6_2_2_M	Double		Cuentas de unidades mixtas con uso no residencial servicios	Servicios
STPI_6_2_3_M	Double		Cuentas de unidades mixtas con uso no residencial agropecuario, agroindustrial, forestal	Agropecuario, Agroindustrial, Forestal
STPI_6_2_4_M	Double		Cuentas de unidades mixtas con uso no residencial sin información	Sin información
STPI_6_3_1_N	Double		Cuentas de unidades no residenciales con uso industria	Industria
STPI_6_3_2_N	Double		Cuentas de unidades no residenciales con uso Comercio	Comercio
STPI_6_3_3_N	Double		Cuentas de unidades no residenciales con uso Servicios	Servicios
STPI_6_3_4_N	Double		Cuentas de unidades no residenciales con uso Agropecuario, Agroindustrial, Forestal	Agropecuario, Agroindustrial, Forestal
STPI_6_3_5_N	Double		Cuentas de unidades no residenciales con uso Institucional	Institucional
STPI_6_3_6_N	Double		Cuentas de unidades no residenciales con uso Construcción (en construcción)	Lote (terreno sin construcción)
STPI_6_3_7_N	Double		Cuentas de unidades no residenciales con uso Parque/Zone Verde	Parque/Zone Verde
STPI_6_3_8_N	Double		Cuentas de unidades no residenciales con uso Móviles Energéticos	Móviles Energéticos
STPI_6_3_9_N	Double		Cuentas de unidades no residenciales con uso Protección/Conservación ambiental	Protección/Conservación ambiental
STPI_6_4_N	Double		Cuentas de unidades no residenciales con uso Piscinas	Piscinas

# Code

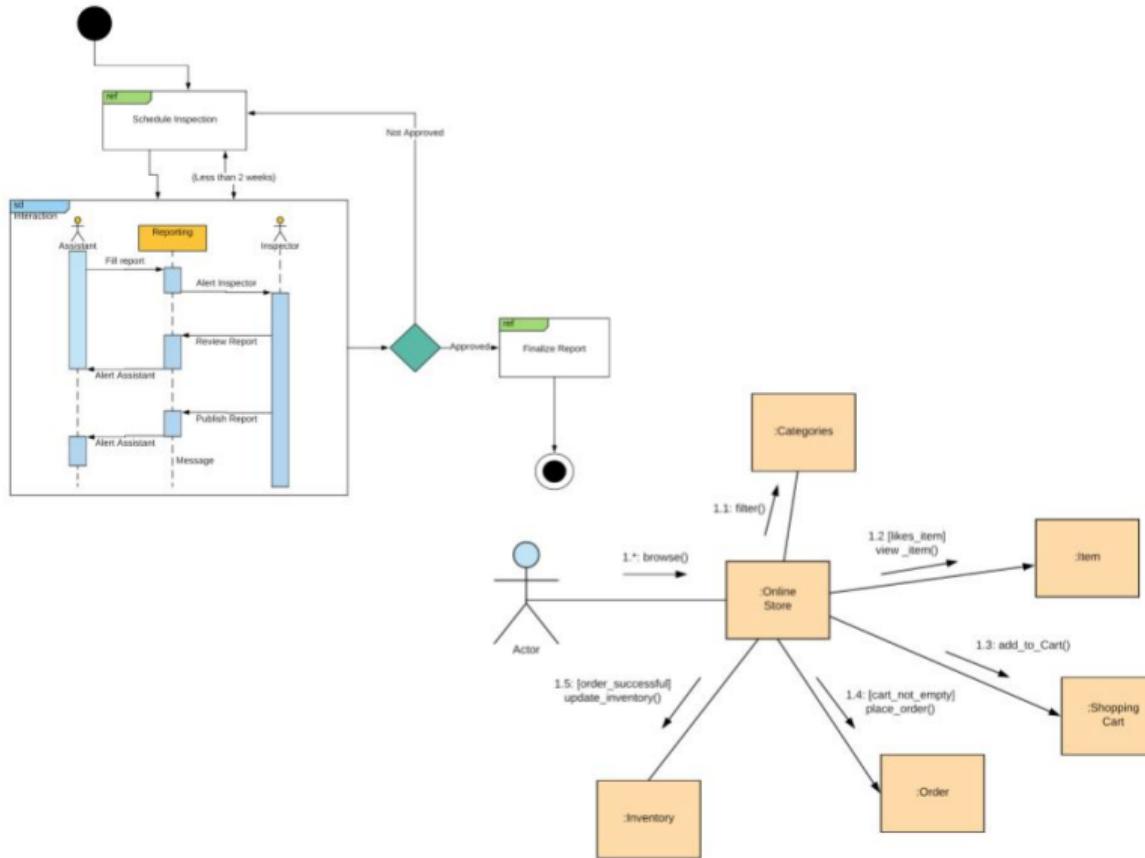
main.py - Visual Studio Code

File Edit Selection View Go Run Terminal Help

```
◆ main.py  x
home > acald013 > MEGA > Work > PUJ > 2025-S1 > ADA > Labs > Lab0_report > main.py > ...
1  #!/usr/bin/env python3
2
3  import time # to get the current time...
4
5  # call the main functions...
6  from array_generator import generate_random_array
7  from insertion_sort import insertion_sort
8  from merge_sort import merge_sort
9
10 # number of runs for each size...
11 number_of_run = 5
12 # the array' sizes we want to evaluate...
13 sizes = [1000, 2000, 4000, 6000, 8000, 10000, 12500, 15000, 17500, 20000]
14
15 for n in range(1, number_of_run):
16     for size in sizes:
17         # generate a random array with the provided size...
18         array = generate_random_array(size)
19         # call insertion-sort and capture the execution time...
20         t0 = time.time()
21         insertion_sort(array)
22         insertion_time = time.time() - t0
23         print("{}\t{}\t{}".format("Insertion", size, insertion_time))
24         # call merge-sort and capture the execution time...
25         t0 = time.time()
26         merge_sort(array)
27         merge_time = time.time() - t0
28         print("{}\t{}\t{}".format("Merge", size, merge_time))
```

