Complementos de Bases de Dados

– *Metadata* –

Engenharia Informática

2º Ano / 1º Semestre

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Preparação da Aula

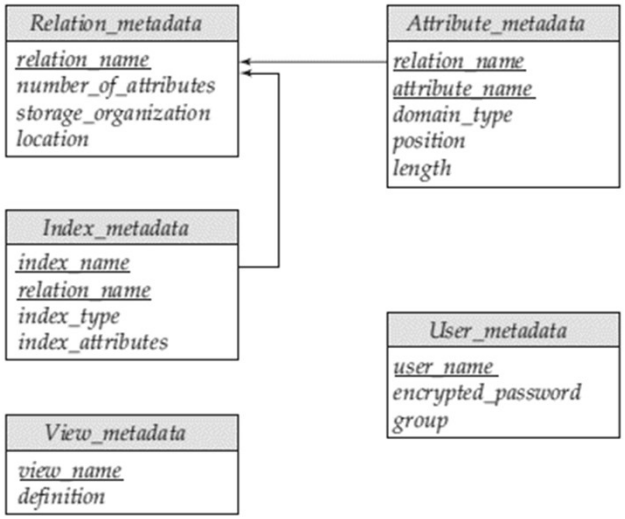
- Organização em grupos de 3/4
- Distribuição das folhas de respostas
- Seria pelo menos 1 elemento com PC por grupo
  - Só para exercicios do final da aula!

METADADOS

Meta-dados

Uma BD sobre a BD !

- A BD tem de manter um conjunto de dados sobre os dados!
- Esta informação está persistida no que se costuma designar o **Catalogo** ou **Dicionário**
- Exemplos:
  - Nomes das relações
  - Nomes dos atributos (e tipos)
  - Nomes e definições das *views* existentes
  - Restrições de integridade (e.g. key constraints)
  - Índices
- Adicionalmente
  - Utilizadores, credenciais e permissões
  - Ficheiros físicos e sua organização
- e ainda, informação complementar como
  - Numero de tuplos de uma relação, estatísticas, …

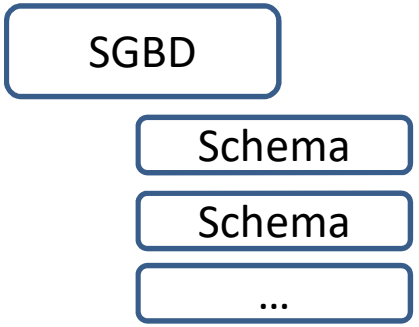


Que utilizações?

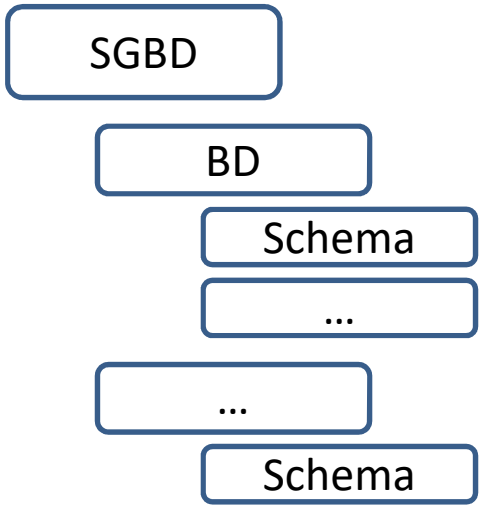
METADADOS

Schemas

- MySQL:
  - Schema = BD

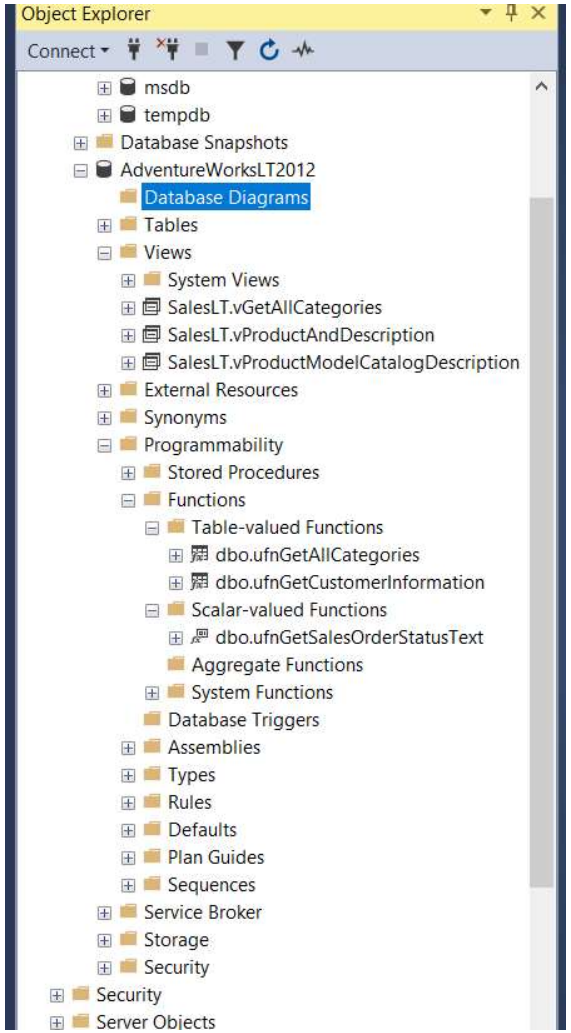


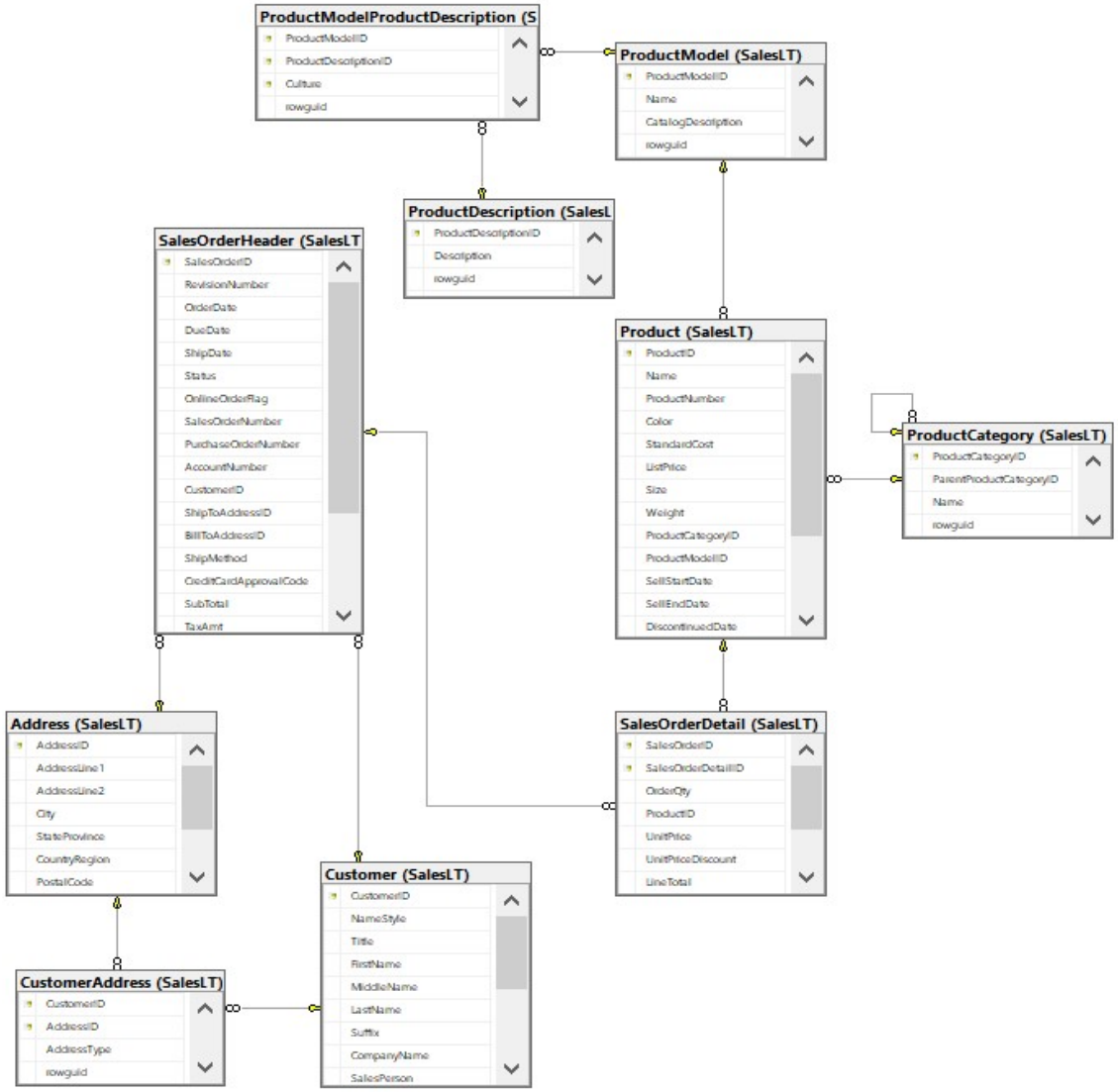
- MS SQL:
  - BDs podem ter multiplos schemas



