UNIVERSITÀ DEGLI STUDI DI PADOVA

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

Database Management Systems, A.Y. 2018/2019
Master Degree in Computer Engineering
Master Degree in Telecommunication Engineering

Homework 4 – Physical Design
Deadline: May 22, 2019

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Variations to the Relational Schema

Figure 1 shows the relational schema. The type of the attribute 'EstimatedHours' in the relation Project has been changed from 'Float' to 'Integer' because the information does not need to be that precise.

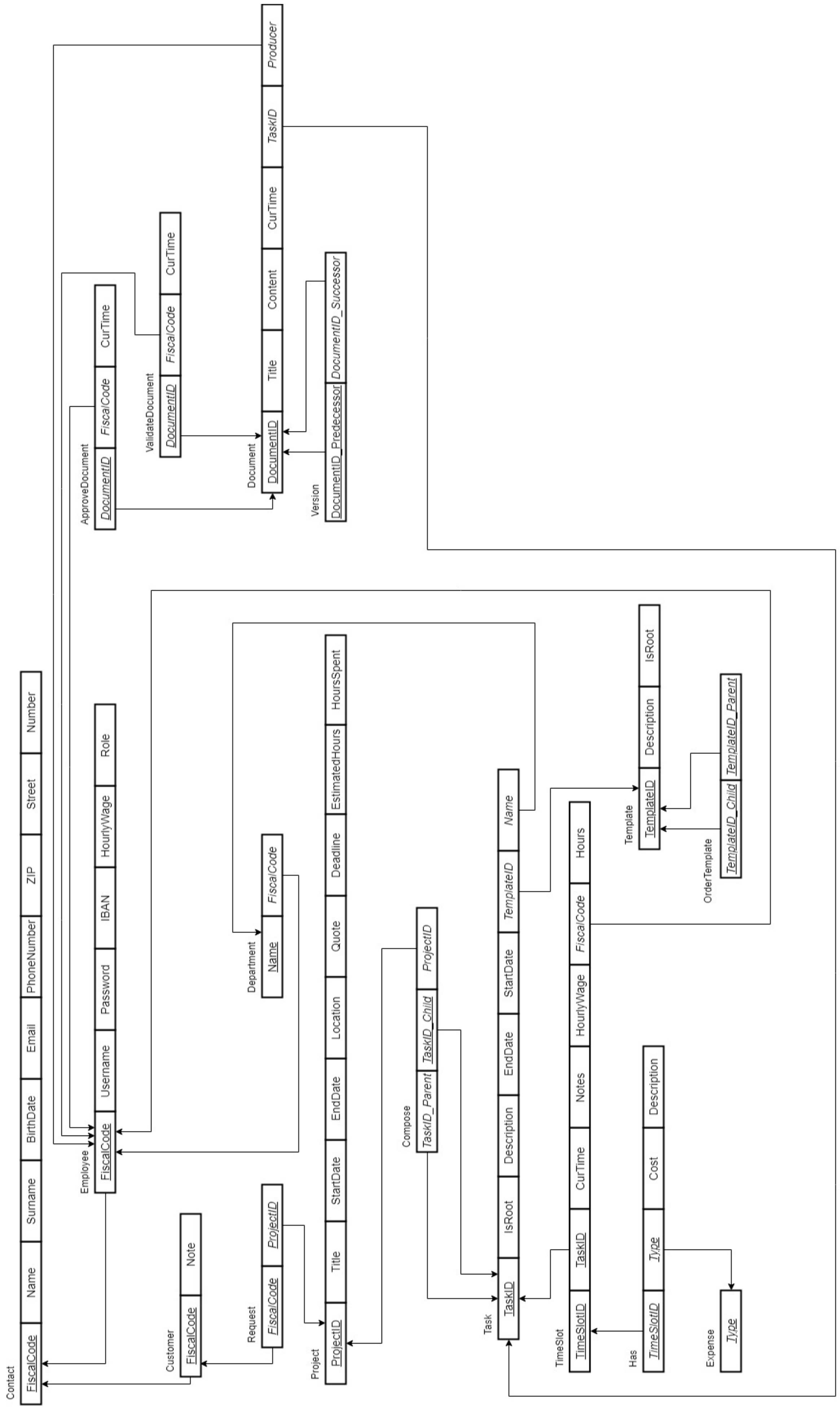


Figure 1: Relational Schema

Physical Schema

In the following the SQL instructions to build the database in Figure 1 are reported. Note that the tables should be created in the correct order, as reported thereafter.

```
-- Database Creation
CREATE DATABASE ennedue OWNER POSTGRES ENCODING = 'UTF8';

-- Connect to examode db to create data for its 'public' schema
\c ennedue

-- Install the extention for the uuid: uuid-ossp.
CREATE EXTENSION IF NOT EXISTS "uuid-ossp";

-- Create new domains
CREATE DOMAIN pwd AS character varying(254)
     CONSTRAINT properpassword CHECK (((VALUE)::text ~* '[A-Za-z0-9._%-
]{5,}'::text));

-- Create new data types
CREATE TYPE roleType AS ENUM (
     'Employee',
     'Chief',
     'Area Manager'
);

-- Table Creation

-- FiscalCode has VARCHAR(16) because the fiscal code length is always 16
-- Contact
CREATE TABLE Contact(
     FiscalCode VARCHAR(16),
     Name VARCHAR NOT NULL,
     Surname VARCHAR NOT NULL,
     BirthDate DATE,
     Email VARCHAR,
     PhoneNumber VARCHAR NOT NULL,
     ZIP VARCHAR(5) NOT NULL,
     Street VARCHAR,
     Number SMALLINT,
     CONSTRAINT Address CHECK ((Street is NULL AND Number is NULL) OR
(Street is NOT  NULL AND Number is NOT NULL)),
     PRIMARY KEY (FiscalCode)
);

COMMENT ON TABLE Contact IS 'Represents a contact.';
COMMENT ON COLUMN Contact.FiscalCode IS 'The unique fiscalCode of the
contact.';
COMMENT ON COLUMN Contact.Name IS 'The name of the contact.';
COMMENT ON COLUMN Contact.Surname IS 'The surname of the contact.';
COMMENT ON COLUMN Contact.BirthDate IS 'The birth date of the contact.';
COMMENT ON COLUMN Contact.Email IS 'The email of the contact.';
COMMENT ON COLUMN Contact.PhoneNumber IS 'The phone number of the
contact.';
COMMENT ON COLUMN Contact.ZIP IS 'The Zone Improvement Plan of the
contact.';
```

```sql
COMMENT ON COLUMN Contact.Street IS 'The street of the contact.';
COMMENT ON COLUMN Contact.Number IS 'The address number of the contact.';

-- Employee
CREATE TABLE Employee(
      FiscalCode VARCHAR(16),
      Username VARCHAR NOT NULL UNIQUE,
      Password VARCHAR NOT NULL,
      IBAN VARCHAR NOT NULL,
      HourlyWage float(2) NOT NULL,
      Role roleType NOT NULL,

      PRIMARY KEY (FiscalCode),
      FOREIGN KEY (FiscalCode) REFERENCES Contact(FiscalCode)
);

COMMENT ON TABLE Employee IS 'Represents an employee.';
COMMENT ON COLUMN Employee.FiscalCode IS 'The unique fiscalCode of the
employee.';
COMMENT ON COLUMN Employee.Username IS 'The username for the login of the
employee.';
COMMENT ON COLUMN Employee.Password IS 'The password for the login of the
employee.';
COMMENT ON COLUMN Employee.IBAN IS 'The IBAN of the employee.';
COMMENT ON COLUMN Employee.HourlyWage IS 'The hourly wage of the
employee.';
COMMENT ON COLUMN Employee.Role IS 'The role in the studio of the
employee.';

-- Customer
CREATE TABLE Customer(
      FiscalCode VARCHAR(16),
      Note TEXT,

      PRIMARY KEY (FiscalCode),
      FOREIGN KEY (FiscalCode) REFERENCES Contact(FiscalCode)
);

COMMENT ON TABLE Customer IS 'Represents a customer.';
COMMENT ON COLUMN Customer.FiscalCode IS 'The unique FiscalCode of the
customer.';
COMMENT ON COLUMN Customer.Note IS 'Some annotations about the
customer.';

-- Project
CREATE TABLE Project(
      ProjectID UUID,
      Title VARCHAR NOT NULL,
      StartDate DATE NOT NULL,
      EndDate DATE,
      Location VARCHAR NOT NULL,
      Quote BYTEA,
      Deadline DATE NOT NULL,
      EstimatedHours INTEGER NOT NULL,
      HoursSpent FLOAT(2) DEFAULT 0.00,
      PRIMARY KEY (ProjectID)
);

COMMENT ON TABLE Project IS 'Represents a project.';
COMMENT ON COLUMN Project.ProjectID IS 'The unique ID of the project.';
COMMENT ON COLUMN Project.Title IS 'The title of the project.';
COMMENT ON COLUMN Project.StartDate IS 'The start date of the project';
COMMENT ON COLUMN Project.EndDate IS 'The end date of the project';
COMMENT ON COLUMN Project.Location IS 'The location of the project';
COMMENT ON COLUMN Project.Quote IS 'The quote of the project';
COMMENT ON COLUMN Project.Deadline IS 'The deadline of the project';
COMMENT ON COLUMN Project.EstimatedHours IS 'The estimated hours for the
project';
COMMENT ON COLUMN Project.HoursSpent IS 'The hours spent for the
project';


-- Request
CREATE TABLE Request(
      FiscalCode VARCHAR(16),
      ProjectID UUID,

      PRIMARY KEY (FiscalCode, ProjectID),
      FOREIGN KEY (FiscalCode) REFERENCES Customer(FiscalCode),
      FOREIGN KEY (ProjectID) REFERENCES Project(ProjectID)
);

COMMENT ON TABLE Request IS 'Represents the request for a project.';
COMMENT ON COLUMN Request.FiscalCode IS 'The unique fiscal code of the
customer.';
COMMENT ON COLUMN Request.ProjectID IS 'The unique ID of the requested
project.';

-- Department
CREATE TABLE Department(
      Name VARCHAR(50),
      FiscalCode VARCHAR(16) NOT NULL,
      PRIMARY KEY (Name),
      FOREIGN KEY (FiscalCode) REFERENCES Employee(FiscalCode)
);

COMMENT ON TABLE Department IS 'Represents a specific area of the
studio.';
COMMENT ON COLUMN Department.Name IS 'The name of the department.';
COMMENT ON COLUMN Department.FiscalCode IS 'The fiscal code of the
employee who leads the department.';

-- Template
CREATE TABLE Template(
      TemplateID VARCHAR,
      Description TEXT,
      IsRoot BOOLEAN NOT NULL,
      PRIMARY KEY (TemplateID)
);

COMMENT ON TABLE Template IS 'Represents a set of predefined templates.';
COMMENT ON COLUMN Template.TemplateID IS 'The name of the template.';
COMMENT ON COLUMN Template.Description IS 'The description of the template.';
COMMENT ON COLUMN Template.IsRoot IS 'Determines if the template is the root of the tree.';

-- Order
CREATE TABLE OrderTemplate(
      Child VARCHAR,
      Parent VARCHAR,
      PRIMARY KEY (Child, Parent),
      FOREIGN KEY (Child) REFERENCES Template(TemplateID),