Ln 4, Col 1 Spaces: 4 UTF-8 LF Python

# Code Metadata



# Databases

pgAdmin 4

File Object Tools Edit View Window Help

Welcome f1db.drivers/f1db/acald013@localhost

Query History

Query

```
3 → SELECT * FROM f1db.drivers
3 → ORDER BY driverid ASC
```

Data Output Messages Notifications

driverid	driverref	number	code	forename	surname	dob	nationality	url
1	1 hamilton	44	HAM	Lewis	Hamilton	1985-01-07	British	<a href="http://en.wikipedia.org/wiki/Lewis_Hamilton">http://en.wikipedia.org/wiki/Lewis_Hamilton</a>
2	2 herfeld	[null]	HEI	Nick	Herfeld	1977-05-10	German	<a href="http://en.wikipedia.org/wiki/Nick_Herfeld">http://en.wikipedia.org/wiki/Nick_Herfeld</a>
3	3 rosberg	6	ROS	Nico	Rosberg	1985-06-27	German	<a href="http://en.wikipedia.org/wiki/Nico_Rosberg">http://en.wikipedia.org/wiki/Nico_Rosberg</a>
4	4 alonso	14	ALO	Fernando	Alonso	1981-07-29	Spanish	<a href="http://en.wikipedia.org/wiki/Fernando_Alonso">http://en.wikipedia.org/wiki/Fernando_Alonso</a>
5	5 kovalainen	[null]	KOV	Heikki	Kovalainen	1985-10-19	French	<a href="http://en.wikipedia.org/wiki/Heikki_Kovalainen">http://en.wikipedia.org/wiki/Heikki_Kovalainen</a>
6	6 naikuma	[null]	NAK	Kazuki	Naikuma	1985-01-11	Japanese	<a href="http://en.wikipedia.org/wiki/Kazuki_Naikuma">http://en.wikipedia.org/wiki/Kazuki_Naikuma</a>
7	7 boundas	[null]	BOU	Sébastien	Bourdais	1979-02-28	French	<a href="http://en.wikipedia.org/wiki/S%C3%A9bastien_Bourdais">http://en.wikipedia.org/wiki/S%C3%A9bastien_Bourdais</a>
8	8 rikkonen	7	RAI	Kimi	Räikkönen	1979-10-17	French	<a href="http://en.wikipedia.org/wiki/Kimi_R%C3%A4ikk%C3%B6nen">http://en.wikipedia.org/wiki/Kimi_R%C3%A4ikk%C3%B6nen</a>
9	9 kubica	88	KUB	Robert	Kubica	1984-12-07	Polish	<a href="http://en.wikipedia.org/wiki/Robert_Kubica">http://en.wikipedia.org/wiki/Robert_Kubica</a>
10	10 glock	[null]	GLO	Timo	Glock	1982-03-18	German	<a href="http://en.wikipedia.org/wiki/Timo_Glock">http://en.wikipedia.org/wiki/Timo_Glock</a>
11	11 sato	[null]	SAT	Takuma	Sato	1977-01-28	Japanese	<a href="http://en.wikipedia.org/wiki/Takuma_Sato">http://en.wikipedia.org/wiki/Takuma_Sato</a>
12	12 piquet Jr	[null]	PQI	Nelson	Piquet Jr.	1985-07-25	Brazilian	<a href="http://en.wikipedia.org/wiki/Nelson_Piquet_Jr.">http://en.wikipedia.org/wiki/Nelson_Piquet_Jr.</a>
13	13 massa	19	MAS	Felipe	Massa	1981-04-25	Brazilian	<a href="http://en.wikipedia.org/wiki/Felipe_Massa">http://en.wikipedia.org/wiki/Felipe_Massa</a>
14	14 coulthard	[null]	COU	David	Coulthard	1971-03-27	British	<a href="http://en.wikipedia.org/wiki/David_Coulthard">http://en.wikipedia.org/wiki/David_Coulthard</a>
15	15 trulli	[null]	TRU	Jarno	Trulli	1974-07-13	Italian	<a href="http://en.wikipedia.org/wiki/Jarno_Trulli">http://en.wikipedia.org/wiki/Jarno_Trulli</a>
16	16 sutil	99	SUT	Adrián	Sutil	1983-01-11	German	<a href="http://en.wikipedia.org/wiki/Adri%C3%A3n_Sutil">http://en.wikipedia.org/wiki/Adri%C3%A3n_Sutil</a>
17	17 webber	[null]	WEB	Mark	Webber	1976-08-27	Australian	<a href="http://en.wikipedia.org/wiki/Mark_Webber_(racing_driver)">http://en.wikipedia.org/wiki/Mark_Webber_(racing_driver)</a>
18	18 button	22	BUT	Jenson	Button	1980-01-19	British	<a href="http://en.wikipedia.org/wiki/Jenson_Button">http://en.wikipedia.org/wiki/Jenson_Button</a>
19	19 davidson	[null]	DAV	Anthony	Davidson	1979-04-18	British	<a href="http://en.wikipedia.org/wiki/Anthony_Davidson">http://en.wikipedia.org/wiki/Anthony_Davidson</a>
20	20 vettel	5	VET	Sebastian	Vettel	1987-07-03	German	<a href="http://en.wikipedia.org/wiki/Sebastian_Vettel">http://en.wikipedia.org/wiki/Sebastian_Vettel</a>
21	21 fisichella	[null]	FI8	Giancarlo	Fisichella	1979-01-14	Italian	<a href="http://en.wikipedia.org/wiki/Giancarlo_Fisichella">http://en.wikipedia.org/wiki/Giancarlo_Fisichella</a>
22	22 barnicello	[null]	BAR	Rubens	Barnicello	1972-05-23	Brazilian	<a href="http://en.wikipedia.org/wiki/Rubens_Barnicello">http://en.wikipedia.org/wiki/Rubens_Barnicello</a>
23	23 ralfschumacher	[null]	SOH	Ralf	Schumacher	1975-06-30	German	<a href="http://en.wikipedia.org/wiki/Ralf_Schumacher">http://en.wikipedia.org/wiki/Ralf_Schumacher</a>
24	24 luizzi	[null]	LUZ	Vitantonio	Luizzi	1980-08-06	Italian	<a href="http://en.wikipedia.org/wiki/Vitantonio_Luizzi">http://en.wikipedia.org/wiki/Vitantonio_Luizzi</a>
25	25 wurz	[null]	WUR	Alexander	Wurz	1974-02-15	Austrian	<a href="http://en.wikipedia.org/wiki/Alexander_Wurz">http://en.wikipedia.org/wiki/Alexander_Wurz</a>
26	26 moser	[null]	MOZ	Ulrich	Moser	1988-11-14	Austrian	<a href="http://en.wikipedia.org/wiki/Ulrich_Moser">http://en.wikipedia.org/wiki/Ulrich_Moser</a>