❖ Schema ~ namespace/package

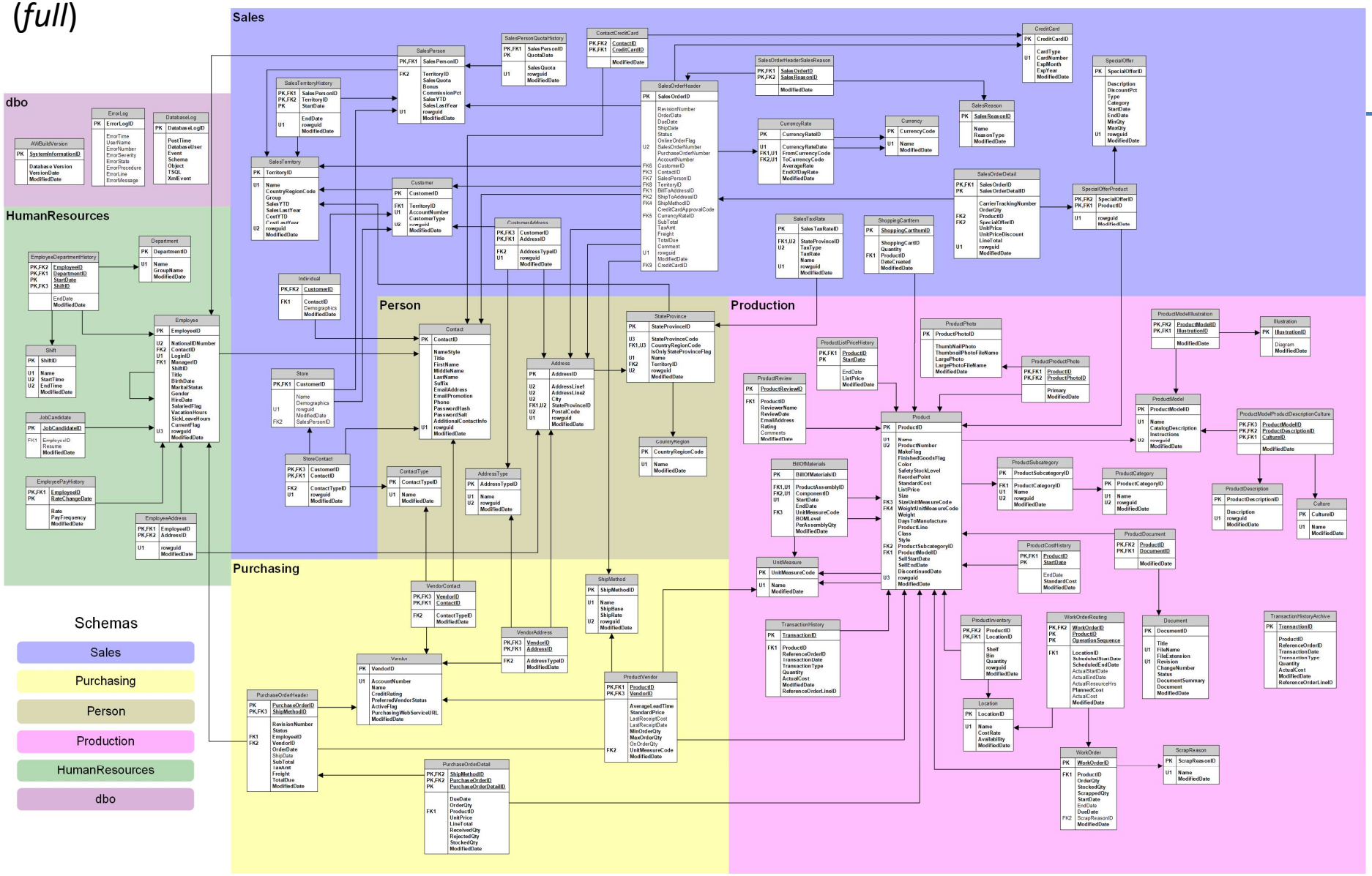
AdventureWorksLT2012





Adventure Works

(*full*)