      FOREIGN KEY (Parent) REFERENCES Template(TemplateID)
);

COMMENT ON TABLE OrderTemplate IS 'Handles the order of the template.';
COMMENT ON COLUMN OrderTemplate.Child IS 'The identifier of the child node.';
COMMENT ON COLUMN OrderTemplate.Parent IS 'The identifier of the parent node.';

-- Task
CREATE TABLE Task(
      TaskID UUID,
      IsRoot BOOLEAN NOT NULL,
      Description TEXT,
      StartDate DATE NOT NULL,
      EndDate DATE,
      TemplateID VARCHAR NOT NULL,
      Name VARCHAR(50) NOT NULL,
      PRIMARY KEY (TaskID),
      FOREIGN KEY (TemplateID) REFERENCES Template(TemplateID),
      FOREIGN KEY (Name) REFERENCES Department(Name)
);

COMMENT ON TABLE Task IS 'Represents an activity of the studio.';
COMMENT ON COLUMN Task.TaskID IS 'The unique ID of the task.';
COMMENT ON COLUMN Task.IsRoot IS 'Determines if the task is the root of the tree.';
COMMENT ON COLUMN Task.Description IS 'The description of the task.';
COMMENT ON COLUMN Task.StartDate IS 'The start date of the task.';
COMMENT ON COLUMN Task.EndDate IS 'The end date of the task.';
COMMENT ON COLUMN Task.TemplateID IS 'The name of the template.';
COMMENT ON COLUMN Task.Name IS 'The name of the department associated to the task.';

-- Compose
CREATE TABLE Compose(
      Parent UUID,
      Child UUID,
      ProjectID UUID NOT NULL,
      PRIMARY KEY (Child),
      FOREIGN KEY (Parent) REFERENCES Task(TaskID),
      FOREIGN KEY (Child) REFERENCES Task(TaskID),
      FOREIGN KEY (ProjectID) REFERENCES Project(ProjectID)
);
```

```
COMMENT ON TABLE Compose IS 'Represents which tasks compose a project.';
COMMENT ON COLUMN Compose.Parent IS 'The identifier of the parent task.';
COMMENT ON COLUMN Compose.Child IS 'The identifier of the child task.';
COMMENT ON COLUMN Compose.ProjectID IS 'The unique identifier of the
associated project.';


-- TimeSlot
CREATE TABLE TimeSlot(
	TimeSlotID UUID,
	TaskID UUID,
	CurTime TIMESTAMPTZ NOT NULL,
	FiscalCode VARCHAR(16) NOT NULL,
	Notes TEXT,
	Hours float(2) NOT NULL,
	HourlyWage float(2) NOT NULL,
	PRIMARY KEY(TimeSlotID),
	FOREIGN KEY(TaskID) REFERENCES Task(TaskID),
	FOREIGN KEY(FiscalCode) REFERENCES Employee(FiscalCode)
);

COMMENT ON TABLE TimeSlot IS 'Represents the contribute of each employee
in different fractions of time.';
COMMENT ON COLUMN TimeSlot.TimeSlotID IS 'The unique identifier of a
specific time slot.';
COMMENT ON COLUMN TimeSlot.TaskID IS 'The unique identifier of the
task.';
COMMENT ON COLUMN TimeSlot.CurTime IS 'The date and time when a time slot
has been reported.';
COMMENT ON COLUMN TimeSlot.FiscalCode IS 'The unique fiscal code of the
employee.';
COMMENT ON COLUMN TimeSlot.Notes IS 'Notes about the time slot.';
COMMENT ON COLUMN TimeSlot.Hours IS 'The number of hours spent in the
time slot.';
COMMENT ON COLUMN TimeSlot.HourlyWage IS 'The employee’s wage per hour.';

-- Expense
CREATE TABLE Expense(
	Type VARCHAR,
	PRIMARY KEY (Type)
);

COMMENT ON TABLE Expense IS 'Represents the expense incurred by an
employee that has to be reimbursed.';
COMMENT ON COLUMN Expense.Type IS 'The type of expense.';

-- Has
CREATE TABLE Has(
	TimeSlotID UUID,
	Type VARCHAR,
	Cost float(2) NOT NULL,
	Description TEXT,
	PRIMARY KEY (TimeSlotID, Type),
	FOREIGN KEY (TimeSlotID) REFERENCES Timeslot(TimeSlotID),
	FOREIGN KEY (Type) REFERENCES Expense (Type)
);
```

```
COMMENT ON TABLE Has IS 'Represents the featurse of an expense.';
COMMENT ON COLUMN Has.TimeSlotID IS 'The unique identifier of a specific
time slot.';
COMMENT ON COLUMN Has.Type IS 'The type of expense.';
COMMENT ON COLUMN Has.Cost IS 'The amount of the expense.';
COMMENT ON COLUMN Has.Description IS 'The description of the time slot.';

-- Document
CREATE TABLE Document(
      DocumentID UUID,
      Title VARCHAR NOT NULL,
      Content BYTEA NOT NULL,
      CurTime TIMESTAMPTZ NOT NULL,
      TaskID UUID NOT NULL,
      Producer VARCHAR(16),
      PRIMARY KEY (DocumentID),
      FOREIGN KEY (TaskID) REFERENCES Task(TaskID),
      FOREIGN KEY (Producer) REFERENCES Employee(FiscalCode)
);

COMMENT ON TABLE Document IS 'Represents the document generated by the
studio.';
COMMENT ON COLUMN Document.DocumentID IS 'The unique identifier of the
document.';
COMMENT ON COLUMN Document.Title IS 'The title of the document.';
COMMENT ON COLUMN Document.Content IS 'The content of the document.';
COMMENT ON COLUMN Document.CurTime IS 'The date when a document has been
received.';
COMMENT ON COLUMN Document.TaskID IS 'The unique identifier of the
task.';
COMMENT ON COLUMN Document.Producer IS 'The producer of the document.';

-- Version
CREATE TABLE Version(
      Predecessor UUID,
      Successor UUID NOT NULL,
      PRIMARY KEY (Predecessor),
      FOREIGN KEY (Predecessor) REFERENCES Document(DocumentID),
      FOREIGN KEY (Successor) REFERENCES Document(DocumentID)
);

COMMENT ON TABLE Version IS 'Represents the version of the document.';
COMMENT ON COLUMN Version.Predecessor IS 'The unique identifier of the
previous version of the document.';
COMMENT ON COLUMN Version.Successor IS 'The unique identifier of the
updated version of the document.';

-- Validate
create TABLE ValidateDocument(
      DocumentID UUID,
      FiscalCode VARCHAR(16) NOT NULL,
      CurTime TIMESTAMPTZ NOT NULL,
      PRIMARY KEY (DocumentID),
      FOREIGN KEY (FiscalCode) REFERENCES Employee(FiscalCode),
      FOREIGN KEY (DocumentID) REFERENCES Document(DocumentID)
);

COMMENT ON TABLE ValidateDocument IS 'Represents the validation of a
document.';
COMMENT ON COLUMN ValidateDocument.DocumentID IS 'The unique identifier
of the document.';
COMMENT ON COLUMN ValidateDocument.FiscalCode IS 'The unique fiscal code
of the employee.';
COMMENT ON COLUMN ValidateDocument.CurTime IS 'The date when a document
has been validated.';

-- Approve
create TABLE ApproveDocument(
      DocumentID UUID,
      FiscalCode VARCHAR(16) NOT NULL,
      CurTime TIMESTAMPTZ NOT NULL,
      PRIMARY KEY (DocumentID),
      FOREIGN KEY (FiscalCode) REFERENCES Employee(FiscalCode),
      FOREIGN KEY (DocumentID) REFERENCES Document(DocumentID)
);

COMMENT ON TABLE ApproveDocument IS 'Represents the approvation of a
document.';
COMMENT ON COLUMN ApproveDocument.DocumentID IS 'The unique identifier of
the document.';
COMMENT ON COLUMN ApproveDocument.FiscalCode IS 'The unique fiscal code
of the employee.';
COMMENT ON COLUMN ApproveDocument.CurTime IS 'The date when a document
has been approved.';
```