Total rows: 861 Query complete 00:00:00.828

LF Ln 1, Col 1

# Databases

pgAdmin 4

Welcome f1db.drivers/f1db/acald013@localhost

File Object Tools Edit View Window Help

Query History

3 → `SELECT * FROM f1db.drivers`  
3 → `ORDER BY driverid ASC`

Scratch Pad

Data Output Messages Notifications

Showing rows: 1 to 861 Page No: 1 of 1 14 44 ▶ ▷

driverid	driverref	number	code	forename	surname	dob	nation	url
1	hamilton	44	HAM	Lewis	Hamilton	1985-01-07	British	<a href="http://en.wikipedia.org/wiki/Lewis_Hamilton">http://en.wikipedia.org/wiki/Lewis_Hamilton</a>
2	herfeld	[null]	HEI	Nick	Heidfeld	1977-05-10	German	<a href="http://en.wikipedia.org/wiki/Nick_Heidfeld">http://en.wikipedia.org/wiki/Nick_Heidfeld</a>
3	rosberg	6	ROS	Nico	Rosberg	1985-06-27	German	<a href="http://en.wikipedia.org/wiki/Nico_Rosberg">http://en.wikipedia.org/wiki/Nico_Rosberg</a>
4	alonso	14	ALO	Fernando	Alonso	1981-07-29	Spanish	<a href="http://en.wikipedia.org/wiki/Fernando_Alonso">http://en.wikipedia.org/wiki/Fernando_Alonso</a>
5	kovaleinen	[null]	KOV	Heikki	Kovalainen	1981-06-19	French	<a href="http://en.wikipedia.org/wiki/Heikki_Kovalainen">http://en.wikipedia.org/wiki/Heikki_Kovalainen</a>
6	nakajima	[null]	NAK	Kazuki	Nakajima	1985-01-11	Japanese	<a href="http://en.wikipedia.org/wiki/Kazuki_Nakajima">http://en.wikipedia.org/wiki/Kazuki_Nakajima</a>
7	bourdais	[null]	BOU	Sébastien	Bourdais	1979-02-28	French	<a href="http://en.wikipedia.org/wiki/S%C3%A9bastien_Bourdais">http://en.wikipedia.org/wiki/S%C3%A9bastien_Bourdais</a>
8	räikkönen	7	RAI	Kimi	Räikkönen	1979-10-17	Finland	<a href="http://en.wikipedia.org/wiki/Kimi_R%C3%A4ikk%C3%B6nen">http://en.wikipedia.org/wiki/Kimi_R%C3%A4ikk%C3%B6nen</a>
9	kubica	88	KUB	Robert	Kubica	1984-12-07	Polish	<a href="http://en.wikipedia.org/wiki/Robert_Kubica">http://en.wikipedia.org/wiki/Robert_Kubica</a>
10	glock	[null]	GLO	Timo	Glock			<a href="http://en.wikipedia.org/wiki/Timo_Glock">http://en.wikipedia.org/wiki/Timo_Glock</a>
11	sono	[null]	SAT	Takuma	Sato	1977-01-28	Japanese	<a href="http://en.wikipedia.org/wiki/Takuma_Sato">http://en.wikipedia.org/wiki/Takuma_Sato</a>
12	piquet_jr	[null]	PJO	Nelson	Piquet Jr.	1985-07-25	Brazilian	<a href="http://en.wikipedia.org/wiki/Nelson_Piquet_Jr.">http://en.wikipedia.org/wiki/Nelson_Piquet_Jr.</a>
13	massa	19	MAS	Felipe	Massa	1981-05-23	Brazilian	<a href="http://en.wikipedia.org/wiki/Felipe_Massa">http://en.wikipedia.org/wiki/Felipe_Massa</a>
14	coulthard	[null]	COU	David	Coulthard	1971-03-27	British	<a href="http://en.wikipedia.org/wiki/David_Coulthard">http://en.wikipedia.org/wiki/David_Coulthard</a>
15	trulli	[null]	TRU	Jarno	Trulli	1974-07-12	Italian	<a href="http://en.wikipedia.org/wiki/Jarno_Trulli">http://en.wikipedia.org/wiki/Jarno_Trulli</a>
16	sutil	99	SUT	Adrián	Sutil	1983-01-11	German	<a href="http://en.wikipedia.org/wiki/Adri%C3%A3n_Sutil">http://en.wikipedia.org/wiki/Adri%C3%A3n_Sutil</a>
17	webber	[null]	WEB	Mark	Webber	1978-08-27	Australian	<a href="http://en.wikipedia.org/wiki/Mark_Webber_(racing_driver)">http://en.wikipedia.org/wiki/Mark_Webber_(racing_driver)</a>
18	button	22	BUT	Jenson	Button	1980-06-16	British	<a href="http://en.wikipedia.org/wiki/Jenson_Button">http://en.wikipedia.org/wiki/Jenson_Button</a>
19	davidson	[null]	DAV	Anthony	Davidson	1975-03-16	British	<a href="http://en.wikipedia.org/wiki/Anthony_Davidson">http://en.wikipedia.org/wiki/Anthony_Davidson</a>
20	vettel	5	VET	Sebastian	Vettel	1987-07-03	German	<a href="http://en.wikipedia.org/wiki/Sebastian_Vettel">http://en.wikipedia.org/wiki/Sebastian_Vettel</a>
21	fisichella	[null]	FI8	Giancarlo	Fisichella	1979-01-14	Italian	<a href="http://en.wikipedia.org/wiki/Giancarlo_Fisichella">http://en.wikipedia.org/wiki/Giancarlo_Fisichella</a>
22	barrichello	[null]	BAR	Rubens	Barrichello	1972-05-23	Brazilian	<a href="http://en.wikipedia.org/wiki/Rubens_Barrichello">http://en.wikipedia.org/wiki/Rubens_Barrichello</a>
23	raffaele schumacher	[null]	SOH	Ralf	Schumacher	1975-06-30	German	<a href="http://en.wikipedia.org/wiki/Ralf_Schumacher">http://en.wikipedia.org/wiki/Ralf_Schumacher</a>
24	luizzi	[null]	LUU	Vitantonio	Luizzi	1980-08-06	Italian	<a href="http://en.wikipedia.org/wiki/Vitantonio_Luizzi">http://en.wikipedia.org/wiki/Vitantonio_Luizzi</a>
25	wurz	[null]	WUR	Alexander	Wurz	1974-02-15	Austrian	<a href="http://en.wikipedia.org/wiki/Alexander_Wurz">http://en.wikipedia.org/wiki/Alexander_Wurz</a>
26	moyston	[null]	MOY	David	Moyston	1988-11-14	American	<a href="http://en.wikipedia.org/wiki/David_Moyston">http://en.wikipedia.org/wiki/David_Moyston</a>

