Steps of Bernstein's Algorithm

Step 1: Find a Minimal Cover

- A minimal cover is a simplified set of functional dependencies (FDs) where:
    1. Every FD has a single attribute on the right-hand side (canonical form).
    2. No FD is redundant (removing any FD would change the closure).
    3. No attribute on the left-hand side is redundant.

Process:

1. Break down FDs with multiple attributes on the right into separate FDs (e.g., A→BC, becomes A→B and A→C).
2. Remove extraneous attributes on the left-hand side of FDs.
3. Eliminate redundant FDs by checking if they can be derived from other FDs.

Step 2: Create Relations for Each FD

- For each FD X→Y in the minimal cover, create a relation Ri
- containing:
    1. All attributes in $X \cup Y$
    2. X is the primary key.

Step 3: Ensure Candidate Keys Are Preserved

- Check if all candidate keys from the original relation are preserved in the decomposed relations.
- If not, create a new relation containing the attributes of the candidate key.

Step 4: Verify Lossless Join

- Ensure the decomposition allows the original relation R to be reconstructed without losing any data.
- Use the lossless join test (e.g., using attribute closures or the decomposition dependency-preservation test).