Problem 1

Convert the following ER diagram into a relational database schema

Figure 1: ER diagram for Company Database

Solution:

Follow the steps of the algorithm for ER-to-relational mapping (Chapter 9)
Problem 2

Consider figure 3. Show scenarios where insertion, deletion, and modification anomalies may be present in the relation.

**Solution:**

- **Insertion anomalies**
  Two scenarios:
  a) We must include correct attribute values for the department for each employee while inserting.
  b) It is difficult to insert a new department that has no employee as yet.

- **Deletion anomalies:**
  If we delete all the employees who were working for a particular department, the information concerning the department is lost.
• Modification anomalies:
  If we update one of the attributes of a particular department, say Dname for a particular employee without doing so for all the employees who work in the same department, the database will be inconsistent.

Note: Read section 14.1.2 for further details.

Problem 3

Prove Armstrong’s axioms (reflexive rule, augmentation rule, and transitive rule).

Solution:

Please refer Section 15.1.1 of the textbook (page 507)

Problem 4

Consider a schema with attributes X=A,B,C,D,E,F,G,H. Determine \( \{A, B, F\}^+ \), the closure of \{A, B, F\}. The following FDs are provided:

\[
\begin{align*}
  &A, C \rightarrow D \\
  &D, H, G \rightarrow E \\
  &A, B \rightarrow G \\
  &F, B, G \rightarrow C
\end{align*}
\]

Solution:

\{A,B,C,D,F,G\}