

第一部分：

1. Discuss the capabilities that should be provided by a DBMS. (10%)
2. What is meant by a recursive relationship type? Give some examples of recursive relationship types. (10%)
3. Consider the universal relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies $F = \{\{A, B\} \rightarrow \{C\}, \{A\} \rightarrow \{D, E\}, \{B\} \rightarrow \{F\}, \{F\} \rightarrow \{G, H\}, \{D\} \rightarrow \{I, J\}\}$. Determine whether the following decomposition has (1) the dependency preservation property, and (2) the lossless join property, with respect to F . Please justify your answer. (10%)

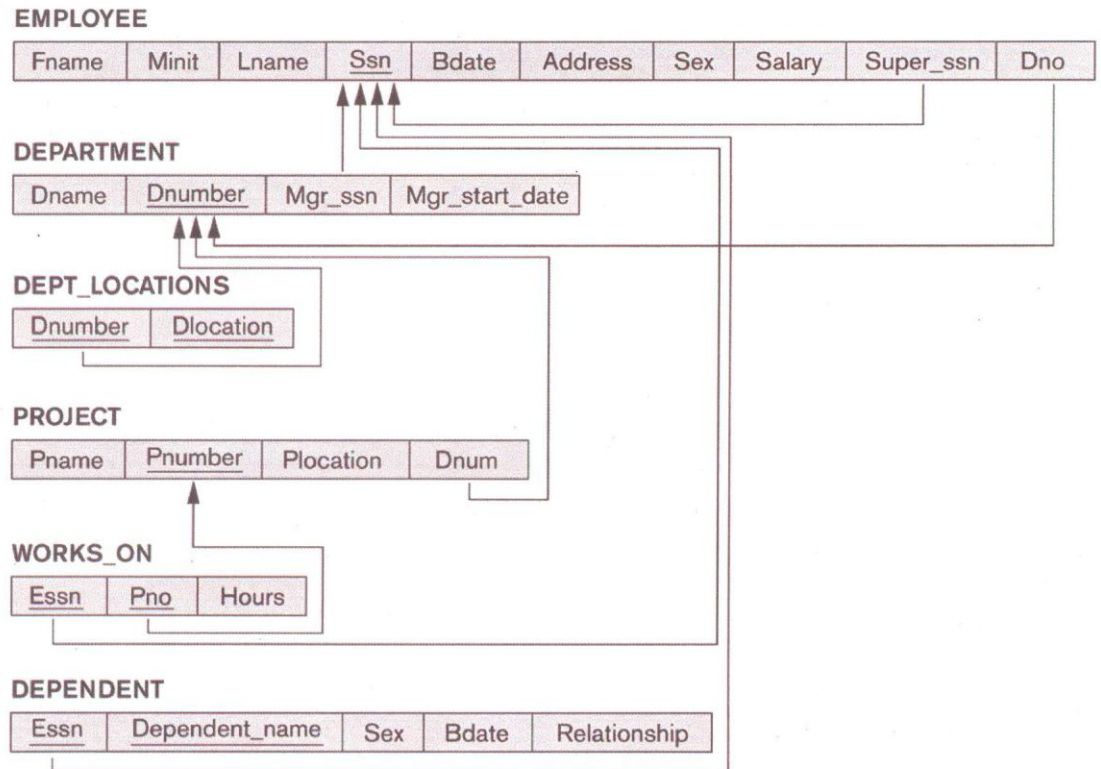
$$D = \{R_1, R_2, R_3, R_4, R_5\};$$

$$R_1 = \{A, B, C, D\}, R_2 = \{D, E\}, R_3 = \{B, F\}, R_4 = \{F, G, H\}, R_5 = \{D, I, J\}$$

4. What is the difference between *discretionary* and *mandatory* access control in database security? (10%)
5. What is the difference between XML schema and XML DTD? (10%)

第二部分：

1. Specify the following queries on the COMPANY relational database schema shown below, using relational algebra and SQL.
 - (a) Find the names and addresses of all employees who work on at least one project located in Houston but whose department has no location in Houston. (10%)
 - (b) For each department whose average employee salary is more than \$30,000, retrieve the department name and the number of male employees working for that department. (10%)



2. How does a B-tree differ from a B⁺-tree? Why is a B⁺-tree usually preferred as an access structure to a data file? (10%)
3. What is the two-phase locking protocol? How does it guarantee serializability? (10%)
4. How do spatial databases differ from regular databases? (10%)