Total rows: 861 Query complete 00:00:00.828

LF Ln 1, Col 1

# Databases

The screenshot displays a database management interface with several windows open:

- Drivers**: A table view showing columns: id, drivername, number, and surname. The table has 861 rows.
- Relationships**: A diagram showing the relationship between the drivers table and the standings table. It indicates a one-to-many relationship from drivers to standings.
- Metadata**: A window showing the structure of the drivers table, including columns: id, drivername, number, code, surname, and nationality.
- Logs**: A window showing the log entry: "Generated by SchemaSpy".
- Query History**: A window showing the query: `SELECT * FROM f1db.drivers ORDER BY driverid ASC`.

# Metadata Characteristics<sup>1</sup>

- ▶ Metadata is information about an *object* or *resource* that describes *characteristics* of that object, such as content, quality, format, location, and access rights.

---

<sup>1</sup>Australian Research Data Commons

# Metadata Characteristics<sup>1</sup>

- ▶ Metadata is information about an *object* or *resource* that describes *characteristics* of that object, such as content, quality, format, location, and access rights.
- ▶ Metadata can be used to describe *physical* objects (e.g. samples and specimens) as well as *digital* objects (e.g. documents, images, datasets and software).

---

<sup>1</sup>Australian Research Data Commons

# Metadata Characteristics<sup>1</sup>

- ▶ Metadata is information about an *object* or *resource* that describes *characteristics* of that object, such as content, quality, format, location, and access rights.
- ▶ Metadata can be used to describe *physical* objects (e.g. samples and specimens) as well as *digital* objects (e.g. documents, images, datasets and software).
- ▶ Metadata can take many *different forms*, from free text (e.g. a read-me file) to standardised, structured, machine-readable, extensible content.

---

<sup>1</sup>Australian Research Data Commons

# Metadata Characteristics<sup>1</sup>

- ▶ Metadata is information about an *object* or *resource* that describes *characteristics* of that object, such as content, quality, format, location, and access rights.
- ▶ Metadata can be used to describe *physical* objects (e.g. samples and specimens) as well as *digital* objects (e.g. documents, images, datasets and software).
- ▶ Metadata can take many *different forms*, from free text (e.g. a read-me file) to standardised, structured, machine-readable, extensible content.
- ▶ Metadata is *analogous to any other form of data*, in terms of how it is created, managed, linked and stored.

---

<sup>1</sup>Australian Research Data Commons

# Metadata Characteristics<sup>1</sup>

- ▶ Metadata is information about an *object* or *resource* that describes *characteristics* of that object, such as content, quality, format, location, and access rights.
- ▶ Metadata can be used to describe *physical* objects (e.g. samples and specimens) as well as *digital* objects (e.g. documents, images, datasets and software).
- ▶ Metadata can take many *different forms*, from free text (e.g. a read-me file) to standardised, structured, machine-readable, extensible content.
- ▶ Metadata is *analogous to any other form of data*, in terms of how it is created, managed, linked and stored.
- ▶ Metadata is *associated with* the data it describes. It can be *embedded* within the data file, or *recorded a separated* text/spreadsheet file that is linked to the collection of data files it describes, or contained in a catalogue record that points to the research data collection.

---

<sup>1</sup>Australian Research Data Commons

# Metadata Characteristics<sup>1</sup>

- ▶ Metadata is information about an *object* or *resource* that describes *characteristics* of that object, such as content, quality, format, location, and access rights.
- ▶ Metadata can be used to describe *physical* objects (e.g. samples and specimens) as well as *digital* objects (e.g. documents, images, datasets and software).
- ▶ Metadata can take many *different forms*, from free text (e.g. a read-me file) to standardised, structured, machine-readable, extensible content.
- ▶ Metadata is *analogous to any other form of data*, in terms of how it is created, managed, linked and stored.
- ▶ Metadata is *associated with* the data it describes. It can be *embedded* within the data file, or *recorded a separated* text/spreadsheet file that is linked to the collection of data files it describes, or contained in a catalogue record that points to the research data collection.
- ▶ Metadata *enables* and *enhances* the *discovery* and *reuse* of data.

---

<sup>1</sup>Australian Research Data Commons

# Metadata Characteristics<sup>1</sup>

- ▶ Metadata is information about an *object* or *resource* that describes *characteristics* of that object, such as content, quality, format, location, and access rights.
- ▶ Metadata can be used to describe *physical* objects (e.g. samples and specimens) as well as *digital* objects (e.g. documents, images, datasets and software).
- ▶ Metadata can take many *different forms*, from free text (e.g. a read-me file) to standardised, structured, machine-readable, extensible content.
- ▶ Metadata is *analogous to any other form of data*, in terms of how it is created, managed, linked and stored.
- ▶ Metadata is *associated with* the data it describes. It can be *embedded* within the data file, or *recorded a separated* text/spreadsheet file that is linked to the collection of data files it describes, or contained in a catalogue record that points to the research data collection.
- ▶ Metadata *enables* and *enhances* the *discovery* and *reuse* of data.