Trigger Function

The first trigger checks if there is correspondence between the hourly wage inside a new timeslot and the actual hourly wage associated to the employee. The second trigger guarantees the data integrity between the hours reported by each employee and the total hours spent on a specific project, in fact when inserting or updating a timeslot the trigger updates the hours counter of the project associated to the employee's report.

```
-- Connect to the database ennedue
\c ennedue

-- When an Employee reports a certain Task, the HourlyWage declared in
his dedicated Timeslot must be consistent with the one assigned to him in
the Employee relation.
CREATE FUNCTION checkHourlyWage() RETURNS TRIGGER AS $$

BEGIN

      -- Join the Employee table with the TimeSlot table
      -- Check if the new HourlyWage inserted in TimeSlot is different
from the one related to the associated Employee
      IF NOT NEW.HourlyWage IN (SELECT E.HourlyWage
                                                 FROM Employee AS E INNER JOIN
TimeSlot AS TS
```

```
                                          ON E.FiscalCode =
TS.FiscalCode
                                          WHERE TS.TaskID = NEW.TaskID)
THEN

          -- If not, the new TimeSlot data cannot be inserted.
          RAISE EXCEPTION 'Inconsistent Hourly Wage %.', NEW.HourlyWage
USING HINT = 'Please check correctness';
     END IF;

     RETURN NEW;

END;
$$ LANGUAGE PLPGSQL;

CREATE TRIGGER CheckWage
     AFTER INSERT ON TimeSlot
     FOR EACH ROW
     EXECUTE PROCEDURE checkHourlyWage();

-- When an Employee inserts new data into the TimeSlot table, the total
amout of HoursSpent for the Project must be updated by adding the new
ones.
CREATE FUNCTION updateHoursSpent() RETURNS TRIGGER AS $$

BEGIN

     -- Update the Project table
     UPDATE Project

          -- Sum the total amount of hours with the inserted ones
          SET HoursSpent = Project.HoursSpent + NEW.Hours

          -- Join TimeSlot, Task, Compose and Project tables and select
the correct project from the Project table.
          WHERE ProjectID IN (SELECT P.ProjectID
                                          FROM Task AS T INNER JOIN
TimeSlot AS TS
                                          ON T.TaskID = TS.TaskID
                                          INNER JOIN Compose AS C
                                          ON TS.TaskID = C.Child
                                          INNER JOIN Project AS P
                                          ON C.ProjectID = P.ProjectID
                                          WHERE C.Child = NEW.taskid);

     RETURN NEW;

END;
$$ LANGUAGE PLPGSQL;

CREATE TRIGGER UpdateHours
     AFTER INSERT OR UPDATE ON TimeSlot
     FOR EACH ROW
     EXECUTE PROCEDURE updateHoursSpent();
```

