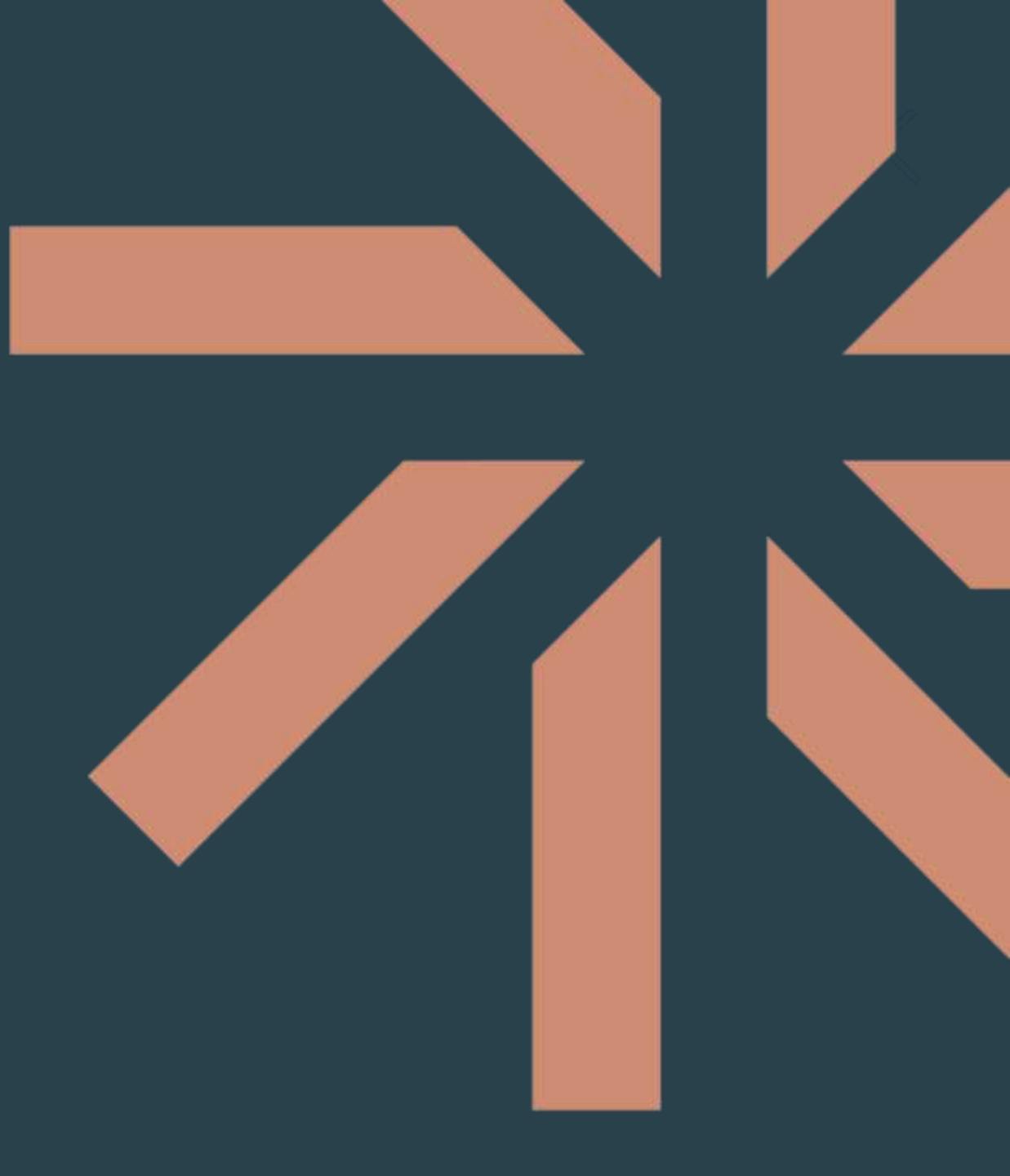
Database Development and Design

Qinshift Academy

Database Development and Design

Developing and Design of databases using PostgreSQL - Powerful, open-source object-relational database



Agenda

- Session 4
  - Homework discussion
  - Quiz
  - Built-in functions and operators
    - Mathematical functions and operators
    - String functions and operators
    - Temporary tables
    - SELECT INTO
    - Workshop
  - Introduction to PL/pgSQL
    - Overview of PL/pgSQL
    - Advantages and disadvantages of PL/pgSQL
    - Dollar-quoted string constant
    - Variables in PL/pgSQL
    - Workshop
  - User-defined functions
    - Creating functions
    - Calling functions
    - Workshop
  - Knowledge check (Workshop, Homework)