---

<sup>1</sup>Australian Research Data Commons

# Plan

What is Metadata?

Metadata Examples

Database Administration Tools

Understanding PostgreSQL System Catalogs

# DBA Tools

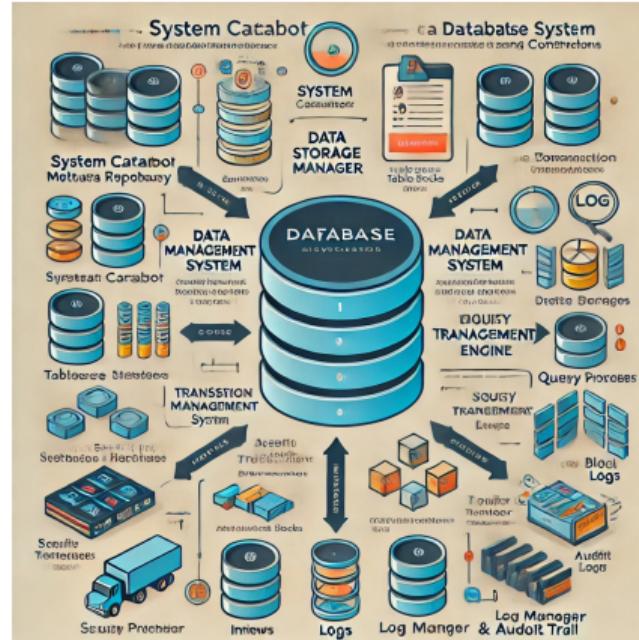
The Data Dictionary (aka Metadata repository)

- ▶ Is a database administration tool.
- ▶ It is a type of metadata itself.
- ▶ Oracle defines it as a collection of tables with metadata.

## Definition

A data dictionary is a “*centralized repository of information about data such as meaning, relationships to other data, origin, usage, and format.*”

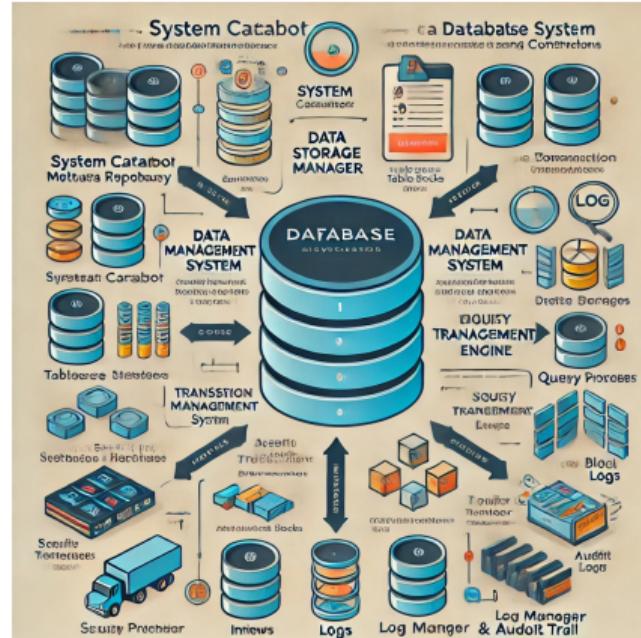
# Data Dictionary



DD stores information about database objects, including:

- ▶ Tables (names, columns, data types, constraints).

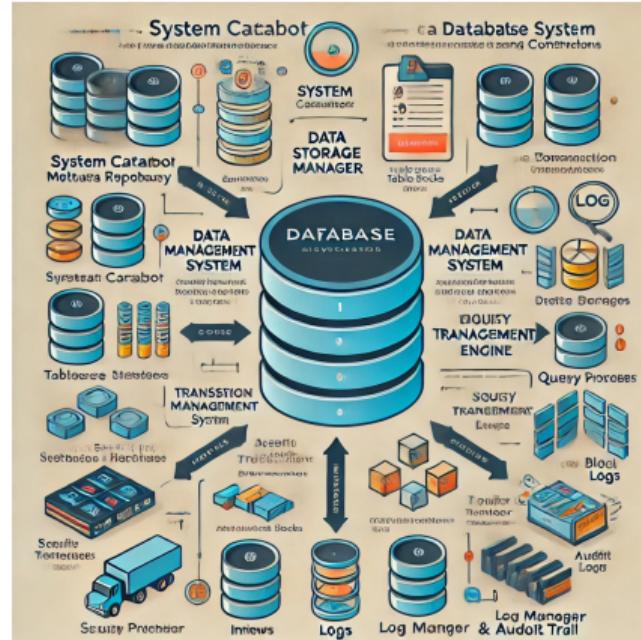
## Data Dictionary



DD stores information about database objects, including:

- ▶ Tables (names, columns, data types, constraints).
  - ▶ Indexes (primary keys, foreign keys).

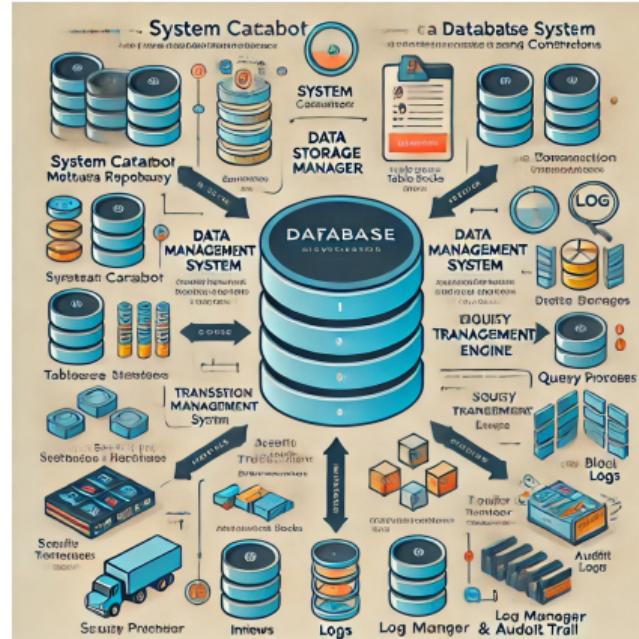
## Data Dictionary



DD stores information about database objects, including:

- ▶ Tables (names, columns, data types, constraints).
  - ▶ Indexes (primary keys, foreign keys).
  - ▶ Views (virtual tables).