Populate the Database: Example

In the following, there are some examples of SQL instructions to insert data within the main relations of the database. Below it is also reported the Java code for inserting PDFs inside the database and also for retrieving them from the DBMS.

```
-- Connect to the database ennedue
\c ennedue

--Insert Operations

--Contact
INSERT INTO Contact(FiscalCode, Name, Surname, BirthDate, Email,
PhoneNumber, ZIP, Street, Number) VALUES
('MNGSLV89H60Z100C','Silvia','Mengotti','1989-08-
20','silviamengotti@gmail.com','3498975114','35017','Via Piave',27),
('LRNBTT96C01D149A','Lorenzo','Bottiglia','1996-03-
01','lorenzo01@gmail.com','3458975211','36061','Via San Giuseppe ',1),
('RSSNRD85D05A044I','Andrea','Rossi','1985-04-
05',NULL,'3281515616','30012','Via II Febbraio',12),
('RSSGVN76A15E189E','Giovanni','Rossi','1976-01-
15','giogio@libero.it','3494949122','36061','Via Santuario',16),
('BRNGNN64G46H005D','Gianna','Bruni','1964-07-
06',NULL,'3271231112','34815','Via Roma',37),
('VLNLIA88A01A007M','Elia','Valencia','1988-01-
01','elia88@hotmail.com','3251516878','36116','Via Verci',22),
('BRDSRA77C43M401T','Sara','Bardi','1977-03-
03','sara0303@hotmail.com','3411579852','36061','Via Marinali',14),
('RSSMRA70A01L726S','Mario','Rossi','1970-01-
01','sigrossi@hotmail.com','3271818523','35082','Via Costa',11),
('PVNTHM56M14A001M','Thomas','Pavan','1956-10-
14',NULL,'3448972123','34014','Via Adriatico',46);


--Employee
INSERT INTO Employee(FiscalCode, Username, Password, IBAN, HourlyWage,
Role) VALUES
('LRNBTT96C01D149A','bottiglialore','1996lorenzo','IT96Z96458799001156840
01800',6.50,'Employee'),
('RSSGVN76A15E189E','rossigio76','giovanni1976','IT46A025876005589031700O
011',7.80,'Employee'),
('BRNGNN64G46H005D','brunigianna46','missbruni46','IT01M07000011456200000
02315',12.50,'Chief'),
('MNGSLV89H60Z100C','mengottisilvia100','silvia1234.','IT47A0789560000002
516182022',9.30,'Area Manager');


--Customer
INSERT INTO Customer(FiscalCode,Note) VALUES
('RSSMRA70A01L726S',NULL),
('PVNTHM56M14A001M','Good Customer'),
('RSSNRD85D05A044I','Problematic payment issues'),
('BRDSRA77C43M401T','Very polite and punctual');

--Project
```

```
INSERT INTO Project(ProjectID, Title, StartDate, EndDate, Location,
Quote, Deadline, EstimatedHours, HoursSpent) VALUES   -- BETA TEST VALUES
FOR EstimatedHours (NEED UPDATE)
('de7c222e-98f0-4eae-b690-7fb37a246bdd','The New House','2018-07-
25','2018-08-25','Padova','300','2018-08-30',112,94.00),
('757ca527-b338-42f5-bbe2-1075d63b492c','Bathroom','2018-08-10','2018-10-
17','Roma','160','2018-10-20',80,45.00),
('866adc89-5a04-463b-82a3-3bf0ad77491b','Company Building','2019-05-
10',NULL,'Venezia','230','2020-01-12',1600,1000.00);

--Request
INSERT INTO Request(FiscalCode, ProjectID) VALUES
('PVNTHM56M14A001M','757ca527-b338-42f5-bbe2-1075d63b492c'),
('BRDSRA77C43M401T','866adc89-5a04-463b-82a3-3bf0ad77491b'),
('RSSMRA70A01L726S','de7c222e-98f0-4eae-b690-7fb37a246bdd');

--Department
INSERT INTO Department(Name, FiscalCode) VALUES
('PlanificationDepartment', 'RSSGVN76A15E189E'),
('VeficationDepartment', 'LRNBTT96C01D149A'),
('ProjectingDepartment', 'MNGSLV89H60Z100C');

--Template
INSERT INTO Template(TemplateID, Description, IsRoot) VALUES
('concept', 'Concept design for the project.', '1'),
('sketches','Sketches with drawings.', '0'),
('architectural model', 'Model of the hourse.', '0'),
('realization', 'Creation of the final drawing.', '0'),
('architectural executive', 'Realization of the project.', '1'),
('task assignment', 'Organize and assign the task to employees.', '0'),
('details analysis', 'Get all the measures for the realization of the
project.', '0'),
('draft', 'Create a simple concept of the project.', '0'),
('drawing', '2D Drawing.', '0'),
('computations', 'Calculus.', '0'),
('modelling', 'Create a model for the project.', '0'),
('take-over', 'Get all the necessary informations for the project.',
'0');

--OrderTemplate

INSERT INTO OrderTemplate(Child, Parent) VALUES
('sketches','concept'),
('architectural model','concept'),
('realization','concept'),
('task assignment', 'architectural executive'),
('details analysis','architectural executive'),
('draft','architectural executive'),
('drawing','sketches'),
('computations','sketches'),
('modelling','sketches'),
('take-over','sketches'),
('drawing','architectural model'),
('computations','architectural model'),
('modelling','architectural model'),
('take-over','architectural model'),
('drawing','realization'),
('computations','realization'),
('modelling','realization'),
('take-over','realization'),
('drawing','task assignment'),
('computations','task assignment'),
('modelling','task assignment'),
('take-over','task assignment'),
('drawing','details analysis'),
('computations','details analysis'),
('modelling','details analysis'),
('take-over','details analysis'),
('drawing','draft'),
('computations','draft'),
('modelling','draft'),
('take-over','draft');

--Task
--For the first operation insert, I have considered a template and I have
specified that the specified task need to be done for that template
INSERT INTO Task(TaskID, IsRoot, Description, EndDate, StartDate,
TemplateID, Name) VALUES
--Project 1
('c769d3a6-41d1-4883-9edf-e74a977446ad','1','The living room must have a
large open space.','2018-08-25','2018-07-
25','concept','PlanificationDepartment'),
('f77d1e8b-3b5f-491c-987c-8d5d77baba3a','0',NULL,'2018-08-03','2018-07-
25','sketches','PlanificationDepartment'),
('e527d149-b101-4bbb-b86f-29ca2ccf6b99','0',NULL,'2018-08-03','2018-07-
25','drawing','PlanificationDepartment'),
('353bf9d0-183e-469d-978a-9484f6c25b15','0',NULL,'2018-08-03','2018-07-
25','modelling','PlanificationDepartment'),
('fc63b2ab-4aa3-45e7-a5a0-85f1436f81b2','0',NULL,'2018-08-25','2018-08-
03','architectural model','PlanificationDepartment'),
('7632306e-63eb-4a48-a630-8891a06580a8','0',NULL,'2018-08-25','2018-08-
03','modelling','PlanificationDepartment'),

--Project 2
('bb6a4192-90d6-4f97-ab66-6518d29a3537','1','This task needs to be
completed 1 week before deadline.','2018-10-17','2018-08-
10','architectural executive','ProjectingDepartment'),
('f23af6d9-6f21-42fd-b35b-e8f9bbc8a753','0',NULL,'2018-10-03','2018-08-
10','task assignment','ProjectingDepartment'),
('fe081609-5c64-465c-b96e-e3c7668d72bc','0',NULL,'2018-10-03','2018-08-
10','computations','ProjectingDepartment'),
('056d76ff-01c6-4248-9749-8a36a26a1144','0',NULL,'2018-10-03','2018-08-