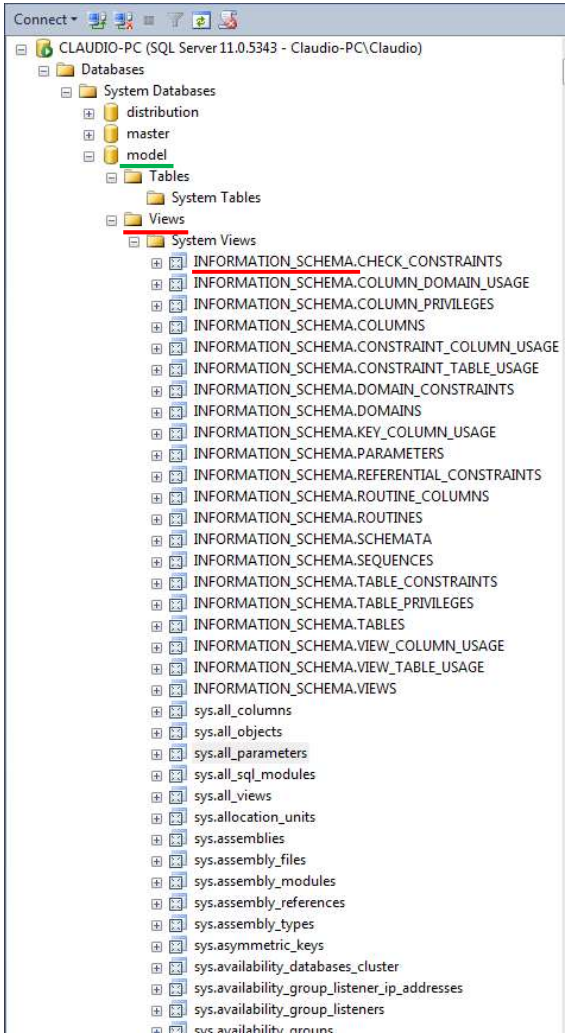


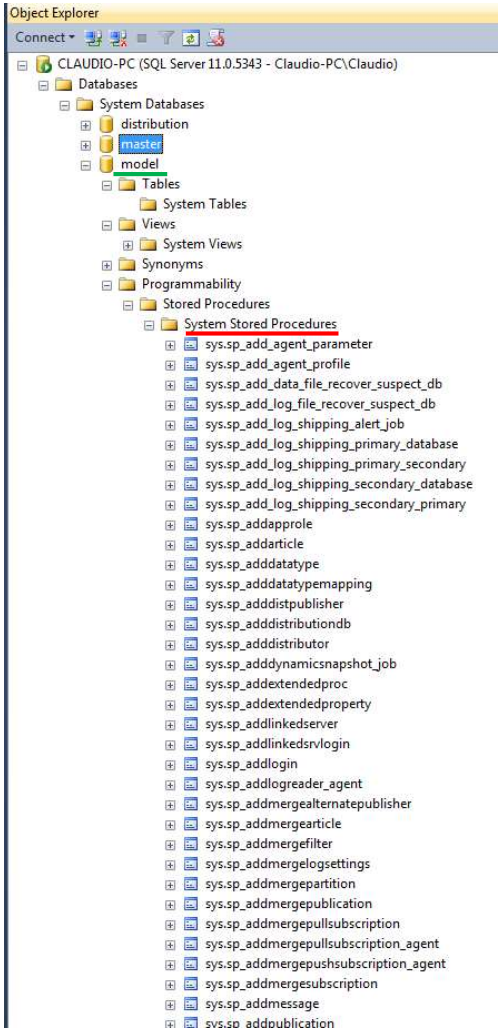
Acesso aos Metadados – *MS SQL*

- ***Sys Schema Views***
  - Uma das formas (preferencial = desempenho) de aceder aos metadados
  - Por serem *views* suportam a independência de eventuais alterações "físicas" às tabelas de sistema
  - Quer as *views* quer as suas colunas são auto-descritivas, de forma a apreender a informação relativa aos metadados solicitados

- ***Information_Schema views***
  - Seguem as definições standard ISO relativas às vistas sobre o catalogo
  - Apresentam a informação dos metadados em formato independente de qualquer implementação das tabelas do catálogo
  - As aplicações quando usam esta coleção de *views* são tendencialmente mais portáveis entre diferentes SGBDs.

Meta-dados


Connect
CLAUDIO-PC (SQL Server 11.0.5343 - Claudio-PC\Claudio)
Databases
System Databases
distribution
master
model
Tables
System Tables
Views
System Views
INFORMATION_SCHEMA.CHECK_CONSTRAINTS
INFORMATION_SCHEMA.COLUMN_DOMAIN_USAGE
INFORMATION_SCHEMA.COLUMN_PRIVILEGES
INFORMATION_SCHEMA.COLUMNS
INFORMATION_SCHEMA.CONSTRAINT_COLUMN_USAGE
INFORMATION_SCHEMA.CONSTRAINT_TABLE_USAGE
INFORMATION_SCHEMA.DOMAIN_CONSTRAINTS
INFORMATION_SCHEMA.DOMAINS
INFORMATION_SCHEMA.KEY_COLUMN_USAGE
INFORMATION_SCHEMA.PARAMETERS
INFORMATION_SCHEMA.REFERENTIAL_CONSTRAINTS
INFORMATION_SCHEMA.ROUTINE_COLUMNS
INFORMATION_SCHEMA.ROUTINES
INFORMATION_SCHEMA.SCHEMATA
INFORMATION_SCHEMA.SEQUENCES
INFORMATION_SCHEMA.TABLE_CONSTRAINTS
INFORMATION_SCHEMA.TABLE_PRIVILEGES
INFORMATION_SCHEMA.TABLES
INFORMATION_SCHEMA.VIEW_COLUMN_USAGE
INFORMATION_SCHEMA.VIEW_TABLE_USAGE
INFORMATION_SCHEMA.VIEWS
sys.all_columns
sys.all_objects
sys.all_parameters
sys.all_sql_modules
sys.all_views
sys.allocation_units
sys.assemblies
sys.assembly_files
sys.assembly_modules
sys.assembly_references
sys.assembly_types
sys.asymmetric_keys
sys.availability_databases_cluster
sys.availability_group_listener_ip_addresses
sys.availability_group_listeners


Object Explorer
Connect
CLAUDIO-PC (SQL Server 11.0.5343 - Claudio-PC\Claudio)
Databases
System Databases
distribution
master
model
Tables
System Tables
Views
System Views
Synonyms
Programmability
Stored Procedures
System Stored Procedures
sys.sp_add_agent_parameter
sys.sp_add_agent_profile
sys.sp_add_data_file_recover_suspect_db
sys.sp_add_log_file_recover_suspect_db
sys.sp_add_log_shipping_alert_job
sys.sp_add_log_shipping_primary_database
sys.sp_add_log_shipping_primary_secondary
sys.sp_add_log_shipping_secondary_database
sys.sp_add_log_shipping_secondary_primary
sys.sp_addapprole
sys.sp_addarticle
sys.sp_adddatatype
sys.sp_adddatatypemapping
sys.sp_adddistpublisher
sys.sp_adddistributiondb
sys.sp_adddistributor
sys.sp_adddynamicsnapshot_job
sys.sp_addextendedproc
sys.sp_addextendedproperty
sys.sp_addlinkedserver
sys.sp_addlinkedsrvlogin
sys.sp_addlogin
sys.sp_addlogreader_agent
sys.sp_addmergealternatepublisher
sys.sp_addmergearticle
sys.sp_addmergefilter
sys.sp_addmergelogsettings
sys.sp_addmergepartition
sys.sp_addmergepublication
sys.sp_addmergepullsubscription
sys.sp_addmergepullsubscription_agent
sys.sp_addmergepushsubscription_agent
sys.sp_addmergesubscription
sys.sp_addmessage
sys.sp_addpublication

Information Schema views

Mapping

SQL Server name	Maps to this equivalent SQL standard name
Database	Catalog
Schema	Schema
Object	Object
user-defined data type	Domain

Exemplo:

SELECT TABLE_CATALOG, TABLE_SCHEMA, TABLE_NAME, COLUMN_NAME, COLUMN_DEFAULT
FROM AdventureWorksLT2012.**INFORMATION_SCHEMA.COLUMNS**
WHERE TABLE_NAME = N'Product';

Views

CHECK_CONSTRAINTS	REFERENTIAL_CONSTRAINTS
COLUMN_DOMAIN_USAGE	ROUTINES
COLUMN_PRIVILEGES	ROUTINE_COLUMNS
COLUMNS	SCHEMATA
CONSTRAINT_COLUMN_USAGE	TABLE_CONSTRAINTS
CONSTRAINT_TABLE_USAGE	TABLE_PRIVILEGES
DOMAIN_CONSTRAINTS	TABLES
DOMAINS	VIEW_COLUMN_USAGE
KEY_COLUMN_USAGE	VIEW_TABLE_USAGE
PARAMETERS	VIEWS

“Equivalentes”

SQL

Information_Schema

SELECT TABLE_CATALOG, TABLE_SCHEMA,
TABLE_NAME, COLUMN_NAME
FROM INFORMATION_SCHEMA.COLUMNS
WHERE TABLE_NAME = N'Product';

Sys Schema

```
select s.name as 'SchemaName’,
o.name as 'TableName’,
c.name as 'ColumnName'
from sys.schemas as s
    inner join sys.all_objects as o
    on s.schema_id = o.schema_id
   inner join sys.all_columns as c
   on c.object_id = o.object_id
where o.name like N'Product' and o.type = 'U'
order by SchemaName,TableName,ColumnName;
```

