In each of the three problems below, you are given an informally stated query. Your task is to translate each such query into equivalent ones in the languages of relational algebra (part (a)) and SQL (part (b)). The queries are all with respect to our old friend, the COMPANY database.

Your SQL answers should be submitted in both printed and electronic form. (The latter should be a plain text file suitable for execution using the \$ command in Postgresql.)

In case you are unable to devise an exact translation of the query given, develop one that is "as close as possible" and point out its deficiencies.

For the purpose of making the informal queries more concise, we define the function $M$, mapping employees to sets of employees, as follows: For employees $e$ and $e'$, $e' \in M(e)$ if and only if either

(i) $e'$ is the manager of the department to which $e$ is assigned (according to the DNO attribute of $e$'s tuple in the EMPLOYEE relation) or

(ii) $e$ works on a project that is controlled by the department of which $e'$ is the manager.

1. For each pair of employees $e$ and $e'$ such that $e' \in M(e)$, list the SSN and last name of $e$ and the SSN, last name, and salary of $e'$.

   (a) Express this query in the language of relational algebra.
   (b) Express this query in the language of SQL. Specify that the tuples in the result are to be in ascending order with respect to the last name of $e$.

2. For each employee $e$, list the SSN and last name of $e$, plus the number of employees in $M(e)$, the minimum of the salaries of the employees in $M(e)$, and the average of the salaries of the employees in $M(e)$.

   (a) Express this query in the language of relational algebra.
   (b) Express this query in the language of SQL. Specify that the tuples in the result are to be in descending order with respect to the third attribute (i.e., the one indicating the cardinality of $M(e)$). For tuples with the same value in the third attribute, they should be in ascending order with respect to the last name of $e$.

3. For each employee $e$ for which $M(e)$ includes at least two elements, list the SSN and ... (as in (2)).

   (a) Express this query in the language of relational algebra.
   (b) Express this query in the language of SQL. Specify that the tuples in the result are to be ordered as in (2b).