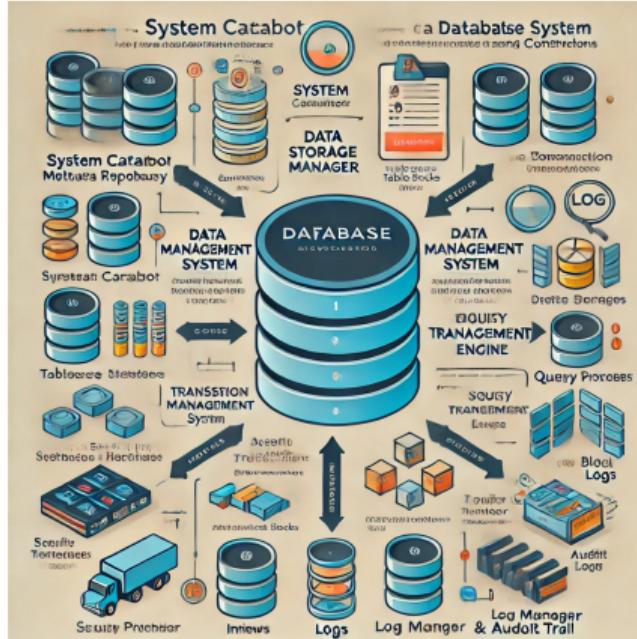
# Data Dictionary



DD stores information about database objects, including:

- ▶ Tables (names, columns, data types, constraints).
  - ▶ Indexes (primary keys, foreign keys).
  - ▶ Views (virtual tables).
  - ▶ Users & Permissions (who can access what).

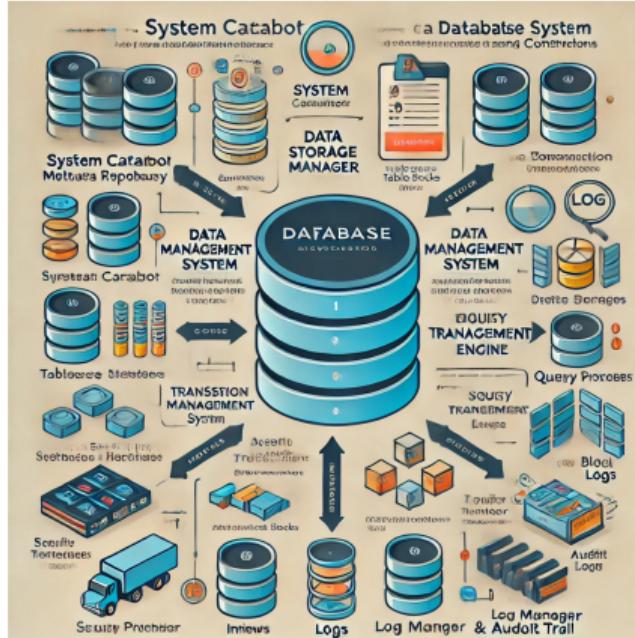
# Data Dictionary



DD stores information about database objects, including:

- ▶ Tables (names, columns, data types, constraints).
- ▶ Indexes (primary keys, foreign keys).
- ▶ Views (virtual tables).
- ▶ Users & Permissions (who can access what).
- ▶ Storage Structures (tablespaces, partitions).

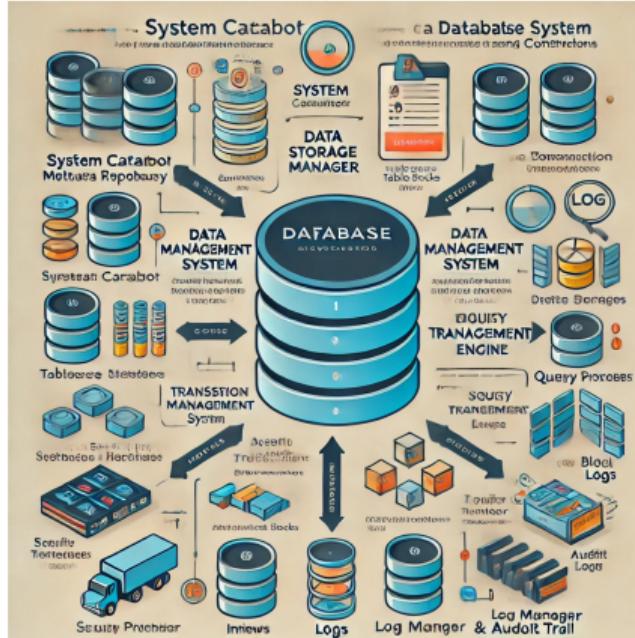
# Data Dictionary



DD stores information about database objects, including:

- ▶ Tables (names, columns, data types, constraints).
- ▶ Indexes (primary keys, foreign keys).
- ▶ Views (virtual tables).
- ▶ Users & Permissions (who can access what).
- ▶ Storage Structures (tablespaces, partitions).
- ▶ Relationships & Dependencies (links between tables).

# Data Dictionary



DD stores information about database objects, including:

- ▶ Tables (names, columns, data types, constraints).
- ▶ Indexes (primary keys, foreign keys).
- ▶ Views (virtual tables).
- ▶ Users & Permissions (who can access what).
- ▶ Storage Structures (tablespaces, partitions).
- ▶ Relationships & Dependencies (links between tables).
- ▶ Audit & Logs (history of schema changes).

# Data Dictionary Types

- ▶ **Integrated:**

- ▶ With the DBMS. i.e., relational DBMSs include a built-in DD or system catalog that is frequently accessed and updated by the RDBMS.
- ▶ Tend to limit their metadata to the data managed by the DBMS.

# Data Dictionary Types

- ▶ **Integrated:**

- ▶ With the DBMS. i.e., relational DBMSs include a built-in DD or system catalog that is frequently accessed and updated by the RDBMS.
- ▶ Tend to limit their metadata to the data managed by the DBMS.

- ▶ **Standalone:**

- ▶ Other DBMSs, especially older types, do not have a built-in data dictionary; instead, the DBA may use third-party standalone systems.
- ▶ Usually more flexible and allow the DBA to describe and manage all of the organization's data, whether they are computerized or not.