InformationSchema *vs* Sys Schema Views

Information_Schema

+ "names friendly"
+ Joins através de *names*
+ Standard/potencialemente mais interoperavel

- Informação mais limitada
- Desempenho pode ser inferior

Sys Schema

+ Melhor desempenho
+ Informação mais promenorizada

- Orientado a objectos
- Joins por objectID

- Menos inteligível
- Proprietário

Exemplos de Objetos

SQL

```sql
use AdventureWorks2012

SELECT *
FROM sys.all_objects
```

	name	object_id	principal_id	schema_id	parent_object_id	type	type_desc
1	sp_MSalreadyhavegeneration	-1073624922	NULL	4	0	P	SQL_STORED_PROCEDURE
2	sp_MSwritemergeperfcounter	-1072815163	NULL	4	0	P	SQL_STORED_PROCEDURE
3	TABLE_PRIVILEGES	-1072372588	NULL	3	0	V	VIEW
4	sp_replsetsyncstatus	-1071944761	NULL	4	0	X	EXTENDED_STORED_PROCEDURE
5	sp_replshowcmds	-1070913306	NULL	4	0	P	SQL_STORED_PROCEDURE
6	sp_publishdb	-1070573756	NULL	4	0	P	SQL_STORED_PROCEDURE
7	sp_addqueued_artinfo	-1068897509	NULL	4	0	P	SQL_STORED_PROCEDURE
8	sp_replcounters	-1068756304	NULL	4	0	X	EXTENDED_STORED_PROCEDURE
9	sp_MSget_subscription_dts_info	-1068452095	NULL	4	0	P	SQL_STORED_PROCEDURE
10	sp_help_spatial_geometry_index_xml	-1068265529	NULL	4	0	P	SQL_STORED_PROCEDURE
11	sp_password	-1067822458	NULL	4	0	P	SQL_STORED_PROCEDURE
12	sp_MSstopdistribution_agent	-1067634502	NULL	4	0	P	SQL_STORED_PROCEDURE
13	sp_replmonitorrefreshjob	-1067473073	NULL	4	0	P	SQL_STORED_PROCEDURE
14	sp_redirect_publisher	-1065960762	NULL	4	0	P	SQL_STORED_PROCEDURE
15	sp_MSenumpartialchangesdirect	-1065074012	NULL	4	0	P	SQL_STORED_PROCEDURE
16	sp_MSupdate_subscriber_info	-1064594347	NULL	4	0	P	SQL_STORED_PROCEDURE
17	sp_MSdrop_distribution_agent	-1064529606	NULL	4	0	P	SQL_STORED_PROCEDURE
18	sp_bindsession	-1064199433	NULL	4	0	X	EXTENDED_STORED_PROCEDURE
19	sp_MSallocate_new_identity_range	-1064127790	NULL	4	0	P	SQL_STORED_PROCEDURE

```sql
SELECT
    distinct ot.type,
    ot.type_desc
FROM sys.all_objects ot
```

Results | Messages

	type	type_desc
1	FN	SQL_SCALAR_FUNCTION
2	IF	SQL_INLINE_TABLE_VALUED_FUNCTION
3	C	CHECK_CONSTRAINT
4	UQ	UNIQUE_CONSTRAINT
5	SQ	SERVICE_QUEUE
6	F	FOREIGN_KEY_CONSTRAINT
7	U	USER_TABLE
8	FS	CLR_SCALAR_FUNCTION
9	D	DEFAULT_CONSTRAINT
10	PK	PRIMARY_KEY_CONSTRAINT
11	V	VIEW
12	AF	AGGREGATE_FUNCTION
13	S	SYSTEM_TABLE
14	IT	INTERNAL_TABLE
15	P	SQL_STORED_PROCEDURE
16	X	EXTENDED_STORED_PROCEDURE
17	TF	SQL_TABLE_VALUED_FUNCTION
18	TR	SQL_TRIGGER
19	PC	CLR_STORED_PROCEDURE

BDs de Sistema

Exemplo

Use Master

GO

SELECT *

FROM *sys.databases*

Results | Messages

	name	dbid	sid	mode	status	status2	crdate	reserved	cat...	cmptlevel	filename
1	master	1	0x01	0	65544	1090...	2003-04-08 09:13:36.390	1900-01-01 00:00:00.000	0	110	C:\Program File
2	tempdb	2	0x01				1-02 09:49:53.157	1900-01-01 00:00:00.000	0	110	C:\Program File
3	model	3	0x01	0	65536	1090...	2003-04-08 09:13:36.390	1900-01-01 00:00:00.000	0	110	C:\Program File
4	msdb	4	0x01	0	65544	1627...	2012-02-10 21:02:17.770	1900-01-01 00:00:00.000	0	110	C:\Program File
5	ReportServer	5	0x01050...	0	65536	1627...	2015-09-25 19:16:48.533	1900-01-01 00:00:00.000	0	110	C:\Program File
6	ReportServerTempDB	6	0x01050...	0	65544	1627...	2015-09-25 19:16:48.800	1900-01-01 00:00:00.000	0	110	C:\Program File
7	AdventureWorks2012	7	0x01	0	65544	1971...	2015-10-13 12:31:24.783	1900-01-01 00:00:00.000	0	110	C:\Program File
8	AdventureWorksLT20...	8	0x01	0	65544	1971...	2015-10-13 12:36:07.620	1900-01-01 00:00:00.000	0	100	C:\Program File
9	CMSTestes	9	0x01	0	65536	1627...	2015-10-16 13:04:20.397	1900-01-01 00:00:00.000	0	110	C:\Program File
10	TwitterAlikeDB	10	0x01	0	65536	1627...	2015-10-26 11:32:56.260	1900-01-01 00:00:00.000	0	110	C:\Program File

Click to select the whole column

BDs de Sistema

MS SQL

- Contem a BD: ***master***
  - armazena informações sobre as bases de dados e seus objetos existentes no SGBD
  - Muito importante pois preserva (meta) informação sobre *user* DBs (e e.g. *logins*)
    - **contudo há que assegurar que não se inscreva diretamente objetos sobre esta (*USE 'uBD'*)**
- Objetos de uma BD
  - Tabelas que suportam os registos
  - Tipos de Dados (de sistema e definidos pelo utilizador)
  - Constraints
  - Indices
  - Views
  - Stored Procedures
  - Funções
  - Triggers
  - …

Information_Schema

SQL

Views dos Meta-dados

- Cada *view* do **INFORMATION_SCHEMA** contém meta informação sobre os objetos armazenados numa base de dados

INFORMATION_SCHEMA (Database metadata)	
CHECK_CONSTRAINTS	one row for each CHECK constraint.
COLUMNS	one row for each column.
KEY_COLUMN_USAGE	one row for each column that is constrained as a key.
REFERENTIAL_CONSTRAINTS	one row for each FOREIGN KEY constraint.
TABLE_CONSTRAINTS	one row for each table constraint.
TABLES	one row for each table in the current database.
VIEW_COLUMN_USAGE	one row for each column that is used in a view definition.
VIEW_TABLE_USAGE	one row for each table that is used in a view.
VIEWS	one row for each view.
COLUMN_DOMAIN_USAGE	one row for each column that has an alias data type.
COLUMN_PRIVILEGES	one row for each column that has a privilege that is either granted to or granted.
CONSTRAINT_COLUMN_USAGE	one row for each column that has a constraint defined on the column.
CONSTRAINT_TABLE_USAGE	one row for each table that has a constraint defined on the table.
DOMAIN_CONSTRAINTS	one row for each alias data type that has a rule bound to it
DOMAINS	one row for each alias data type.
PARAMETERS	one row for each parameter of a user-defined function or stored procedure.
ROUTINES	one row for each stored procedure and function
ROUTINE_COLUMNS	one row for each column returned by the table-valued functions
SCHEMATA	one row for each schema in the current database.
TABLE_PRIVILEGES	one row for each table privilege that is granted to or granted by the current user.

