TD 4: Stratification and Query Optimization

Exercise 1. (Query Optimization)

Let us consider the following database:
EDB (schema)

```
emp(Ssn,Salary,Num_Dep,Age).
dept(Num_Dep,Ssn_Resp,Floor).
sales(Num_Dep,Article,Vol).
```

The IDB and the constraints are as follows:
IDB (Rules):

```
highDepSales(x1,x2,x3,y2,y3) :- dept(x1,x2,x3),sales(x1,y2,y3),y3>100000.
highMgrSales(x2,y2,y4) :- emp(x2,y2,y3,y4),highDepSales(x1,x2,x3,x4,x5).
```

IC:

```
[IC1] ⊥:- dept(x,y,2)
[IC2] (y>40000):- emp(x,y,z,u), (u>50).
```

Questions: Answer the following questions:

1. What do the constraints IC1 and IC2 mean?
2. Rewrite the IDB clauses using only basic relations in the body of the clauses.
3. Consider the following query:

   ```
   Answer(x,z) :- highDepSales(x,y,2,z,u).
   ```

   What does the evaluation of this request return by considering the EDB, IDB and IC?
4. Consider the following query:

   ```
   Answer(x1,x2) :- highMgrSales(x1,x2,x3)(x3>50).
   ```

   Rewrite this query by considering the EDB, IDB and IC?
5. Provide the result of the compilation of EDB and IDB as well as the expansion of ICs.
6. Provide the semantically constrained axioms (SCA).

Exercise 2. (Datalog with Negation)

Indicate the correct rules and incorrect rules among the following:

```
S(x) :- ¬R(x).
S(x) :- R(x), x > y.
S(x) :- S(x).
S(x) :- R(x), ¬S(x).
```

Exercise 3. (Stratification)

Let us consider the following Datalog program Π:

```
1. S(x) :- R1(x), ¬R(x).
2. T(x) :- R2(x), ¬R(x).
3. U(x) :- R3(x), ¬T(x):
4. V(x) :- R4(x), ¬S(x), ¬U(x).
```

Among the following propositions, indicate which are correct stratifications:

A. {1},{2},{3},{4}
B. {2},{1},{3},{4}
C. {2},{3},{1},{4}
D. {1,2},{3},{4}
E. {2},{1,3},{4}
F. {3},{1,2},{4}
G. {2,3},{1},{4}

Exercise 4. (Stratification)

Let us consider the following Datalog program Π:

$$\begin{cases} p \leftarrow \neg q \\ q \leftarrow \neg p \\ r \leftarrow r \end{cases}$$

Can we stratify this program?