## Data Dictionary Types

- ▶ **Active:** Automatically updated by the DBMS with every database access to keep its access information up to date.

## Data Dictionary Types

- ▶ **Active:** Automatically updated by the DBMS with every database access to keep its access information up to date.
- ▶ **Passive:** Not updated automatically and usually DBA requires running a batch process.

## Data Dictionary Function

- ▶ The DD main function is to store the description of all objects that interact with the database.
- ▶ Whatever the data dictionary's format, it provides database designers and end users with a much-improved ability to communicate.
- ▶ The DD is the tool that helps the DBA resolve data conflicts.

## Data Dictionary Content<sup>2</sup>

Although there is no standard format for the information stored in the DD, several features are common. DD typically stores descriptions of the following:

- ▶ Data elements that are defined in all tables of all databases.

---

<sup>2</sup>More info in “*Database Systems: Design, Implementation, & Management.*” 13<sup>th</sup> Ed. (Coronel & Morris, 2017). Section 16-7a.

## Data Dictionary Content<sup>2</sup>

Although there is no standard format for the information stored in the DD, several features are common. DD typically stores descriptions of the following:

- ▶ Data elements that are defined in all tables of all databases.
- ▶ Tables defined in all databases.

---

<sup>2</sup>More info in “*Database Systems: Design, Implementation, & Management.*” 13<sup>th</sup> Ed. (Coronel & Morris, 2017). Section 16-7a.

## Data Dictionary Content<sup>2</sup>

Although there is no standard format for the information stored in the DD, several features are common. DD typically stores descriptions of the following:

- ▶ Data elements that are defined in all tables of all databases.
- ▶ Tables defined in all databases.
- ▶ Indexes defined for each database table.

---

<sup>2</sup>More info in “*Database Systems: Design, Implementation, & Management.*” 13<sup>th</sup> Ed. (Coronel & Morris, 2017). Section 16-7a.

## Data Dictionary Content<sup>2</sup>

Although there is no standard format for the information stored in the DD, several features are common. DD typically stores descriptions of the following:

- ▶ Data elements that are defined in all tables of all databases.
- ▶ Tables defined in all databases.
- ▶ Indexes defined for each database table.
- ▶ Defined databases.

---

<sup>2</sup>More info in “*Database Systems: Design, Implementation, & Management.*” 13<sup>th</sup> Ed. (Coronel & Morris, 2017). Section 16-7a.

## Data Dictionary Content<sup>2</sup>

Although there is no standard format for the information stored in the DD, several features are common. DD typically stores descriptions of the following:

- ▶ Data elements that are defined in all tables of all databases.
- ▶ Tables defined in all databases.
- ▶ Indexes defined for each database table.
- ▶ Defined databases.
- ▶ End users and administrators of the database.

---

<sup>2</sup>More info in “*Database Systems: Design, Implementation, & Management.*” 13<sup>th</sup> Ed. (Coronel & Morris, 2017). Section 16-7a.

## Data Dictionary Content<sup>2</sup>

Although there is no standard format for the information stored in the DD, several features are common. DD typically stores descriptions of the following:

- ▶ Data elements that are defined in all tables of all databases.
- ▶ Tables defined in all databases.
- ▶ Indexes defined for each database table.
- ▶ Defined databases.
- ▶ End users and administrators of the database.
- ▶ Programs that access the database.

---

<sup>2</sup>More info in “*Database Systems: Design, Implementation, & Management.*” 13<sup>th</sup> Ed. (Coronel & Morris, 2017). Section 16-7a.

## Data Dictionary Content<sup>2</sup>

Although there is no standard format for the information stored in the DD, several features are common. DD typically stores descriptions of the following:

- ▶ Data elements that are defined in all tables of all databases.
- ▶ Tables defined in all databases.
- ▶ Indexes defined for each database table.
- ▶ Defined databases.
- ▶ End users and administrators of the database.
- ▶ Programs that access the database.
- ▶ Access authorizations for all users of all databases.

---

<sup>2</sup>More info in “*Database Systems: Design, Implementation, & Management.*” 13<sup>th</sup> Ed. (Coronel & Morris, 2017). Section 16-7a.

## Data Dictionary Content<sup>2</sup>

Although there is no standard format for the information stored in the DD, several features are common. DD typically stores descriptions of the following:

- ▶ Data elements that are defined in all tables of all databases.
- ▶ Tables defined in all databases.
- ▶ Indexes defined for each database table.
- ▶ Defined databases.
- ▶ End users and administrators of the database.
- ▶ Programs that access the database.
- ▶ Access authorizations for all users of all databases.
- ▶ Relationships among data elements.

---

<sup>2</sup>More info in “*Database Systems: Design, Implementation, & Management.*” 13<sup>th</sup> Ed. (Coronel & Morris, 2017). Section 16-7a.

# Plan

What is Metadata?

Metadata Examples

Database Administration Tools

Understanding PostgreSQL System Catalogs

# What are PostgreSQL System Catalogs?

- ▶ Internal tables where PostgreSQL stores schema metadata.
- ▶ Contain information about databases, tables, columns, and more.
- ▶ Essential for managing and querying database structure.

# Naming Conventions

- ▶ Catalog names start with `pg_`.
- ▶ Column prefixes often derived from catalog names:
  - ▶ `pg_database`: columns start with `dat` (e.g., `datname`).
  - ▶ `pg_proc`: columns start with `pro`.
  - ▶ `pg_namespace`: columns start with `nsp`.
  - ▶ `pg_class`: columns start with `rel` (stores information about tables and other objects with columns, referred to as “relations”).

# Retrieving Database Metadata

- ▶ pg\_database stores information about databases.
- ▶ To find the owner of a specific database:

```
1  SELECT
2      a.rolname AS 'Owner'
3  FROM
4      pg_database d
5  JOIN
6      pg_authid a
7  ON
8      a.oid = d.datdba
9  WHERE
10     datname = 'your_database_name';
```

- ▶ Replace your\_database\_name with the name of your database.

# Retrieving Table Metadata

- ▶ `pg_class` stores information about tables, indexes, and views.
- ▶ To list all ordinary tables:

---

```
SELECT
    relname
  FROM
    pg_class
 WHERE
    relkind = 'r';
```

---

- ▶ `relkind = 'r'` indicates ordinary tables.