Sys Schema

SQL

***Views* dos Meta-dados**

- Cada *view* do **SYS SCHEMA** contém meta informação sobre os objetos armazenados numa base de dados

```
select s.name as 'SchemaName',o.name as 'TableName'
from sys.schemas as s
    inner join sys.all_objects as o
    on s.schema_id = o.schema_id
 where s.name='sys' and
       o.type = 'V'
order by SchemaName,TableName;
```

mini Sumário

1. O que são schemas?
2. O que é o catalogo de uma BD?
3. Quais as principais diferenças entre o InformationSchema e o Sys schema?

Exercício

AdventureWorksLT2012

Escolher a(s) opções de query para cada um dos pontos:

1. Listar todas as tabelas da BD?
2. Quantas tabelas tem a BD?
3. Quantas colunas tem cada tabela?


```
--A select * from INFORMATION_SCHEMA.TABLES;
```

```
--B select * from INFORMATION_SCHEMA.TABLES t
where t.TABLE_TYPE=upper('base table');
```

```
--C select * from sys.tables;
```

```
--D select count(*)
from sys.tables t ;
```

```
--E select c.TABLE_NAME, count(c.COLUMN_NAME)
from INFORMATION_SCHEMA.COLUMNS c join INFORMATION_SCHEMA.TABLES t
on t.TABLE_NAME=c.TABLE_NAME where t.TABLE_TYPE='base table'
group by c.TABLE_NAME;
```

```
--F select t.name, count(*)
from sys.all_columns as c inner join sys.tables t on c.object_id=t.object_id
group by t.name;
```

SYSTEM STORED PROCEDURES AND FUNCTIONS

System Stored Procedures and Functions

- *stored procedures* e *functions* de sistema retornam informação do catalogo
- Tratam-se de *sps* e *functions* especificas do MS SQL
  - Contudo isoladas da implementação do catalogo subjacente

Procedures

sp_column_privileges	sp_special_columns
sp_columns	sp_sproc_columns
sp_databases	sp_statistics
sp_fkeys	sp_stored_procedures
sp_pkeys	sp_table_privileges
sp_server_info	sp_tables

Functions

@@PROCID	INDEX_COL
APP_NAME	INDEXKEY_PROPERTY
APPLOCK_MODE	INDEXPROPERTY
APPLOCK_TEST	NEXT VALUE FOR
ASSEMBLYPROPERTY	OBJECT_DEFINITION
COL_LENGTH	OBJECT_ID
COL_NAME	OBJECT_NAME
COLUMNPROPERTY	OBJECT_SCHEMA_NAME
DATABASE_PRINCIPAL_ID	OBJECTPROPERTY
DATABASEPROPERTYEX	OBJECTPROPERTYEX
DB_ID	ORIGINAL_DB_NAME
DB_NAME	PARSENAME
FILE_ID	SCHEMA_ID
FILE_IDEX	SCHEMA_NAME
FILE_NAME	SCOPE_IDENTITY
FILEGROUP_ID	SERVERPROPERTY
FILEGROUP_NAME	STATS_DATE
FILEGROUPPROPERTY	TYPE_ID
FILEPROPERTY	TYPE_NAME
FULLTEXTCATALOGPROPERTY	TYPEPROPERTY
FULLTEXTSERVICEPROPERTY	

Stored Procedures

SQL

***sp* de Sistema vs Consultas** (a tabelas de sistema)

- Lista de tabelas de utilizador numa BD

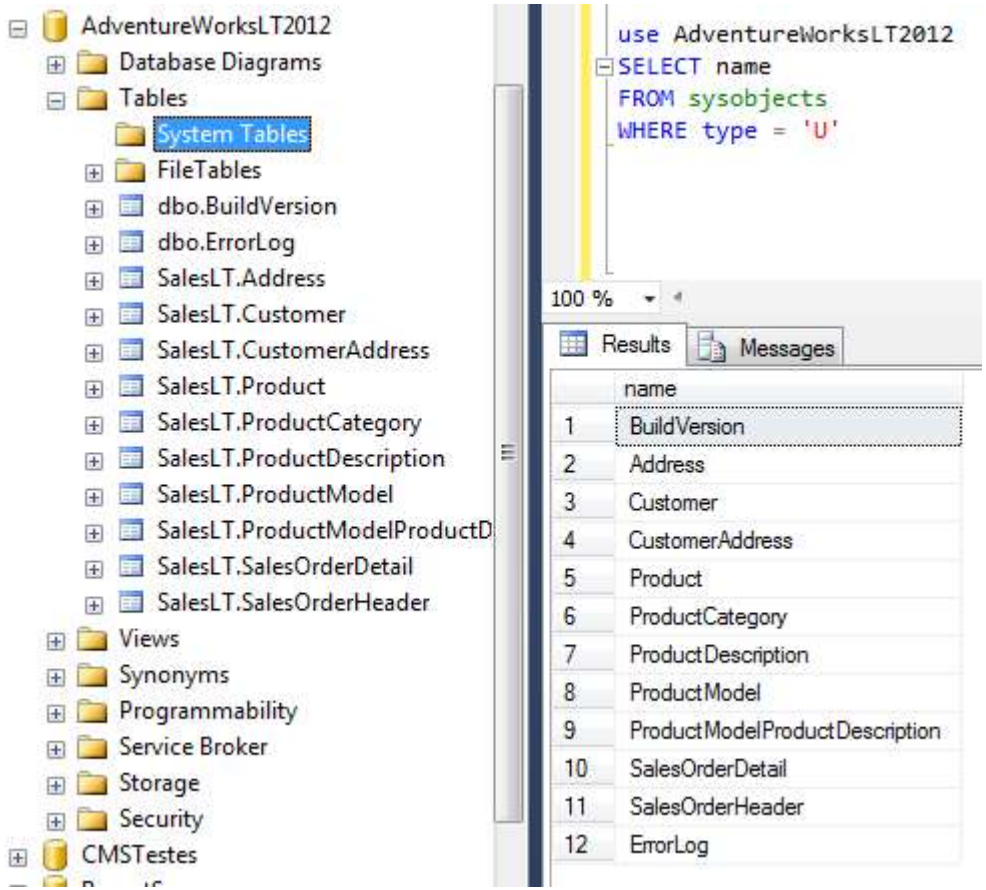
  SELECT name

  FROM sys.all_objects

  WHERE type = 'U'

- ou

  EXEC sp_tables



Stored Procedures

***sp*'s para acesso a Meta informação**

System stored procedures that implement data dictionary functions.	
sp_column_privileges	Returns column privilege information for a single table in the current environment.
sp_columns	Returns column information for the specified objects that can be queried in the current environment.
sp_fkeys	Returns logical foreign key information for the current environment.
sp_pkeys	Returns primary key information for a single table in the current environment.
sp_server_info	Returns a list of attribute names and matching values for SQL Server
sp_special_columns	Returns the optimal set of columns that uniquely identify a row in the table.
sp_sproc_columns	Returns column information for a single stored procedure or user-defined function in the current environment.
sp_statistics	Returns a list of all indexes and statistics on a specified table or indexed view.
sp_stored_procedures	Returns a list of stored procedures in the current environment.
sp_table_privileges	Returns a list of table permissions (such as INSERT, DELETE, UPDATE, SELECT, REFERENCES) for the specified table or tables.
sp_tables	Returns a list of objects that can be queried in the current environment. This means any table or view, except synonym objects.

