7.1 (modified) [25 pts.] Draw the functional-dependency diagram (as described in class) for the following set \( F \) of functional dependencies for the relation scheme \( R = (A, B, C, D, E) \). Compute the closure of \( F \). [Omit trivial dependencies or those with extraneous variables.]

\[
\begin{align*}
[1] &\quad A \rightarrow BC \\
[2] &\quad CD \rightarrow E \\
[3] &\quad B \rightarrow D \\
[4] &\quad E \rightarrow A \\
\end{align*}
\]

Set \( F \) of functional dependencies.

List the candidate keys for \( R \).

7.2 (modified) [20 pts.] Using the set \( F \) of functional dependencies from Exercise 7.1:

(a) Compute \( B^+ \).

(b) Compute the canonical cover \( F_c \).

7.17 [10 pts.] Explain what is meant by repetition of information and inability to represent information. Explain why each of these properties may indicate a bad relational-database design.

7.20 [5 pts.] Consider the following proposed rule for functional dependencies: If \( \alpha \rightarrow \beta \) and \( \gamma \rightarrow \beta \) then \( \alpha \rightarrow \gamma \). Prove that this rule is not sound by showing a relation \( r \) which satisfies \( \alpha \rightarrow \beta \) and \( \gamma \rightarrow \beta \) but does not satisfy \( \alpha \rightarrow \gamma \).

7.23 [10 pts.] Show that the following decomposition of the schema \( R = (A, B, C, D, E) \) of Practice Exercise 7.1 is not a lossless-join decomposition:

\[
\begin{align*}
(A, B, C) \\
(C, D, E)
\end{align*}
\]

under the following set of functional dependencies given in Problem 7.1.

*Hint:* Give an example of a relation \( r \) on \( R \) [satisfying the set \( F \) of functional dependencies] such that

\[
\Pi_{A,B,C}(r) \Join \Pi_{C,D,E}(r) \neq r
\]