# Retrieving Schema Metadata

- ▶ `pg_namespace` stores information about schemas.
- ▶ To list all schema names:

---

```
SELECT
    nspname
FROM
    pg_namespace;
```

---

# Retrieving Index Metadata

- ▶ pg\_index and pg\_class store information about indexes.
- ▶ To find tables without indexes:

---

```
1  SELECT
2      c.oid::regclass AS table_name
3  FROM
4      pg_class c
5  WHERE
6      relkind = 'r' AND NOT EXISTS (
7          SELECT 1 FROM pg_index i WHERE i.indrelid = c.oid
8      );
```

---

# Retrieving Column Metadata

- ▶ `pg_attribute` stores information about table columns.
- ▶ To list column names and their data types:

---

```
1   SELECT
2       attname, atttypid::regtype
3   FROM
4       pg_attribute LIMIT 50;
```

---

- ▶ The `regtype` cast provides human-readable data types.

# Retrieving Function Metadata

- ▶ `pg_proc` stores information about functions.
- ▶ To find functions that accept a `text` argument:

---

```
1   SELECT
2       oid::regprocedure
3   FROM
4       pg_proc
5   WHERE
6       'text'::regtype = ANY(proargtypes);
```

---

# Retrieving Size Information

- ▶ To get the size of tables:

```
1  SELECT
2      oid::regclass AS table_name,
3      pg_size.pretty(pg_table_size(oid)) AS size
4  FROM
5      pg_class
6  WHERE
7      relkind = 'r'
8  ORDER BY
9      pg_table_size(oid) DESC;
```

- ▶ `pg_size.pretty` formats sizes into readable units.

End of Lecture 2.

TDT5FTOTTC



## Top 5 Fundamental Takeaways

## Top 5 Fundamental Takeaways

- 5 PostgreSQL uses system catalogs to store metadata about databases, tables, schemas, and indexes, helping administrators manage the database.

## Top 5 Fundamental Takeaways

- 5 **PostgreSQL uses system catalogs** to store metadata about databases, tables, schemas, and indexes, helping administrators manage the database.
- 4 **SQL queries can retrieve metadata** to list tables, schemas, indexes, and data sizes, making database management more efficient.

## Top 5 Fundamental Takeaways

- 5 **PostgreSQL uses system catalogs** to store metadata about databases, tables, schemas, and indexes, helping administrators manage the database.
- 4 **SQL queries can retrieve metadata** to list tables, schemas, indexes, and data sizes, making database management more efficient.
- 3 **Metadata can be structured or unstructured** and is used to describe both digital and physical objects for better data discovery and reuse.

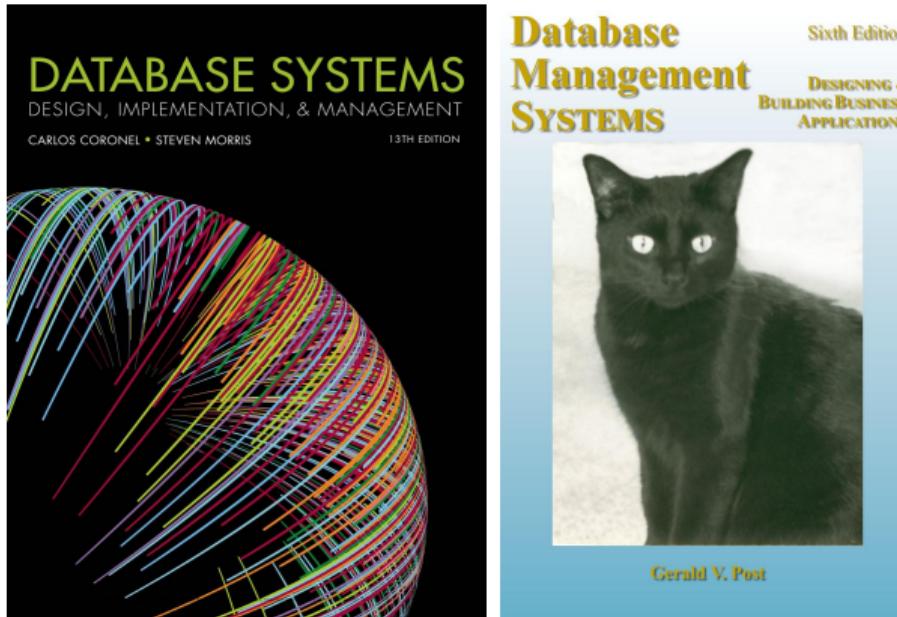
## Top 5 Fundamental Takeaways

- 5 **PostgreSQL uses system catalogs** to store metadata about databases, tables, schemas, and indexes, helping administrators manage the database.
- 4 **SQL queries can retrieve metadata** to list tables, schemas, indexes, and data sizes, making database management more efficient.
- 3 **Metadata can be structured or unstructured** and is used to describe both digital and physical objects for better data discovery and reuse.
- 2 **Metadata is data about data**, describing properties like type, size, and relationships to help organize and manage information.

## Top 5 Fundamental Takeaways

- 5 **PostgreSQL uses system catalogs** to store metadata about databases, tables, schemas, and indexes, helping administrators manage the database.
- 4 **SQL queries can retrieve metadata** to list tables, schemas, indexes, and data sizes, making database management more efficient.
- 3 **Metadata can be structured or unstructured** and is used to describe both digital and physical objects for better data discovery and reuse.
- 2 **Metadata is data about data**, describing properties like type, size, and relationships to help organize and manage information.
- 1 **The Data Dictionary** is a key tool in database administration, storing details about tables, indexes, users, and permissions.

# Database Administration: What is Metadata?



Content has been extracted from *Database Systems: Design, Implementation, and Management.*, 13th Edition, by Carlos Coronel & Steven Morris. Cengage Learning. 2018. and *Database Management Systems: Designing & Building Business Applications.*, 6th Edition, by Gerald Post. McGraw-Hill/Irwin. 2014.

Visit <https://www.cengage.com/c/database-systems-design-implementation-management-13e-coronel/9781337627900PF/> and <https://www.jerrypost.com/database/DBBookSummary.html>.