Stored Procedures

SQL

Exemplo

(*Adventure Work LT*)

tabela

- sys.sp_columns 'customer'

Results | Messages

	TABLE_QUALIFIER	TABLE_OWNER	TABLE_NAME	COLUMN_NAME	DATA_TYPE	TYPE_NAME	PRECISION
1	AdventureWorksLT2012	SalesLT	Customer	CustomerID	4	int identity	10
2	AdventureWorksLT2012	SalesLT	Customer	NameStyle	-7	NameStyle	1
3	AdventureWorksLT2012	SalesLT	Customer	Title	-9	nvarchar	8
4	AdventureWorksLT2012	SalesLT	Customer	FirstName	-9	Name	50
5	AdventureWorksLT2012	SalesLT	Customer	MiddleName	-9	Name	50
6	AdventureWorksLT2012	SalesLT	Customer	LastName	-9	Name	50
7	AdventureWorksLT2012	SalesLT	Customer	Suffix	-9	nvarchar	10
8	AdventureWorksLT2012	SalesLT	Customer	CompanyName	-9	nvarchar	128
9	AdventureWorksLT2012	SalesLT	Customer	SalesPerson	-9	nvarchar	256
10	AdventureWorksLT2012	SalesLT	Customer	EmailAddress	-9	nvarchar	50
11	AdventureWorksLT2012	SalesLT	Customer	Phone	-9	Phone	25
12	AdventureWorksLT2012	SalesLT	Customer	PasswordHash	12	varchar	128
13	AdventureWorksLT2012	SalesLT	Customer	PasswordSalt	12	varchar	10
14	AdventureWorksLT2012	SalesLT	Customer	rowguid	-11	uniqueidenti...	36
15	AdventureWorksLT2012	SalesLT	Customer	ModifiedDate	11	datetime	23

Metadata Functions

SQL

```
SELECT DB_NAME()

SELECT DB_ID(N'AdventureWorksLT2012');

SELECT DB_NAME(database_id)
FROM sys.databases
WHERE database_id = DB_ID();
```

Functions

@@PROCID	INDEX_COL
APP_NAME	INDEXKEY_PROPERTY
APPLOCK_MODE	INDEXPROPERTY
APPLOCK_TEST	NEXT VALUE FOR
ASSEMBLYPROPERTY	OBJECT_DEFINITION
COL_LENGTH	OBJECT_ID
COL_NAME	OBJECT_NAME
COLUMNPROPERTY	OBJECT_SCHEMA_NAME
DATABASE_PRINCIPAL_ID	OBJECTPROPERTY
DATABASEPROPERTYEX	OBJECTPROPERTYEX
DB_ID	ORIGINAL_DB_NAME
DB_NAME	PARSENAME
FILE_ID	SCHEMA_ID
FILE_IDEX	SCHEMA_NAME
FILE_NAME	SCOPE_IDENTITY
FILEGROUP_ID	SERVERPROPERTY
FILEGROUP_NAME	STATS_DATE
FILEGROUPPROPERTY	TYPE_ID
FILEPROPERTY	TYPE_NAME
FULLTEXTCATALOGPROPERTY	TYPEPROPERTY
FULLTEXTSERVICEPROPERTY	

Metadata Functions

SQL

```
SELECT OBJECT_ID(N'SalesLT.Product');

SELECT OBJECT_NAME(OBJECT_ID(N'SalesLT.Product'));
```

```
SELECT OBJECT_NAME(c.object_id)
FROM sys.columns c
join sys.tables t
on t.object_id=c.object_id
WHERE c.is_nullable = 1
GROUP BY c.object_id
```

O que devolve?

Functions

@@PROCID	INDEX_COL
APP_NAME	INDEXKEY_PROPERTY
APPLOCK_MODE	INDEXPROPERTY
APPLOCK_TEST	NEXT VALUE FOR
ASSEMBLYPROPERTY	OBJECT_DEFINITION
COL_LENGTH	OBJECT_ID
COL_NAME	OBJECT_NAME
COLUMNPROPERTY	OBJECT_SCHEMA_NAME
DATABASE_PRINCIPAL_ID	OBJECTPROPERTY
DATABASEPROPERTYEX	OBJECTPROPERTYEX
DB_ID	ORIGINAL_DB_NAME
DB_NAME	PARSENAME
FILE_ID	SCHEMA_ID
FILE_IDEX	SCHEMA_NAME
FILE_NAME	SCOPE_IDENTITY
FILEGROUP_ID	SERVERPROPERTY
FILEGROUP_NAME	STATS_DATE
FILEGROUPPROPERTY	TYPE_ID
FILEPROPERTY	TYPE_NAME
FULLTEXTCATALOGPROPERTY	TYPEPROPERTY
FULLTEXTSERVICEPROPERTY	

Metadata Functions

SQL

O que devolve?

```
SELECT OBJECT_NAME(c.object_id)
FROM sys.columns c
join sys.tables t
on t.object_id=c.object_id
WHERE c.is_nullable = 1
GROUP BY c.object_id
```

-- ajuda …..

```
-- descriptions
-- columns
select * from sys.system_columns c
where c.object_id in
    (SELECT sv.object_id FROM sys.system_views sv
    where sv.name='columns' and sv.schema_id=schema_ID('sys'));

-- tables
select * from sys.system_columns c
where c.object_id in
    (SELECT sv.object_id FROM sys.system_views sv
    where sv.name='tables' and sv.schema_id=schema_ID('sys'));
```

Metadata Functions

"Categorias" da *metadata functions*

Categories				
Object	Database	Column	File	Schema
Object_Id()	Databaseproperty()	Col_Length()	File_Id()	Schema_Id()
Object_Name()	Databasepropertyex()	Col_Name()	File_Name()	Schema_Name()
Objectproperty()	Db_Id()	Columnproperty()	Filegroup_Id()	Object_Schema_Name()
Objectpropertyex()	Db_Name()		Filegroup_Name()	
Object_Schema_Name()			Filegroupproperty()	
Object_Definition()			Fileproperty()	

Index	FullText	Others	
Index_Col()	Fulltextcatalogproperty()	@@Procid	Stats_Date()
Indexkey_Property()	Fulltextserviceproperty()	Next Value For	Applock_Mode()
Indexproperty()		Typeproperty()	Applock_Test()
		Sql_Variant_Property()	ParseName()
		APP_NAME()	
		ASSEMBLYPROPERTY()	
		Scope_Identity()	

mini Sumário

1. Indique duas formas possíveis de aceder aos metadados?

2. As funções *OBJECT_ID()* e *OBJECT_NAME()* podem ser utilizadas em *queries* às *views* do *Sys Schema* e do *Information_Schema*?

3. As *sp* de sistema que facilitam o acesso a metadados pertencem ao *Sys schema*, ao *Information_Schema* ou ambos?

Exemplos

SQL

```sql
SELECT name, column_id
FROM sys.columns
WHERE object_id = OBJECT_ID(N'SalesLT.ProductModel');
```

ou

```sql
SELECT c.COLUMN_NAME,
c.ORDINAL_POSITION
FROM INFORMATION_SCHEMA.COLUMNS c
WHERE c.TABLE_NAME='ProductModel'
```

	COLUMN_NAME	ORDINAL_POSITION
1	ProductModelID	1
2	Name	2
3	CatalogDescription	3
4	rowguid	4
5	ModifiedDate	5

Exemplos

SQL

```
SELECT
  name,
  max_column_id_used as 'Numero de colunas'
FROM sys.tables st
WHERE schema_id = SCHEMA_ID(N'SalesLT');
```

O que devolve ?

	name	Numero de colunas
1	Address	9
2	Customer	15
3	CustomerAddress	5
4	Product	17
5	ProductCategory	5
6	ProductDescription	4
7	ProductModel	5
8	ProductModelProductDescripti...	5
9	SalesOrderDetail	9
10	SalesOrderHeader	22

O que pode estar aqui mal?

