Laboratory 12
Normalization of relational databases

It is expected that you attended the lecture classes in the weeks 12 and 13 before implementation of the tasks included in Laboratory 12.

This laboratory consists of 3 tasks.

Task 1   Derivation of functional dependencies

(a) Consider a set `F` of functional dependencies among the attributes `A`, `B`, `C`, and `D`.

```
F = { A->B, B->C, B->D, C->A }
```

Find what other nontrivial functional dependencies can be derived from a set `F` using Armstrong axioms and show their derivations. A functional dependency is nontrivial if its right hand side is not included in or equal to its left hand side.

(b) Consider a set `G` of functional dependencies among the attributes `A`, `B`, `C`, and `D`.

```
G = { A->B, A->D, BD->C }
```

Show how to derive a functional dependency `A->C` from a set of dependencies `G` using the Armstrong axioms.

Save the results in a file `task1.pdf`. A file `task1.pdf` will be submitted at the end of laboratory class.

Task 2 Identification of minimal keys

(a) Assume, that set `H` of functional dependencies given below is valid in a relational schema `R`.

```
R = (A, B, C, D)
H = { AB->C, AB->D, D->B }
```

Find all minimal keys in a schema `R`.

(b) Assume, that set `I` of functional dependencies is valid in a relational schema R.

```
R = ( A, B, C, D )
I = { A->B, B->C, B->D, C->A }
```

Find all minimal keys in a schema `R`.

Save the results in a file `task2.pdf`. A file `task2.pdf` will be submitted at the end of laboratory class.

Task 3   Normalization of relational schemas

For each one of the relational schemas given below, identify its highest normal form and justify your choice.

(a) `P = (N, C, A, K)`
`S->N`
`S->A`
`C->N`

(b) `P = (R, N, O, C, E)`
`R->N`
`R->E`
`O->C`
`O->R`

(c) `R = (A, B, C)`
No valid functional dependencies

(d) `V = (S, C, L, D)`
`CS->L`
`CS->D`
`L->C`

Save the results in a file `task3.pdf`. A file `task3.pdf` will be submitted at the end of laboratory class.

Submission

Zip the files `task1.pdf`, `task2.pdf`, and `task3.pdf` obtained as the solutions of tasks 1, 2, and 3 into a file `solutions12.zip` and submit the file through eLearning. A submission procedure is the following.

(1) Connect to eLearning.
(2) Navigate to a folder `SUBMISSIONS`→`LABORATORY SUBMISSIONS`.
(3) Click at `LABORATORY 12, Submit your solutions here` link.
(4) Click at `Add Attachments` button.
(5) Navigate to a location where a file `solutions12.zip` has been saved.
(6) Select the file and click at `Open` button.
(7) Click at `Submit` button.
(8) Click at `OK` button to return to `Home Page`.

End of laboratory 12