Built-In functions and operators

Built-In functions – Mathematical operators

Operator	Description	Example	Result
+	Addition	2 + 3	5
-	Subtraction	3 - 2	1
*	Multiplication	2 * 3	6
/	Division (integer division truncates the result)	4 / 2	2
^	Exponentiation	2 ^ 3	8
@	Absolute value	@ -5	5

Built-In functions – Mathematical functions

Function	Description	Example	Result
`abs(x)`	Absolute value	`abs(-13.2)`	`13.2`
`ceil(x)`	Nearest integer greater than or equal to argument	`ceil(13.2)`	`14`
`floor(x)`	Nearest integer less than or equal to argument	`floor(13.8)`	`13`
`round(x)`	Round to nearest integer	`round(14.8)`	`15`
`random(x)`	Random value in the range 0.0 <= x < 1.0	`random()`	`0.12514…`

Built-In functions – String functions and operators 1/2

Function	Description	Example	Result
`string || string`	String concatenation	`'Post' || 'greSQL'`	`PostgreSQL`
`string || non-string` **or** `non-string || string`	String concatenation with one non-string input	`'Value: ' || 42`	`Value: 42`
`char_length(string)` **or** `character_length(string)` **or** `length(string)`	Number of characters in a string	`char_length('bojan')`	`5`
`lower(string)`	Convert string to lower case	`lower('BOJAN')`	`bojan`
`position(substring in string)`	Location in string of specified substring	`position('an' in 'Bojan')`	`4`
`substring(string text` **from** `N int` **for** `M int)`	Extract substring **from** n-th position **for** m number of characters	`substring('Seavus' from 2 for 3)`	`eav`
`upper(string)`	Convert string to upper case	`upper('bojan')`	`BOJAN`

Built-In functions – String functions and operators 2/2

Function	Description	Example	Result
`concat(string1, string2, ...)`	Concatenate all arguments. Null arguments are ignored.	`concat('Bojan', 2, NULL, 'Zdravkovski')`	`Bojan2Zdravkovski`
`left(str text, n int)`	Return first n characters in the string.	`left('Bojan', 2)`	`Bo`
`replace(string text, from text, to text)`	Replace all occurrences in string of substring **from** with substring **to.**	`replace('123ab123cd123ef', '123', 'XX')`	`XXabXXcdXXef`
`reverse(str)`	Return reversed string.	`reverse('Bojan')`	`najoB`
`right(str text, n int)`	Return last n characters in the string.	`right('Bojan', 2)`	`an`

Temporary tables

- A temporary table is a short-lived table that exists for the duration of a database session. PostgreSQL automatically drops the temporary tables at the end of a session or a transaction.
- To create a temporary table, you use the CREATE TEMPORARY TABLE statement.
- The TEMP and TEMPORARY keywords are equivalent so you can use them interchangeably:

```
CREATE TEMPORARY TABLE temp_table_name(
   column_list
);
```

SELECT INTO

- The PostgreSQL SELECT INTO statement can create a new table and insert data returned from a query into the table.

```
SELECT
   select_list
INTO TEMPORARY TABLE new_table_name
FROM
   table_name
WHERE
   search_condition;
```

- More commonly, SELECT INTO is used to assign the values from the select statement into a variable. We will get on this later.

Built-in functions – workshop

- Concatenate director's first name and last name with movie title
- Convert all genre names to uppercase
- Convert all movie titles to lowercase
- Extract the first 10 characters of movie titles
- Extract the last 5 characters of actor names
- Extract the last 5 characters of actor names
- Get the length of movie titles
- Extract a substring from movie plot summaries (characters 10-40)
- Remove leading and trailing spaces from movie locations
- Replace null values with 'Not Available' for movie languages
- Replace 'a' with 'A' in movie titles

Introduction to PL/pgSQL

Overview of PostgreSQL PL/pgSQL

- PL/pgSQL is a procedural programming language for the PostgreSQL database system.
- PL/pgSQL allows you to extend the functionality of the PostgreSQL database server by creating server objects with complex logic.
- PL/pgSQL was designed to:
- Create user-defined functions, stored procedures, and triggers.
- Extend standard SQL by adding control structures such as if, case, and loop statements.
- Inherit all user-defined functions, operators, and types.
- Since PostgreSQL 9.0, PL/pgSQL is installed by default.

Advantages of using PL/pgSQL 1/2

- SQL is a query language that allows you to query data from the database easily. However, PostgreSQL can only execute SQL statements individually.
- It means that you have multiple statements, you need to execute them one by one like this:
- Send a query to the PostgreSQL database server.
- Wait for it to process.
- Process the result set.
- Do some calculations.
- Send another query to the PostgreSQL database server and repeat this process.
- This process creates unnecessary network overhead and is not efficient for working with complex queries containing multiple statements.
- To resolve this issue, PostgreSQL uses PL/pgSQL.

