Problems for Week 4

Problem 1. Refer to Example 5.4 in the book. Write a nonrecursive LDL++ program that solves the temporal coalescing problem of Example 5.4, using user-defined aggregates. Assume that the tuples of the valid-time relations are already sorted according to the Start time of their temporal intervals.

Problem 2. Consider the following versions of Datalog, listed by increasing power (In all cases, assume that there is no function symbols, no arithmetics, no total order in the universe):

1. Datalog without recursion, negation and choice.
2. Datalog with recursion but without negation and choice
3. Datalog with stratified negation but without choice
4. Datalog with recursion, stratified negation and choice (i.e., the non deterministic choice of LDL++ returning the first answer that satisfies the choice constraints).

Now, consider the following queries on a directed graph $G$ stored as a binary relation:
A. Is there an Hamiltonian circuit in $G$?
B. Is node $b$ reachable from node $a$ in $G$?
C. Is there an even number of arcs in the graph $G$?
D. Is the graph $G$ connected?

For each query, please, state which version of Datalog (if any) is necessary and sufficient to express it, and justify your answer (e.g., your answer might be something like: For query 2 version X is needed because ...)

Problem 3. Given the database table $\text{emp}(\text{Eno}, \text{Sal}, \text{Dno})$

1. Write an LDL++ program to compute the median salary of the employees in each department. You can use aggregates and assume that:
   - the $\text{emp}$ table is already sorted by increasing salary,
   - no two employees in the same department make the same salary
   - each department has an odd number of employees.

2. Are the aggregate you just defined monotononic? Justify your answer.