

COMP 280 : Assignment 10

due: Thursday, April 13, 2000

1. (4 pts) A simple airline database consists of a relation `direct_flight(from_city, to_city)`. For each of the following queries over this database, either express it as a conjunctive query (no negation) or prove that it cannot be written as a conjunctive query.
 - (a) There exists a route with only two stopovers from Houston to Paris.
 - (b) All routes from Houston to Paris contain two stopovers.
2. (3 pts) An employee database contains a relation `EmpInfo` with attributes `Name`, `Division`, `Manager`, `Office`, and `Extension`. The database has a functional dependency from `Division` \rightarrow `Manager`. If the database also has a functional dependency from `Name` \rightarrow `Manager`, must it also satisfy a functional dependency from `Name` \rightarrow `Division`? Provide a proof or a counterexample.
3. (14 pts) In class, we considered the film database query “pairs of actors and directors such that the actor appeared in a film directed by the director”. One proposal was the conjunctive query

$$ans(Dir, Actor) \leftarrow Movies(Title, Dir, Actor),$$

which we determined was incorrect because a single film might have multiple directors. Instead, we decided that the correct query is

$$ans(Dir, Actor) \leftarrow Movies(Title, Dir, Actor'), Movies(Title, Dir', Actor)$$

- (a) (3 pts) Consider a movie database with a functional dependency from `Title` \rightarrow `Director`. Are the two above queries equivalent in this case? Prove your answer or provide a counterexample.
- (b) (3 pts) Consider a movie database with a join dependency
$$Movies: \bowtie[\{Title, Actor\}, \{Title, Director\}]$$
Are the two above queries equivalent in this case? Prove your answer or provide a counterexample.
- (c) (3 pts) Consider a movie database with a join dependency
$$Movies: \bowtie[\{Director, Title\}, \{Director, Actor\}]$$
Are the two above queries equivalent in this case? Prove your answer or provide a counterexample.
- (d) (5 pts) Consider a film database with a functional dependency `Title` \rightarrow `Director` and a join dependency

$$Movies: \bowtie[\{Title, Actor\}, \{Title, Director\}].$$

Is either dependency redundant in the presence of the other? Specifically, does the functional dependency imply the join dependency or vice-versa? For each case, provide a proof or counterexample to justify your answer.