Advantages of using PL/pgSQL 2/2

- PL/pgSQL wraps multiple statements in an object and stores it on the PostgreSQL database server.
- So instead of sending multiple statements to the server one by one, you can send one statement to execute the object stored in the server. This allows you to:
- Reduce the number of round trips between the application and the PostgreSQL database server.
- Avoid transferring the intermediate results between the application and the server.

PostgreSQL PL/pgSQL disadvantages

- Slower in software development because PL/pgSQL requires specialized skills that many developers do not possess.
- Difficult to manage versions and hard to debug.
- May not be portable to other database management systems.

Dollar-quoted string constant syntax

- In PostgreSQL, you use single quotes for a string constant like this:

```
SELECT 'String constant';
```

- When a string constant contains a single quote ('), you need to escape it by doubling up the single quote. For example:

```
SELECT 'I''m also a string constant';
```

- In older versions of PostgreSQL, backslashes need to be escaped too.
- The problem arises when the string constant contains many single quotes and backslashes. Doubling every single quote and backslash makes the string constant more difficult to read and maintain.
- The dollar quoting feature gets rid of this problem. Example:

```
$tag$<string_constant>$tag$
```

Using dollar-quoted string constant in anonymous blocks

- The following shows the anonymous block in PL/pgSQL:

```
do
 'declare
  totalquantity integer;
begin
  select count(quantity) into totalquantity from orderdetails;
  raise notice ''The total number of quantities for all orders is: %'',
totalquantity;
  end;';
```

- To avoid escaping every single quotes and backslashes, you can use the dollar-quoted string as follows:

```
do
$$
 declare
  totalquantity integer;
begin
  select count(quantity) into totalquantity from orderdetails;
  raise notice 'The total number of quantities for all orders is: %', totalquantity;
  end; $$;
```

Variables in PL/pgSQL

- A variable is a meaningful name of a memory location. A variable holds a value that can be changed through the block. A variable is always associated with a particular data type.
- Before using a variable, you must declare it in the declaration section of the PL/pgSQL block.

```
variable_name data_type [:= expression];
```

- Example:

```
do $$
declare
   first_name varchar(50) := 'John';
   last_name  varchar(50) := 'Doe';
   payment    numeric(11,2) := 20.5;
begin
   raise notice '% % has been paid % USD',
             first_name,
             last_name,
             payment;
end $$;
```

User-defined functions

CREATE FUNCTION 1/2

- The CREATE FUNCTION statement allows you to define a new user-defined function.
- The following illustrates the syntax of the create function statement:

```
create [or replace] function function_name(param_list)
   returns return_type
   language plpgsql
  as
$$
declare
-- variable declaration
begin
 -- logic
end;
$$
```

CREATE FUNCTION 2/2

- First, specify the name of the function after the create function keywords. If you want to replace the existing function, you can use the or replace keywords.
- Then, specify the function parameter list surrounded by parentheses after the function name. A function can have zero or many parameters.
- Next, specify the datatype of the returned value after the returns keyword.
- After that, use the language plpgsql to specify the procedural language of the function. Note that PostgreSQL supports many procedural languages, not just plpgsql.
- Finally, place a block in the dollar-quoted string constant.

Calling a user-defined function

- PostgreSQL provides you with three ways to call a user-defined function:
- Using positional notation
- Using named notation
- Using the mixed notation

```
create function get_product_count_by_weight(min_weight int, max_weight int)
    returns int
    language plpgsql
as
$$
declare
    product_count integer;
begin
    select count(*)
    into product_count
    from product
    where weight between min_weight and max_weight;

    return product_count;
end;
$$;
```

Calling a user-defined function using positional notation

- To call a function using the positional notation, you need to specify the arguments in the same order as parameters. For example:

```
select get_product_count_by_weight(40, 90);
```

Calling a user-defined function using named notation

- In the named notation, you use the => to separate the argument's name and its value.

```
select get_product_count_by_weight(
    min_weight => 40,
    max_weight => 90
);
```

Calling a user-defined function using mixed notation

- The mixed notation is the combination of positional and named notations. For example:

```
select get_product_count_by_weight(40, max_weight => 90);
```

- Note that you cannot use the named arguments before positional arguments like this:

```
select get_product_count_by_weight(min_weight => 40, 90);
```

User-defined functions – workshop

- Declare function (calculate_movie_age) to calculate movie age in years
- Declare function (format_full_name) to format full name (combines first and last name with proper spacing)
- Declare function to (calculate_profit) to calculate movie profit

Questions?

Trainer Name

Trainer mail

Assistant Name

Assistant mail

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