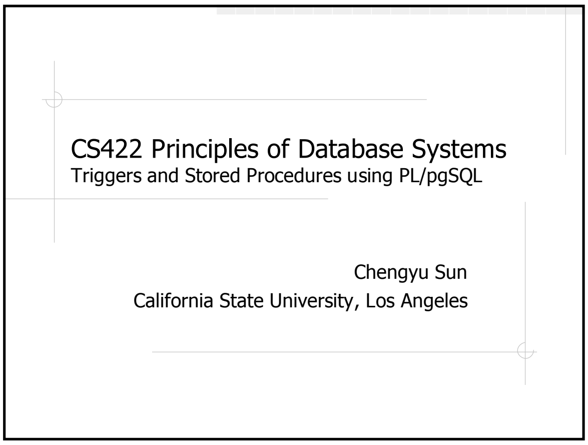

CS422 Principles of Database Systems

Triggers and Stored Procedures using PL/pgSQL

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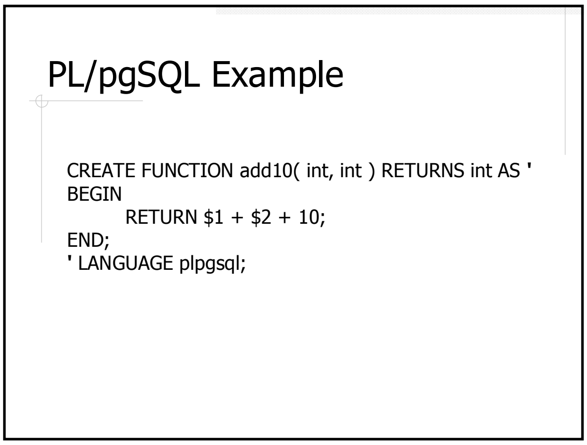
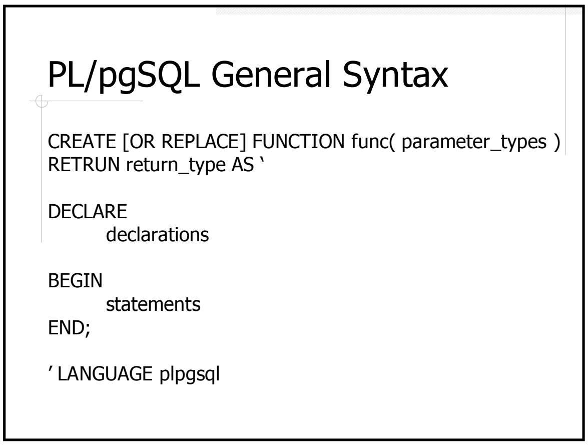


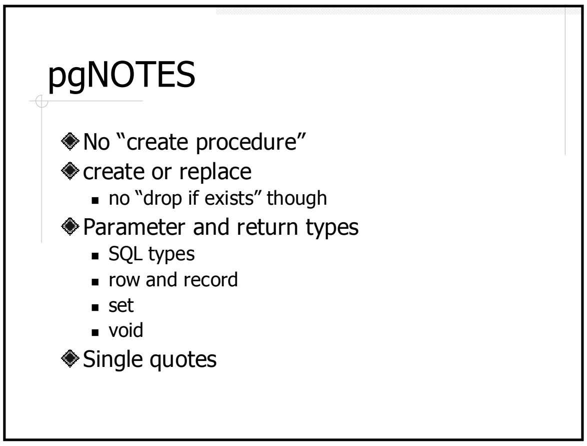
PL/pgSQL Example

```
CREATE FUNCTION add10( int, int ) RETURNS int AS '
BEGIN
        RETURN $1 + $2 + 10;
END;
' LANGUAGE plpgsql;
```