Exemplos

SQL

Solução?

```
SELECT st.name, count(sc.name) as 'Numero de colunas'
FROM sys.columns sc
join sys.tables st
on sc.object_id=st.object_id
WHERE st.schema_id= schema_ID(N'SalesLT')
GROUP BY st.name
```

	name	Numero de colunas
1	Address	9
2	Customer	15
3	CustomerAddress	5
4	Product	17
5	ProductCategory	5
6	ProductDescription	4
7	ProductModel	5
8	ProductModelProductDescripti...	5
9	SalesOrderDetail	9
10	SalesOrderHeader	22

Exemplos

SQL

Solução? (alternativa – utilizando INFORMATION.SCHEMA)

Exercício

```
SELECT ct.TABLE_NAME, COUNT(*) as 'Numero de colunas'
FROM INFORMATION_SCHEMA.COLUMNS ct
WHERE ct.TABLE_SCHEMA = 'SalesLT'
group by ct.TABLE_NAME
```

Results | Messages

	TABLE_NAME	Numero de colunas
1	Address	9
2	AddressType	4
3	BusinessEntity	3
4	BusinessEntityAddress	5
5	BusinessEntityContact	5
6	ContactType	3
7	CountryRegion	3
8	EmailAddress	5
9	Password	5
10	Person	13
11	PersonPhone	4
12	PhoneNumberType	3
13	StateProvince	8
14	vAdditionalContactInfo	17
15	vStateProvinceCountryRegion	7

≠

Results | Messages

	name	Numero de colunas
1	Address	9
2	AddressType	4
3	BusinessEntity	3
4	BusinessEntityAddress	5
5	BusinessEntityContact	5
6	ContactType	3
7	CountryRegion	3
8	EmailAddress	5
9	Password	5
10	Person	13
11	PersonPhone	4
12	PhoneNumberType	3
13	StateProvince	8

Exemplos

SQL

Solução? (alternativa revista – uma hipótese)

```
SELECT ct.TABLE_NAME, COUNT(*) as 'Numero de colunas'
FROM INFORMATION_SCHEMA.COLUMNS ct
WHERE ct.TABLE_SCHEMA = 'SalesLT' AND
      ct.TABLE_NAME not in (
            SELECT v.TABLE_NAME
            FROM INFORMATION_SCHEMA.VIEWS v
            )
group by ct.TABLE_NAME
```

Results | Messages

	name	Numero de colunas
1	Address	9
2	AddressType	4
3	BusinessEntity	3
4	BusinessEntityAddress	5
5	BusinessEntityContact	5
6	ContactType	3
7	CountryRegion	3
8	EmailAddress	5
9	Password	5
10	Person	13
11	PersonPhone	4
12	PhoneNumberType	3
13	StateProvince	8

Results | Messages

	name	Numero de colunas
1	Address	9
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5	BusinessEntityContact	5
6	ContactType	3
7	CountryRegion	3
8	EmailAddress	5
9	Password	5
10	Person	13
11	PersonPhone	4
12	PhoneNumberType	3
13	StateProvince	8

Exemplos

SQL

Solução? (alternativa revista – outra hipótese)

```
SELECT col.table_name, COUNT(col.column_name) 'Numero de colunas'
FROM information_schema.columns col
  JOIN information_schema.tables tbl
       ON tbl.table_name = col.table_name
          AND tbl.table_schema = col.table_schema
          AND tbl.table_catalog = col.table_catalog
          AND tbl.table_type <> 'VIEW'
WHERE tbl.TABLE_SCHEMA = 'Person'
GROUP BY col.table_name
```

Results | Messages

	name	Numero de colunas
1	Address	9
2	AddressType	4
3	BusinessEntity	3
4	BusinessEntityAddress	5
5	BusinessEntityContact	5
6	ContactType	3
7	CountryRegion	3
8	EmailAddress	5
9	Password	5
10	Person	13
11	PersonPhone	4
12	PhoneNumberType	3
13	StateProvince	8

5:00

Exercício

quizz

Qual dos comandos produz o resultado da figura?

```
A. exec sp_tables;

B. select schema_name(t.schema_id), t.name,
t.type_desc
from sys.tables t;

C. select *
from INFORMATION_SCHEMA.TABLES;
```

	TABLE_QUALIFIER	TABLE_OWNER	TABLE_NAME	TABLE_TYPE
7	AdventureWorksLT2012	SalesLT	Product	TABLE
8	AdventureWorksLT2012	SalesLT	ProductCategory	TABLE
9	AdventureWorksLT2012	SalesLT	ProductDescription	TABLE
10	AdventureWorksLT2012	SalesLT	ProductModel	TABLE
11	AdventureWorksLT2012	SalesLT	ProductModelProductDescripti...	TABLE
12	AdventureWorksLT2012	SalesLT	SalesOrderDetail	TABLE
13	AdventureWorksLT2012	SalesLT	SalesOrderHeader	TABLE
14	AdventureWorksLT2012	sys	trace_xe_action_map	TABLE
15	AdventureWorksLT2012	sys	trace_xe_event_map	TABLE
16	AdventureWorksLT2012	INFORMATION_SCHEMA	CHECK_CONSTRAINTS	VIEW
17	AdventureWorksLT2012	INFORMATION_SCHEMA	COLUMN_DOMAIN_USAGE	VIEW
18	AdventureWorksLT2012	INFORMATION_SCHEMA	COLUMN_PRIVILEGES	VIEW
19	AdventureWorksLT2012	INFORMATION_SCHEMA	COLUMNS	VIEW
20	AdventureWorksLT2012	INFORMATION_SCHEMA	CONSTRAINT_COLUMN_USA...	VIEW
21	AdventureWorksLT2012	INFORMATION_SCHEMA	CONSTRAINT_TABLE_USAGE	VIEW

5:00

Exercício

quizz

Que “problema” podemos apontar a esta utilização conjunta dos 2 *schemas*?

```
SELECT isv.TABLE_NAME, isv.VIEW_DEFINITION
FROM INFORMATION_SCHEMA.VIEWS isv
where isv.TABLE_NAME in
                        ( SELECT
                            OBJECT_NAME(sv.object_id)
                          FROM sys.views sv
                          where sv.is_replicated = 0
                          )
```

Exemplos e Exercícios

Outras Funções “uteis”

Exemplos

https://msdn.microsoft.com/en-us/library/ms176105.aspx

OBJECTPROPERTY()

OBJECT_DEFINITION()

HasAfterTrigger	Table, view	Table or view has an AFTER trigger. 1 = True 0 = False
HasDeleteTrigger	Table, view	Table or view has a DELETE trigger. 1 = True 0 = False

```
SELECT OBJECTPROPERTY(OBJECT_ID(N’SalesLT.Product'),'HasDeleteTrigger');
SELECT OBJECTPROPERTY(OBJECT_ID(N’SalesLT.Customer'),'IsUserTable');

SELECT OBJECT_DEFINITION(OBJECT_ID(‘dbo.uspLogError'))
```