10','take-over','ProjectingDepartment'),
('197dd0f2-56f3-449b-9241-92491a773e5e','0',NULL,'2018-10-10','2018-10-
03','draft','ProjectingDepartment'),
('735dcc1b-2843-41de-a74c-c040d6f8155b','0',NULL,'2018-10-10','2018-10-
03','drawing','ProjectingDepartment'),
('d17c7007-fa6a-4cbb-bc72-9d51fd6c1796','0',NULL,'2018-10-10','2018-10-
03','computations','ProjectingDepartment'),

--Project 3
```

```
('e6f40259-69f5-402c-9616-dc58fbd1fb4b','1','Task to be completed
carefully.',NULL,'2019-05-10','concept','VeficationDepartment'),
('84a0ee99-4702-41de-8aff-185d257c9dc1','0',NULL,NULL,'2019-05-
10','realization','VeficationDepartment'),
('165b25b4-8b44-46eb-b8ca-4becc7e6ca7c','0',NULL,NULL,'2019-05-
10','drawing','VeficationDepartment'),
('35e0ef16-edee-4a30-9f46-80b0b959610c','0',NULL,NULL,'2019-05-
10','computations','VeficationDepartment'),
('644932c2-c6c5-4872-b6a8-114634c6a472','0',NULL,NULL,'2019-05-
10','modelling','VeficationDepartment'),
('850216a6-3c23-4aca-ad7d-ee0b1916bc7b','0',NULL,'2019-05-25','2019-05-
10','take-over','VeficationDepartment');

--Compose
INSERT INTO Compose(Parent, Child, ProjectID) VALUES
--Project 1
(NULL,'c769d3a6-41d1-4883-9edf-e74a977446ad','de7c222e-98f0-4eae-b690-
7fb37a246bdd'),
('c769d3a6-41d1-4883-9edf-e74a977446ad','f77d1e8b-3b5f-491c-987c-
8d5d77baba3a','de7c222e-98f0-4eae-b690-7fb37a246bdd'),
('f77d1e8b-3b5f-491c-987c-8d5d77baba3a','e527d149-b101-4bbb-b86f-
29ca2ccf6b99','de7c222e-98f0-4eae-b690-7fb37a246bdd'),
('f77d1e8b-3b5f-491c-987c-8d5d77baba3a','353bf9d0-183e-469d-978a-
9484f6c25b15','de7c222e-98f0-4eae-b690-7fb37a246bdd'),
('c769d3a6-41d1-4883-9edf-e74a977446ad','fc63b2ab-4aa3-45e7-a5a0-
85f1436f81b2','de7c222e-98f0-4eae-b690-7fb37a246bdd'),
('fc63b2ab-4aa3-45e7-a5a0-85f1436f81b2','7632306e-63eb-4a48-a630-
8891a06580a8','de7c222e-98f0-4eae-b690-7fb37a246bdd'),

--Project 2
(NULL,'bb6a4192-90d6-4f97-ab66-6518d29a3537','757ca527-b338-42f5-bbe2-
1075d63b492c'),
('bb6a4192-90d6-4f97-ab66-6518d29a3537','f23af6d9-6f21-42fd-b35b-
e8f9bbc8a753','757ca527-b338-42f5-bbe2-1075d63b492c'),
('f23af6d9-6f21-42fd-b35b-e8f9bbc8a753','fe081609-5c64-465c-b96e-
e3c7668d72bc','757ca527-b338-42f5-bbe2-1075d63b492c'),
('f23af6d9-6f21-42fd-b35b-e8f9bbc8a753','056d76ff-01c6-4248-9749-
8a36a26a1144','757ca527-b338-42f5-bbe2-1075d63b492c'),
('bb6a4192-90d6-4f97-ab66-6518d29a3537','197dd0f2-56f3-449b-9241-
92491a773e5e','757ca527-b338-42f5-bbe2-1075d63b492c'),
('197dd0f2-56f3-449b-9241-92491a773e5e','735dcc1b-2843-41de-a74c-
c040d6f8155b','757ca527-b338-42f5-bbe2-1075d63b492c'),
('197dd0f2-56f3-449b-9241-92491a773e5e','d17c7007-fa6a-4cbb-bc72-
9d51fd6c1796','757ca527-b338-42f5-bbe2-1075d63b492c'),

--Project 3
(NULL,'e6f40259-69f5-402c-9616-dc58fbd1fb4b','866adc89-5a04-463b-82a3-
3bf0ad77491b'),
('e6f40259-69f5-402c-9616-dc58fbd1fb4b','84a0ee99-4702-41de-8aff-
185d257c9dc1','866adc89-5a04-463b-82a3-3bf0ad77491b'),
('84a0ee99-4702-41de-8aff-185d257c9dc1','165b25b4-8b44-46eb-b8ca-
4becc7e6ca7c','866adc89-5a04-463b-82a3-3bf0ad77491b'),
('84a0ee99-4702-41de-8aff-185d257c9dc1','35e0ef16-edee-4a30-9f46-
80b0b959610c','866adc89-5a04-463b-82a3-3bf0ad77491b'),
('84a0ee99-4702-41de-8aff-185d257c9dc1','644932c2-c6c5-4872-b6a8-
114634c6a472','866adc89-5a04-463b-82a3-3bf0ad77491b'),
('84a0ee99-4702-41de-8aff-185d257c9dc1','850216a6-3c23-4aca-ad7d-
ee0b1916bc7b','866adc89-5a04-463b-82a3-3bf0ad77491b');

--TimeSlot
--The hours specified in this insertions are added to the total amount of
hours dedicated to the project by means of the UpdateHours trigger
INSERT INTO TimeSlot(TimeSlotID, TaskID, CurTime, Notes, HourlyWage,
FiscalCode, Hours) VALUES
--Project 1
('69aed574-6572-42f0-863e-c7ba2260d752','353bf9d0-183e-469d-978a-
9484f6c25b15','2018-07-25
16:32:25+01',NULL,'6.50','LRNBTT96C01D149A','5.5'),
('e5b6ca51-14e6-4959-b0c4-e9d882a2fcde','353bf9d0-183e-469d-978a-
9484f6c25b15','2018-07-28
13:32:25+01',NULL,'6.50','LRNBTT96C01D149A','6.0'),
('6f4fc82d-0e6c-4395-85ab-e6f919620f93','353bf9d0-183e-469d-978a-
9484f6c25b15','2018-07-30
18:32:25+01',NULL,'6.50','LRNBTT96C01D149A','18.5'),
('b0426e09-1097-44db-9a55-113c9330ab1e','e527d149-b101-4bbb-b86f-
29ca2ccf6b99','2018-08-01
11:32:25+01',NULL,'9.30','MNGSLV89H60Z100C','9.0'),
('ee6b4167-1c71-4b16-9f9d-9ddbeda67c1c','7632306e-63eb-4a48-a630-
8891a06580a8','2018-08-24
10:32:25+01',NULL,'9.30','MNGSLV89H60Z100C','4.0'),

--Project 2
('12476d9b-058c-4a71-b33b-bdca507e53c6','fe081609-5c64-465c-b96e-
e3c7668d72bc','2018-08-11
16:32:25+01',NULL,'7.80','RSSGVN76A15E189E','2.5'),
('8563d0ef-a842-42c6-b613-b9bf824977bc','056d76ff-01c6-4248-9749-
8a36a26a1144','2018-09-03
12:32:25+01',NULL,'7.80','RSSGVN76A15E189E','2.5'),
('976af0cc-ceee-4477-b81e-cf0199bb07bf','735dcc1b-2843-41de-a74c-
c040d6f8155b','2018-10-03
14:32:25+01',NULL,'7.80','RSSGVN76A15E189E','6.0'),
('a1001926-a9cf-4b4e-98fa-96ee0d546187','d17c7007-fa6a-4cbb-bc72-
9d51fd6c1796','2018-10-09
22:32:25+01',NULL,'7.80','RSSGVN76A15E189E','7.0'),

--Project 3
('31f1de04-e117-4463-8eef-ba0598502e66', '165b25b4-8b44-46eb-b8ca-
4becc7e6ca7c','2018-05-10
10:32:25+01',NULL,'12.50','BRNGNN64G46H005D','3.5'),
('1a14cdb1-6d78-4266-b9ea-7e76d8822701', '35e0ef16-edee-4a30-9f46-
80b0b959610c','2018-05-14
12:32:25+01',NULL,'12.50','BRNGNN64G46H005D','10.5'),
('2cae32d3-7bf1-435f-b851-9220fb8c2ca1', '644932c2-c6c5-4872-b6a8-
114634c6a472','2018-05-17
18:32:25+01',NULL,'12.50','BRNGNN64G46H005D','9.0'),
('7134af62-a1e2-43df-a150-1ec98e44c8fb', '850216a6-3c23-4aca-ad7d-
ee0b1916bc7b','2018-05-21
15:32:25+01',NULL,'12.50','BRNGNN64G46H005D','7.5');

--This insertion attempt fails since the specified hourly wage is
different from the one declared in the employee table (see trigger
CheckWage)
```

```
INSERT INTO TimeSlot(TimeSlotID, TaskID, CurTime, Notes, HourlyWage,
FiscalCode, Hours) VALUES
('b4614a62-215a-4cbe-a080-4ac35032aeef','353bf9d0-183e-469d-978a-
9484f6c25b15','2018-08-02
04:32:25+01',NULL,'6.55','LRNBTT96C01D149A','2.0');

--Expense
INSERT INTO Expense(Type) VALUES
('TripExpenses'),
('FuelExpenses'),
('DesignMaterials');

--Has
INSERT INTO Has(TimeSlotID, Type, Cost, Description) VALUES
('69aed574-6572-42f0-863e-c7ba2260d752','DesignMaterials','250.80','Paper
and some other materials needed for the design'),
('12476d9b-058c-4a71-b33b-bdca507e53c6','TripExpenses','540.12',NULL),
('31f1de04-e117-4463-8eef-ba0598502e66','FuelExpenses','320.00','Fuel for
150 km');
```