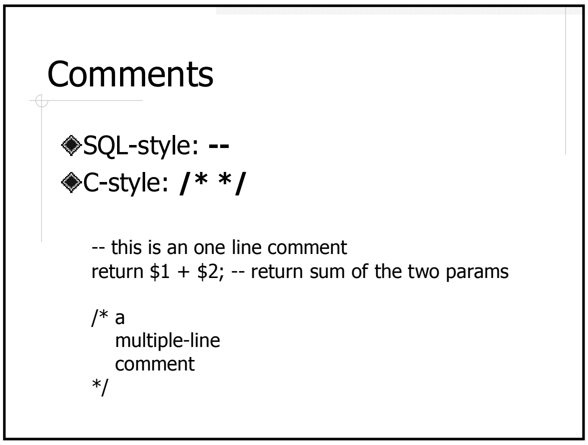
PL/pgSQL General Syntax

```
CREATE [OR REPLACE] FUNCTION func( parameter_types )
RETRUN return_type AS ‘

DECLARE
        declarations

BEGIN
        statements
END;

’ LANGUAGE plpgsql
```



pgNOTES

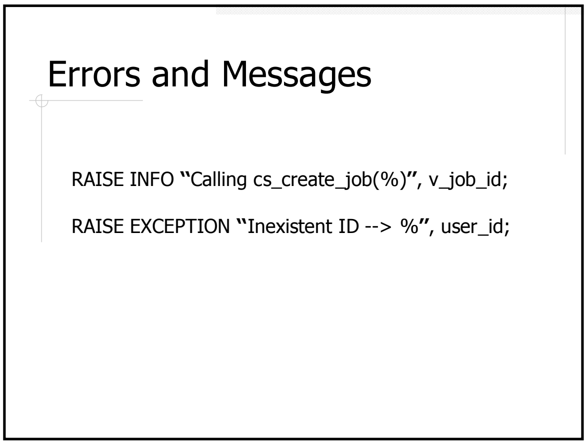
- No “create procedure”
- create or replace
  - no “drop if exists” though
- Parameter and return types
  - SQL types
  - row and record
  - set
  - void
- Single quotes



Comments

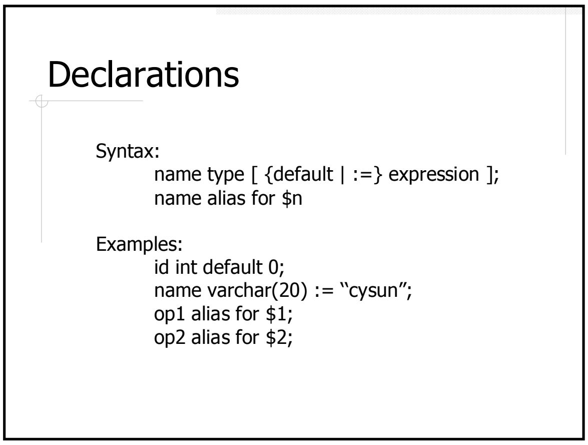
- SQL-style: **--**
- C-style: **/* */**

```
-- this is an one line comment
return $1 + $2; -- return sum of the two params

/* a
   multiple-line
   comment
*/
```



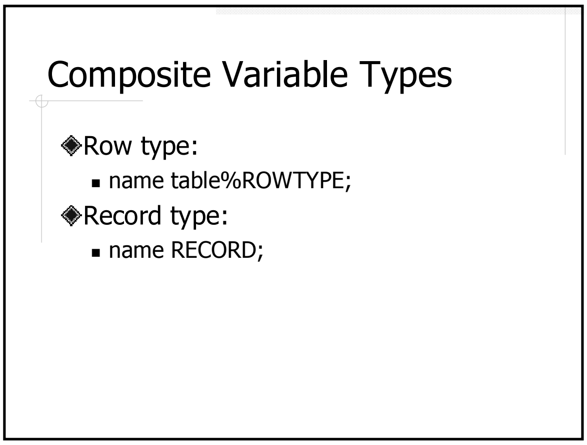
Errors and Messages

```
RAISE INFO “Calling cs_create_job(%)”, v_job_id;

RAISE EXCEPTION “Inexistent ID --> %”, user_id;
```