Exemplos e Exercícios

SQL

Exercício

O que faz?

```
SELECT name, object_id, type_desc
FROM sys.all_objects
WHERE OBJECTPROPERTY(object_id, N'SchemaId') = SCHEMA_ID(N'SalesLT')
AND OBJECTPROPERTY(object_id, N'ISTABLE')=1
ORDER BY type_desc, name;
```

Results | Messages

	name	object_id	type_desc
1	Address	373576369	USER_TABLE
2	AddressType	421576540	USER_TABLE
3	BusinessEntity	629577281	USER_TABLE
4	BusinessEntityAddress	677577452	USER_TABLE
5	BusinessEntityContact	725577623	USER_TABLE
6	ContactType	773577794	USER_TABLE
7	CountryRegion	837578022	USER_TABLE
8	EmailAddress	1189579276	USER_TABLE
9	Password	1717581157	USER_TABLE
10	Person	1765581328	USER_TABLE
11	PersonPhone	1909581841	USER_TABLE

5:00

Exercício 2 + 2

Indique:

1. 2 tópicos que considera importantes na aula de hoje
2. 2 tópicos que requeiram esclarecimento adicional

Recolha das Folhas de Resposta

CORREÇÃO DOS EXERCÍCIOS

Exercício

AdventureWorksLT2012

SQL

Escolher a(s) opções de query para cada um dos pontos:

1. Listar todas as tabelas da BD?
2. Quantas tabelas tem a BD?
3. Quantas colunas tem cada tabela?

```
--A select * from INFORMATION_SCHEMA.TABLES;
```

```
--B select * from INFORMATION_SCHEMA.TABLES t
where t.TABLE_TYPE=upper('base table');
```

```
--C select * from sys.tables;
```

```
--D select count(*)
from sys.tables t ;
```

```
--E select c.TABLE_NAME, count(c.COLUMN_NAME)
from INFORMATION_SCHEMA.COLUMNS c join INFORMATION_SCHEMA.TABLES t
on t.TABLE_NAME=c.TABLE_NAME where t.TABLE_TYPE='base table'
group by c.TABLE_NAME;
```

```
--F select t.name, count(*)
from sys.all_columns as c inner join sys.tables t on c.object_id=t.object_id
group by t.name;
```

Exercício

quizz

Qual dos comandos produz o resultado da figura?

```
A. exec sp_tables;

B. select schema_name(t.schema_id), t.name,
t.type_desc
from sys.tables t;

C. select *
from INFORMATION_SCHEMA.TABLES;
```

	TABLE_QUALIFIER	TABLE_OWNER	TABLE_NAME	TABLE_TYPE
7	AdventureWorksLT2012	SalesLT	Product	TABLE
8	AdventureWorksLT2012	SalesLT	ProductCategory	TABLE
9	AdventureWorksLT2012	SalesLT	ProductDescription	TABLE
10	AdventureWorksLT2012	SalesLT	ProductModel	TABLE
11	AdventureWorksLT2012	SalesLT	ProductModelProductDescripti...	TABLE
12	AdventureWorksLT2012	SalesLT	SalesOrderDetail	TABLE
13	AdventureWorksLT2012	SalesLT	SalesOrderHeader	TABLE
14	AdventureWorksLT2012	sys	trace_xe_action_map	TABLE
15	AdventureWorksLT2012	sys	trace_xe_event_map	TABLE
16	AdventureWorksLT2012	INFORMATION_SCHEMA	CHECK_CONSTRAINTS	VIEW
17	AdventureWorksLT2012	INFORMATION_SCHEMA	COLUMN_DOMAIN_USAGE	VIEW
18	AdventureWorksLT2012	INFORMATION_SCHEMA	COLUMN_PRIVILEGES	VIEW
19	AdventureWorksLT2012	INFORMATION_SCHEMA	COLUMNS	VIEW
20	AdventureWorksLT2012	INFORMATION_SCHEMA	CONSTRAINT_COLUMN_USA...	VIEW
21	AdventureWorksLT2012	INFORMATION_SCHEMA	CONSTRAINT_TABLE_USAGE	VIEW

Exercício

quizz

Que “problema” podemos apontar a esta utilização conjunta dos 2 *schemas*?

```
SELECT isv.TABLE_NAME, isv.VIEW_DEFINITION
FROM INFORMATION_SCHEMA.VIEWS isv
where isv.TABLE_NAME in
                        ( SELECT
                            OBJECT_NAME(sv.object_id)
                          FROM sys.views sv
                          where sv.is_replicated = 0
                          )
```

EXERCÍCIOS COM PC

Exemplos e Exercícios

SQL

Exercício

- Liste todos os campos que são *nullable* da tabela Product

```
SELECT name, is_nullable
FROM sys.columns sc
WHERE object_id = OBJECT_ID(N'SalesLT.Product')
  and is_nullable =1
```

- Liste o tipo de todos os campos da tabela Customer

```
SELECT name ColumnName,
  TYPE_NAME(system_type_id) SystemType
FROM sys.columns
WHERE object_id = OBJECT_ID(N'SalesLT.Customer')
```

Exemplos e Exercícios

SQL

Exercício

- Liste o conjunto de chaves Primária(s) e Estrangeira(s) associadas a uma tabela; e.g. Product

```
SELECT
DISTINCT
Constraint_Name AS [Constraint],
Table_Schema AS [Schema],
Table_Name AS [TableName]
FROM INFORMATION_SCHEMA.KEY_COLUMN_USAGE
WHERE TABLE_NAME='Product'
```

	Constraint	Schema	TableName
1	AK_Product_Name	SalesLT	Product
2	AK_Product_ProductNumber	SalesLT	Product
3	AK_Product_rowguid	SalesLT	Product
4	FK_Product_ProductCategory_ProductCategory...	SalesLT	Product
5	FK_Product_ProductModel_ProductModelID	SalesLT	Product
6	PK_Product_ProductID	SalesLT	Product

Exemplos e Exercícios

SQL

Exercício (alternativa)

- Liste o conjunto de chaves Primária(s) e Estrangeira(s) associadas a uma tabela; e.g. Product

```
SELECT OBJECT_NAME(OBJECT_ID) AS NameofConstraint,
SCHEMA_NAME(schema_id) AS SchemaName,
OBJECT_NAME(parent_object_id) AS TableName,
type_desc AS ConstraintType
FROM sys.objects
WHERE type_desc IN
('FOREIGN_KEY_CONSTRAINT','PRIMARY_KEY_CONSTRAINT')
AND OBJECT_NAME(parent_object_id)='Product'
```

	NameofConstraint	SchemaNa...	TableName	ConstraintType
1	PK_Product_ProductID	SalesLT	Product	PRIMARY_KEY_CONSTRAI...
2	FK_Product_ProductCategory_ProductCategory...	SalesLT	Product	FOREIGN_KEY_CONSTRAI...
3	FK_Product_ProductModel_ProductModelID	SalesLT	Product	FOREIGN_KEY_CONSTRAI...

Exemplos e Exercícios

Exercício

- Liste as tabelas referenciadas pelas Chaves Estrangeira(s) de uma tabela; e.g. SalesLT.Product

```
SELECT
  object_name(parent_object_id) Origem,
  object_name(referenced_object_id) Referenciado,
  name
FROM sys.foreign_keys
WHERE parent_object_id = object_id('SalesLT.Product')
```

	Origem	Referenciado	name
1	Product	ProductCategory	FK_Product_ProductCategory_ProductCategory...
2	Product	ProductModel	FK_Product_ProductModel_ProductModelID

Complementos de Bases de Dados

– *Metadata* –

Engenharia Informática

2º Ano / 1º Semestre

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