Java code for inserting and retrieving the PDFs from the database:

```
import java.io.*;

import java.io.BufferedReader;
import java.io.FileReader;
import java.io.IOException;
import java.io.InputStream;
import java.io.InputStreamReader;
import java.io.Reader;
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.PreparedStatement;
import java.sql.SQLException;
import java.util.Scanner;
import java.util.UUID;
import java.sql.ResultSet;
import java.sql.Statement;

/**
 * Reads data inside a file to be inserted to the database
 *
 * @author Winniest Team
 * @version 1.00
 */
public class InsertDocument {

      /**
       * The JDBC driver to be used
       */
      private static final String DRIVER = "org.postgresql.Driver";

      /**
       * The URL of the database to be accessed
       */
	private static final String DATABASE = 
"jdbc:postgresql://localhost/ennedue";

	/**
	 * The username for accessing the database
	 */
	private static final String USER = "postgres";

	/**
	 * The default input file for reading the data
	 */
	private static final String DEFAULT_INPUT_FILE = "data.txt";

	/**
	 * The SQL statement for inserting/retrieving data into/from the 
Document table.
	 */
	private static final String INSERT_DOCUMENT = "INSERT INTO Document 
(DocumentID, Title, Content, CurTime, TaskID, Producer) VALUES (?, ?, ?, 
?, ?, ?)";
	private static final String RETRIEVE = "SELECT Content, Title FROM 
Document WHERE DocumentID = '6fd2ef9f-3812-4317-914b-b4bb5b685686'";


	/**
	 * The password for accessing the database, initialized during 
runtime
	 */
	private static String password;

	/**
	 * List all the projects in the database with the customer that as 
demanded it
	 * 
	 * @param args
	 *            command-line arguments used for inserting the 
password and eventually the filepath to the file with all the data to be 
inserted.
	 */
	public static void main(String[] args) {

		// Retrive the password from the input
		if (args.length < 1){

			// Exit the program with a generic error
			System.out.printf("ERROR: Insert a password in the 
input.%n");
			System.exit(-1);
		}

		// Get the password from the input
		password = args[0];

		// The connection to the DBMS
		Connection con = null;
```

```
          // The SQL statement to be executed
          PreparedStatement pstmt = null;
          Statement ret_stmt = null;

          // Start time of a statement
          long start;

          // End time of a statement
          long end;

          // The input file from which data are read
          Reader input = null;

          // A scanner for parsing the content of the input file
          Scanner s = null;

          // Current line number in the input file
          int l = 0;

          // The data about the document

          UUID id = null;
          String title = null;
          String filename = null;
          int len = 0;
          java.sql.Timestamp timeStamp = null;
          UUID taskID = null;
          String producer = null;

          // The results of the statement execution
          ResultSet result = null;


          try {
               // Register the JDBC driver
               Class.forName(DRIVER);

               System.out.printf("Driver %s successfully
registered.%n", DRIVER);
          } catch (ClassNotFoundException e) {
               System.out.printf(
                         "Driver %s not found: %s.%n", DRIVER,
e.getMessage());

               // Terminate with a generic error code
               System.exit(-1);
          }

          try {

               // Connect to the database
               start = System.currentTimeMillis();

               con = DriverManager.getConnection(DATABASE, USER,
password);
```

```
                end = System.currentTimeMillis();

                System.out.printf(
                            "Connection to database %s successfully
established in %,d milliseconds.%n",
                            DATABASE, end-start);

                // Create the statements for inserting the data
                start = System.currentTimeMillis();

                pstmt = con.prepareStatement(INSERT_DOCUMENT);


                end = System.currentTimeMillis();

                System.out.printf(
                            "Statements successfully created in %,d
milliseconds.%n",
                            end-start);

           } catch (SQLException e) {
                System.out.printf("Connection error:%n");

                // Get all the exceptions
                while (e != null) {
                     System.out.printf("Message: %s%n", e.getMessage());
                     System.out.printf("SQL status code: %s%n",
e.getSQLState());
                     System.out.printf("SQL error code: %s%n",
e.getErrorCode());
                     System.out.printf("%n");
                     e = e.getNextException();
                }

                // Terminate with a generic error code
                System.exit(-1);
           }

           // If there are no input arguments, use the default input file
           if (args.length <= 1) {

                // get the class loader
                ClassLoader cl = InsertDocument.class.getClassLoader();
                if (cl == null) {
                     cl = ClassLoader.getSystemClassLoader();
                }

                // Get the stream for reading the configuration file
                InputStream is =
cl.getResourceAsStream(DEFAULT_INPUT_FILE);

                if (is == null) {
                     System.out.printf("Input file %s not found.%n",
DEFAULT_INPUT_FILE);

                     // Terminate with a generic error code
```

```
                    System.exit(-1);
               }

               input = new BufferedReader(new InputStreamReader(is));

               System.out.printf("Input file %s successfully
opened.%n", DEFAULT_INPUT_FILE);

          } else {

               try {
                    input = new BufferedReader(new
FileReader(args[1]));

                    System.out.printf("Input file %s successfully
opened.%n", args[1]);
               } catch (IOException ioe) {
                    System.out.printf(
                              "Impossible to read input file %s:
%s%n", args[1],
                              ioe.getMessage());

                    // Terminate with a generic error code
                    System.exit(-1);
               }
          }

          // Create the input file parser
          s = new Scanner(input);

          // Set the delimiter for the fields in the input file
          s.useDelimiter("##");

          try {

               // While the are lines to be read from the input file
               while (s.hasNext()) {

                    // Increment the line number counter
                    l++;

                    System.out.printf("%n-------------------------------
-------------------------%n");

                    // Read one line from the input file
                    start = System.currentTimeMillis();

                    // Create the arrays for containing document data
                    id = UUID.fromString(s.next());
                    title = s.next();
                    filename = s.next();
                    java.util.Date today = new java.util.Date();
                    timeStamp = new
java.sql.Timestamp(today.getTime());
                    taskID = UUID.fromString(s.next());
                    producer = s.next();
                    // Go to the next line
                    s.nextLine();

                    end = System.currentTimeMillis();

                    System.out.printf(
                              "Line %,d successfully read in %,d
milliseconds.%n",
                              l, end-start);

                    // Insert one line from the input file into the
database
                    start = System.currentTimeMillis();

                    // Insert the document
                    try {
                         File file = new File(filename);
                    FileInputStream fis = new FileInputStream(file);
                    len = (int)file.length();
                         pstmt.setObject(1, id);
                         pstmt.setString(2, title);
                         pstmt.setBinaryStream(3, fis, len);
                         pstmt.setTimestamp(4, timeStamp);
                         pstmt.setObject(5, taskID);
                         pstmt.setString(6, producer);
                         pstmt.execute();

                    } catch (SQLException e) {

                         if (e.getSQLState().equals("23505")) {
                              System.out
                                        .printf("Document %s already
inserted, skip it. [%s]%n",
                                                  title,
                                                  e.getMessage());
                         } else {
                              System.out
                                        .printf("Unrecoverable error
while inserting document %s:%n",
                                                  title);
                              System.out.printf("Message: %s%n",
e.getMessage());
                              System.out.printf("SQL status code:
%s%n", e.getSQLState());
                              System.out.printf("SQL error code:
%s%n", e.getErrorCode());
                              System.out.printf("%n");
                         }
                    } catch (IOException e) {

                         System.out.println("Exception while streaming
the file to the database");
                    }

                    end = System.currentTimeMillis();
                    System.out.printf(
                              "Line %,d successfully inserted into the
database in %,d milliseconds.%n%n",
                              l, end-start);

               }
          } finally {

               // Close the scanner and the input file
               s.close();

               System.out.printf("%nInput file successfully
closed.%n");

               try {

                    // Create the statement to execute the query and
count the time
                    start = System.currentTimeMillis();

                    ret_stmt = con.createStatement();

                    // Stop timing
                    end = System.currentTimeMillis();

                    System.out.printf(
                         "Statement successfully created in %,d
milliseconds.%n",
                         end-start);

                    // Execute the query
                    start = System.currentTimeMillis();

                    result = ret_stmt.executeQuery(RETRIEVE);

                    end = System.currentTimeMillis();

                    System.out.printf("Query: %n%s%nsuccessfully
executed in %,d milliseconds.%n",
                         RETRIEVE, end - start);

                    byte[] fileBytes;
                    String PDFName;

                    try {

                         result.next();
                         fileBytes = result.getBytes("Content");
                         PDFName = result.getString("Title");

                         OutputStream targetFile=  new
FileOutputStream(PDFName+".pdf");
                         targetFile.write(fileBytes);
                         targetFile.close();
```

```
                System.out.println("Document successfully retrieved");

                 } catch (Exception e) {
                     e.printStackTrace();
                     }
                } catch (Exception e) {
                     e.printStackTrace();
                }

                try {

                     // Close the statements
                     if (pstmt != null) {

                          start = System.currentTimeMillis();

                          pstmt.close();


                          end = System.currentTimeMillis();

                          System.out
                               .printf("Prepared statements
successfully closed in %,d milliseconds.%n",
                                         end-start);

                     }

                     // Close the connection to the database
                     if(con != null) {

                          start = System.currentTimeMillis();

                          con.close();

                          end = System.currentTimeMillis();

                          System.out
                          .printf("Connection successfully closed in %,d
milliseconds.%n",
                                    end-start);

                     }

                     System.out.printf("Resources successfully
released.%n");

                } catch (SQLException e) {
                     System.out.printf("Error while releasing
resources:%n");

                     // Get all the exceptions
                     while (e != null) {
                          System.out.printf("Message: %s%n",
e.getMessage());
```

```
                           System.out.printf("SQL status code: %s%n",
e.getSQLState());
                           System.out.printf("SQL error code: %s%n",
e.getErrorCode());
                           System.out.printf("%n");
                           e = e.getNextException();
                      }
                }

           }

      }
}
```