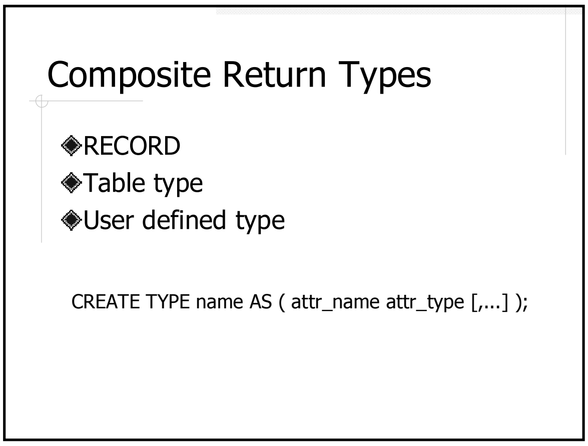
Declarations

```
Syntax:
        name type [ {default | :=} expression ];
        name alias for $n

Examples:
        id int default 0;
        name varchar(20) := "cysun";
        op1 alias for $1;
        op2 alias for $2;
```



Composite Variable Types

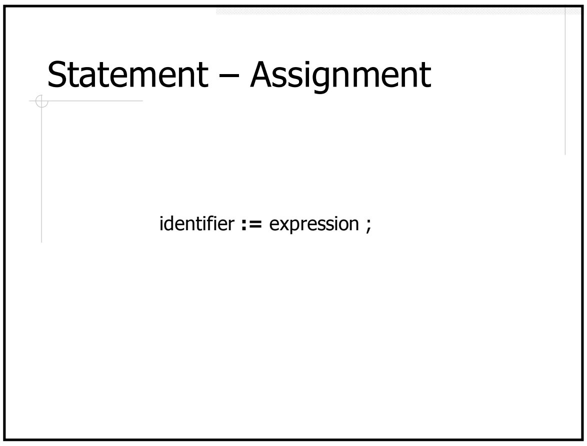
- Row type:
  - name table%ROWTYPE;
- Record type:
  - name RECORD;



Composite Return Types

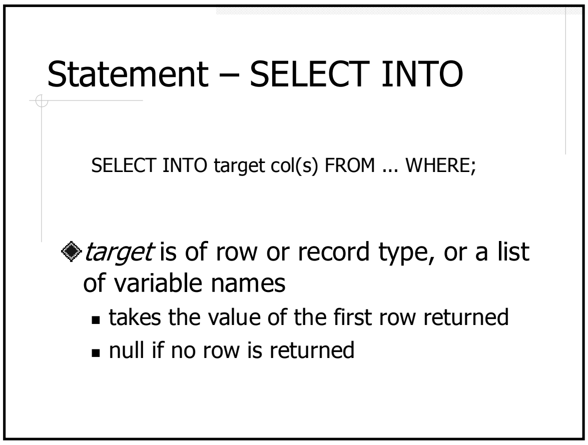
- RECORD
- Table type
- User defined type

```
CREATE TYPE name AS ( attr_name attr_type [,...] );
```



Statement – Assignment

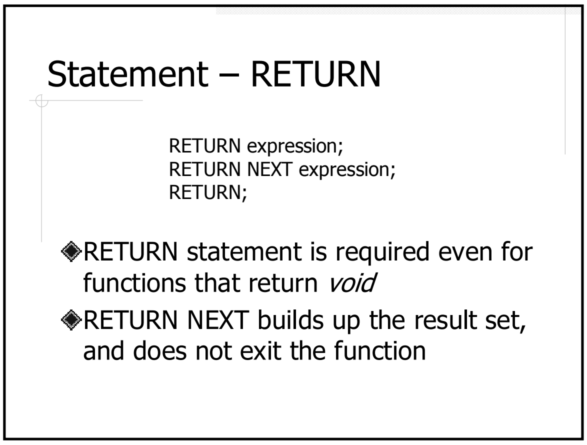
```
identifier := expression ;
```



Statement – SELECT INTO

```
SELECT INTO target col(s) FROM ... WHERE;
```

- *target* is of row or record type, or a list of variable names
  - takes the value of the first row returned
  - null if no row is returned



