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Datenbanksysteme · Prof. Dr. Grust

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Datenbanksysteme I

WS 2019/20
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Assignment #5

Submission Deadline: November 26, 2019 - 10:00

Exercise 1: Constraints (14 Points)

Consider the following SQL DDL statement that creates a table to hold a company's employees:

```
CREATE TABLE employees (
  employee_id   int,
  lastname      text,
  firstname     text,
  address       text,
  hire_date     date,
  salary        salary,    -- monthly salary (in €)
  emp_role      emp_role,  -- employee role
  department_id int        -- department identifier where the employee works in
);
```

Given the following mini-world rules:

i. No attribute of an employee must be omitted.

ii. The `salary` of all employees must not be less than 1,473.33 EUR a month.

iii. An employee's role is either 'Manager', 'Developer', 'Accountant' or 'Secretary'.

iv. Managers hired after November 24, 2013 have a monthly `salary` of at most 17,679.96 EUR.

v. No two employees must share the same identifier.

1. For each rule, use SQL DDL statements to define constraints to enforce the rule as well as one `INSERT`-statement that abides by the rule and one example that violates the rule. Create types for `salary` and `emp_role`.

2. Please explain, why it is impossible to enforce...

   (a) ...rule iv using a domain constraint (`CREATE DOMAIN`),

   (b) ...rule v in terms of a `CHECK` constaint.

Exercise 2: Defining Keys (3 Points)

Please define the terms "candidate keys", "superkeys" and "primary key" in your own words as precisely as possible.

Exercise 3: Identifying Keys **(5 Points)**

Based on the following instance of a relation $R(A, B, C, D)$:

A	B	C	D
1	1	9	11
1	2	8	12
2	2	7	13
3	4	4	11
4	4	5	12
5	5	6	13

1. List all possible *candidate keys*.
2. What is the total number of *superkeys* in this relation?

Exercise 4: Using Keys **(8 Points)**

Consider the following schema definition and constraints for table `r`:

```
CREATE TABLE r (a int, b varchar(9999), c int, d int, e text);

ALTER TABLE r ALTER COLUMN a SET NOT NULL;
ALTER TABLE r ALTER COLUMN b SET NOT NULL;
ALTER TABLE r ALTER COLUMN c SET NOT NULL;

ALTER TABLE r ADD UNIQUE (a, c);
ALTER TABLE r ADD UNIQUE (b);
ALTER TABLE r ADD UNIQUE (d);
```

1. Your task is to choose a primary key for `r` under the assumption that neither `a` nor `c` are unique on their own. Which (combinations of) columns are eligible for primary key? Which primary key would you choose? Why?
2. Extend the schema definition to declare the primary key you chose.
3. For one reasone or another you are not satisfied with your choice of primary key in 4.1 above. Your co-worker thus proposes to add an **artificial primary key** `id` to table `r`.

   ```
   -- PostgreSQL assigns <table name>_pkey to the primary key constraint, thus:
   ALTER TABLE r DROP CONSTRAINT r_pkey;

   ALTER TABLE r ADD COLUMN id int;
   ALTER TABLE r ALTER COLUMN id SET NOT NULL;
   ALTER TABLE r ADD UNIQUE (id);

   ALTER TABLE r ADD PRIMARY KEY (id);
   ```

   What advantages and disadvantages does the new column `id` bring with it? Discuss briefly.
4. Consider the following query:

   ```
   SELECT DISTINCT v.a, v.b, v.f FROM r v;
   ```

   Is it necessary to use `DISTINCT` here? Justify your answer.