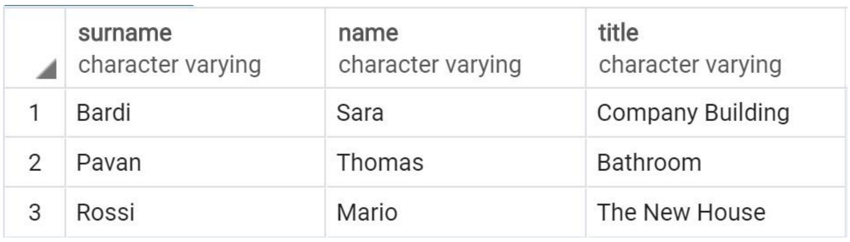
Principal Queries

In this section, we report four queries to navigate the database:

1. Retrieve general information about the customers and the projects that they have requested;
2. Retrieve the number of task that each department is in charge of;
3. Retrieve the highest salary in a certain period;
4. Retrieve the structure of the tasks inside the projects;

1.

```
-- Retrieve customer's names, surnames and the names of the projects
assigned by them
SELECT surname, name, title
     FROM Contact AS Co INNER JOIN Customer AS Cu ON Co.FiscalCode =
Cu.FiscalCode
     INNER JOIN Request AS R ON Cu.FiscalCode = R.FiscalCode
     INNER JOIN Project as P ON R.ProjectID = P.ProjectID
ORDER BY surname, name, title ASC;
```

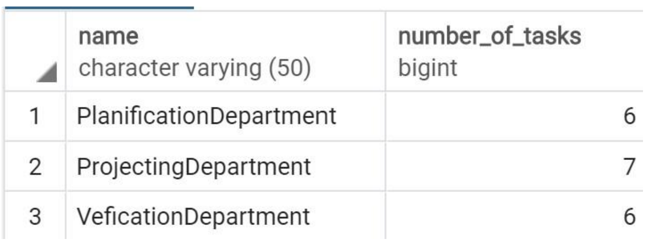


	surname character varying	name character varying	title character varying
1	Bardi	Sara	Company Building
2	Pavan	Thomas	Bathroom
3	Rossi	Mario	The New House

Figure 2 Results for Query 1

2.

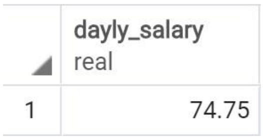
```
-- Retrieve the names of the departments and the number of tasks to which
they are assigned
SELECT d.Name, COUNT(TaskID) as number_of_tasks
FROM Department as d
     LEFT OUTER JOIN TASK AS t ON d.Name = t.Name
GROUP BY d.Name
ORDER BY d.Name ASC;
```



	name character varying (50)	number_of_tasks bigint
1	PlanificationDepartment	6
2	ProjectingDepartment	7
3	VeficationDepartment	6

Figure 3 Results for Query 2

3.
```
-- Return the highest salary in a certain period
SELECT MAX(DaylySalary) AS Dayly_Salary
FROM(SELECT        Employee.FiscalCode,        SUM(TimeSlot.Hours        *
TimeSlot.hourlyWage) AS DaylySalary
 FROM Employee
 INNER JOIN TimeSlot ON Employee.FiscalCode = TimeSlot.FiscalCode
 INNER JOIN Task ON TimeSlot.TaskID = Task.TaskID
WHERE    TimeSlot.CurTime    >=    '2018-07-01    00:00:00+01'::DATE    AND
TimeSlot.CurTime < '2018-07-30 23:59:59+01'::DATE
GROUP BY Employee.FiscalCode) AS Count;
```

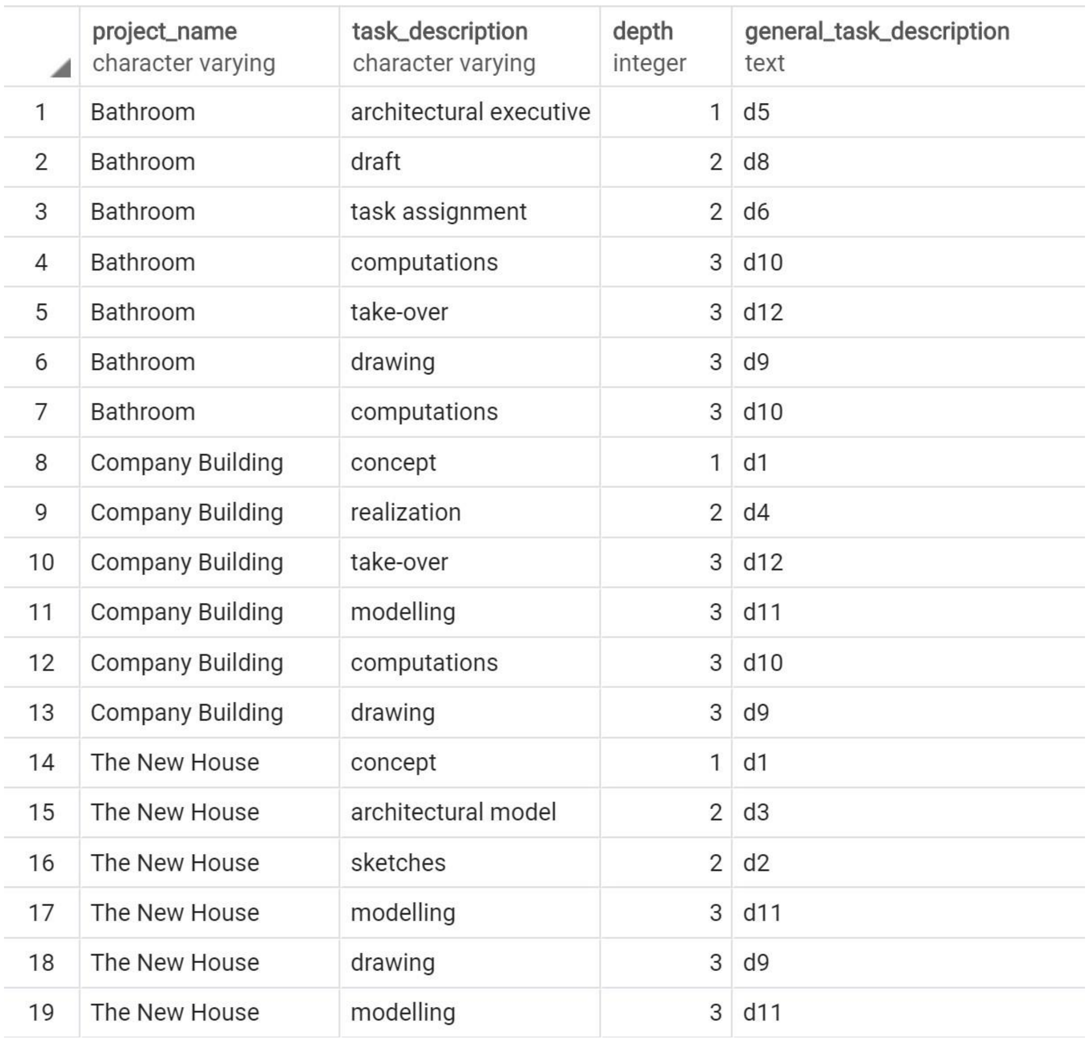


	dayly_salary real
1	74.75

Figure 4 Results for Query 3

4.
```
--Display the structure of the projects along with their descriptions
WITH RECURSIVE proj_subpart AS (
     SELECT Parent, Child, ProjectID, 1 AS Depth
     FROM Task as t INNER JOIN Compose AS C
          ON t.taskID = C.Child
     WHERE isRoot = TRUE
     UNION ALL
     SELECT C.Parent, C.Child, C.ProjectID, Depth + 1
     FROM proj_subpart AS pr INNER JOIN Compose AS C ON C.Parent =
pr.Child
)

SELECT  p.Title  AS  Project_Name,  tmt.TemplateID  AS  Task_Description,
Depth, tmt.Description AS General_task_description
     FROM Project AS p INNER JOIN proj_subpart AS ps ON p.ProjectID =
ps.ProjectID
     INNER JOIN Task AS t ON ps.Child = t.taskID
     INNER JOIN Template AS tmt ON t.TemplateID = tmt.TemplateID
ORDER BY p.Title, Depth ASC;
```



	project_name	task_description	depth	general_task_description
	character varying	character varying	integer	text
1	Bathroom	architectural executive	1	d5
2	Bathroom	draft	2	d8
3	Bathroom	task assignment	2	d6
4	Bathroom	computations	3	d10
5	Bathroom	take-over	3	d12
6	Bathroom	drawing	3	d9
7	Bathroom	computations	3	d10
8	Company Building	concept	1	d1
9	Company Building	realization	2	d4
10	Company Building	take-over	3	d12
11	Company Building	modelling	3	d11
12	Company Building	computations	3	d10
13	Company Building	drawing	3	d9
14	The New House	concept	1	d1
15	The New House	architectural model	2	d3
16	The New House	sketches	2	d2
17	The New House	modelling	3	d11
18	The New House	drawing	3	d9
19	The New House	modelling	3	d11