Statement – RETURN

```
RETURN expression;
RETURN NEXT expression;
RETURN;
```

- RETURN statement is required even for functions that return *void*
- RETURN NEXT builds up the result set, and does not exit the function

Cursors

```
name CURSOR [ ( arguments ) ] FOR query ;
```

Examples:

```
curs1 refcursor;
curs2 CURSOR FOR SELECT * FROM table1;
curs3 CURSOR (k integer) FOR SELECT * FROM table1 WHERE key=k;
```

Opening and Closing Cursors

- Bound and unbound cursors

```
OPEN curs1 FOR SELECT * FROM table2;

OPEN curs2;

OPEN curs3(47);

CLOSE curs1;
CLOSE curs2;
CLOSE curs3;
```

Fetching From a Cursor

```
FETCH cursor INTO target;
```

Examples:

```
FETCH curs1 INTO record1;

FETCH curs2 INTO v1, v2, v3;
```

- Special variable FOUND

Statement – Conditionals

```
IF boolean-expression THEN
    statements
END IF;

IF boolean-expression THEN
    statements
ELSE
    statements
END IF;
```

```
IF boolean-expression THEN
    statements
ELSIF boolean-expression THEN
    statements
ELSE
    statements ]
END IF;
```

Statement – Simple Loops

```
LOOP
    statements
END LOOP;
```

```
WHILE expression LOOP
    statements
END LOOP;
```

```
EXIT [ WHEN expression ];
```

Statement – FOR (Integer)

```
FOR name IN [ REVERSE ] expression .. expression LOOP
    statements
END LOOP;
```

Examples:

```
FOR i IN 1..10 LOOP
    -- something here
END LOOP;
```

```
FOR i IN REVERSE 10..1 LOOP
    -- something here
END LOOP;
```

Statement – FOR (Query)

```
FOR record_or_rowtype IN query LOOP
    statements
END LOOP;
```

Create Triggers

```
CREATE TRIGGER name
    { BEFORE | AFTER } { event [ OR ... ] }
    ON table [ FOR [ EACH ] { ROW | STATEMENT } ]
    EXECUTE PROCEDURE funcname ( arguments )
```

About Triggers

- ◈Event
  - insert, update, delete
- ◈A trigger is associated with a *table*
- ◈The trigger can be executed
  - once per statement, or
  - once per row

About Firing Triggers

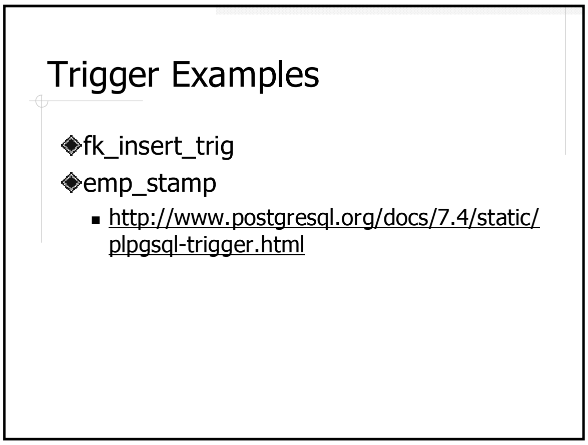
- ◈Multiple triggers are fired in alphabetic order by trigger name
- ◈No restrictions on cascading triggers

About Trigger Procedures

- ◈Must be defined before the trigger is created
- ◈Must be declared as no parameter and return a trigger type
- ◈Return
  - NULL, or
  - the tuple to be modified

Trigger Procedure in PL/pgSQL

- ◈Special variables
  - NEW, OLD
  - TG_NAME, TG_WHEN, TG_LEVEL, TG_OP
  - TG_RELID, TG_RELNAME
  - TG_NARGS, TG_ARGV[]



Trigger Examples

- ◈fk_insert_trig
- ◈emp_stamp
  - http://www.postgresql.org/docs/7.4/static/plpgsql-trigger.html