Figure 5 Results for Query 4

Stored Procedure

The following stored procedure is required due to the high demand of the employee's report of the hours.

```
-- Connect to ennedue db
\c ennedue

-- Stored procedure to select all the timeslots of an employee in a
certain period
-- Replace to modify an existing version of this function
CREATE OR REPLACE FUNCTION viewEmployeeHours(targetEmployeeFiscalCode
VARCHAR(16), fromDate DATE, toDate DATE)
RETURNS TABLE(
    TimeSlotId UUID,
    Hours FLOAT(2)
)

LANGUAGE plpgsql
AS $$
```

```
DECLARE
      -- The fiscal code of the employee
    fiscalCodeCheck VARCHAR;

BEGIN
    -- Check whether the employee fiscal code exists
    SELECT FiscalCode INTO fiscalCodeCheck
           FROM Employee WHERE FiscalCode = targetEmployeeFiscalCode;

      IF NOT FOUND THEN

                RAISE EXCEPTION 'employee fiscal code % does not exist',
targetEmployeeFiscalCode;

      ELSE
           IF fromDate > toDate THEN

                RAISE EXCEPTION 'date interval is not valid';

           ELSE
                -- Return all the timeslots of the employee
                RETURN QUERY
                     SELECT TimeSlot.TimeSlotID, TimeSlot.Hours
                     FROM Employee
                          INNER JOIN TimeSlot ON Employee.FiscalCode =
TimeSlot.FiscalCode
                          INNER JOIN Task ON TimeSlot.TaskID =
Task.TaskID
                     WHERE TimeSlot.CurTime::DATE >= fromDate
                          AND TimeSlot.CurTime::DATE < toDate
                          AND Employee.FiscalCode =
targetEmployeeFiscalCode;
           END IF;

      END IF;
END;
$$;
```

JDBC Implementations of the Principal Queries and Visualization

Hereafter, we report a java class which read the data from the database and print the results on screen.

```
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Statement;

/**
 * This method prints all the Tasks associated to a Job
 *
 * @author Winniest Team
 * @version 1.00
 */
```

```
public class PrintProjects {

      /**
       * The JDBC driver to be used
       */
      private static final String DRIVER = "org.postgresql.Driver";

      /**
       * The URL of the database to be accessed
       */
      private static final String DATABASE =
"jdbc:postgresql://localhost/ennedue";

      /**
       * The username for accessing the database
       */
      private static final String USER = "postgres";

      /**
       * The SQL statement to be executed
       */
      private static final String SQL = "SELECT name, surname, title,
StartDate, EndDate, Location, Deadline, EstimatedHours, HoursSpent FROM
Customer AS Cu INNER JOIN Contact AS Co ON Cu.FiscalCode = Co.FiscalCode
INNER JOIN Request AS R ON Cu.FiscalCode = R.FiscalCode INNER JOIN
Project as P ON R.ProjectID = P.ProjectID;";

      /**
       * The password for accessing the database, initialized during
runtime
       */
      private static String password;

      /**
       * List all the projects in the database with the customer that as
demanded it
       *
       * @param args
       *            command-line arguments used for inserting the
password.
       */
      public static void main(String[] args) {

            // Retrive the password from the input
            if (args.length < 1){

                  // Exit the program with a generic error
                  System.out.printf("ERROR: Insert a password in the
input.%n");
                  System.exit(-1);
            }

            // Get the password from the input
            password = args[0];

            // The connection to the DBMS
```

```
		Connection con = null;

		// The statement to be executed
		Statement stmt = null;

		// The results of the statement execution
		ResultSet result = null;

		// Start time of a statement
		long start;

		// End time of a statement
		long end;

		// Variables for saving the result from the database
		// Data about the project
		String name = null;
		String surname = null;
		String title = null;
		String startDate = null;
		String endDate = null;
		String location = null;
		String deadline = null;
		int estimatedHours = -1;
		double hoursSpent = -1.0;

		// Register the JDBC driver
		try {

			Class.forName(DRIVER);

			System.out.printf("Driver %s successfully
registered.%n",
				DRIVER);
		} catch (ClassNotFoundException e) {
			System.out.printf("Driver %s not found: %s.%n",
				DRIVER, e.getMessage());

			// Exit with an error code
			System.exit(-1);
		}

		// Connect to the database
		try {

			// Count the necessary time for the conection
			start = System.currentTimeMillis();

			con = DriverManager.getConnection(DATABASE, USER,
password);

			// Stop timing
			end = System.currentTimeMillis();

			System.out.printf(
                     "Connection to database %s successfully established
in %,d milliseconds.%n",
                     DATABASE, end-start);

                // Create the statement to execute the query and count
the time
                start = System.currentTimeMillis();

                stmt = con.createStatement();

                // Stop timing
                end = System.currentTimeMillis();

                System.out.printf(
                     "Statement successfully created in %,d
milliseconds.%n",
                     end-start);

                // Execute the query
                start = System.currentTimeMillis();

                result = stmt.executeQuery(SQL);

                end = System.currentTimeMillis();

                System.out.printf("Query: %n%s%nsuccessfully executed in
%,d milliseconds.%n",
                     SQL, end - start);

                System.out.printf("%nQUERY RESULT:%n");

                // Print all the result of the query
                while (result.next()) {

                     // Read the customer's data
                     name = result.getString("name");
                     surname = result.getString("surname");

                     // Read the project's data
                     title = result.getString("title");
                     startDate = result.getString("startDate");
                     endDate = result.getString("endDate");
                     location = result.getString("location");
                     deadline = result.getString("deadline");
                     estimatedHours = result.getInt("estimatedHours");
                     hoursSpent = result.getDouble("hoursSpent");

                     // Print result
                     // EndDate can be null if the project is still in
progress so we can have two different kind of responses
                     if (endDate == null){
                          // The project is still in progress
                          System.out.printf("%nCustomer: %s %s %nTitle:
%s, %s %nstarted on %s and still in progress%ndue on %s%nStatistics: %.2f
/ %d%n%n",
                                name, surname, title, location,
startDate, deadline, hoursSpent, estimatedHours);
                     } else {
                          // The project is completed
                          System.out.printf("%nCustomer: %s %s %nTitle:
%s, %s %nstarted on %s and ended on %s%ndue on %s%nStatistics: %.2f /
%d%n%n",
                                name, surname, title, location,
startDate, endDate, deadline, hoursSpent, estimatedHours);
                     }
                }
           } catch (SQLException e) {
                System.out.printf("ERROR: Database access error%n");
                printErrorMessages(e);
           } finally {

                // Close all the connection in the reverse order of
their creation
                try {

                     // Close the used resources
                     if (result != null) {

                          // Count time
                          start = System.currentTimeMillis();

                          result.close();

                          // Stop timing
                          end = System.currentTimeMillis();

                          System.out.printf("Result set successfully
closed in %,d milliseconds.%n",
                                end-start);
                     }

                     if (stmt != null) {

                          // Count time
                          start = System.currentTimeMillis();

                          stmt.close();

                          // Stop timing
                          end = System.currentTimeMillis();

                          System.out.printf("Statement successfully
closed in %,d milliseconds.%n",
                                end-start);
                     }

                     if (con != null) {

                          // Count time
                          start = System.currentTimeMillis();
                          con.close();

                          // Stop timing
                          end = System.currentTimeMillis();

                          System.out.printf("Connection successfully
closed in %,d milliseconds.%n",
                                     end-start);
                     }

                     System.out.printf("All the resources successfully
released.%n");

                } catch (SQLException e) {
                     System.out.printf("Error while releasing
resources:%n");
                     printErrorMessages(e);

                } finally {

                     // Release resources to the garbage collector
                     result = null;
                     stmt = null;
                     con = null;

                     System.out.printf("Resources released to the
garbage collector.%n");
                }
           }

           System.out.printf("Program ended.%n");

      }

      private static void printErrorMessages(SQLException e){
           // Get all the errors
           while (e != null) {
                System.out.printf("Message: %s%n", e.getMessage());
                System.out.printf("SQL status code: %s%n",
e.getSQLState());
                System.out.printf("SQL error code: %s%n",
e.getErrorCode());
                System.out.printf("%n");
                e = e.getNextException();
           }
      }
}
```