1. Find all candidate keys for relation \( R(ABCDE) \). Following functional dependencies exist in relation \( R \):

\[ A \rightarrow B, BC \rightarrow E, ED \rightarrow A \]

2. Given relation \( R(ABCDEF) \) and following functional dependencies:

\[ F = \{A \rightarrow BC, E \rightarrow ABC, F \rightarrow CD, CD \rightarrow BEF\} \]

Determine all candidate keys!

3. Given two sets of functional dependencies:

- \( A \rightarrow B, A \rightarrow C, CD \rightarrow E, B \rightarrow D \)
- \( A \rightarrow BC, AD \rightarrow E, DB \rightarrow B, A \rightarrow D \)

Test in a systematic way, whether both sets are equivalent, one set is a superset, or no set is semantically contained within the other set.

4. Given a relation about drinking suppliers:

<table>
<thead>
<tr>
<th>Company</th>
<th>Product</th>
<th>Export</th>
<th>Caffeine Content</th>
<th>Popularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meier</td>
<td>tea</td>
<td>yes</td>
<td>16</td>
<td>high</td>
</tr>
<tr>
<td>Meier</td>
<td>coffee</td>
<td>yes</td>
<td>8</td>
<td>low</td>
</tr>
<tr>
<td>Dept</td>
<td>{tea, coffee}</td>
<td>no</td>
<td>17</td>
<td>high</td>
</tr>
<tr>
<td>HB</td>
<td>{tea, coffee}</td>
<td>no</td>
<td>30</td>
<td>low</td>
</tr>
</tbody>
</table>

Following functional dependencies exist:

\[
(Company, Product \rightarrow Export, CaffeineContent, Popularity), \\
(Company \rightarrow Export), (CaffeineContent \rightarrow Popularity), \\
(CaffeineContent \rightarrow Company).
\]

Transfer the relation step-by-step into the **Boyce-Codd-Normal Form (BCNF)**. Present each intermediate result!
5. Given following relation:

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>COURSE</th>
<th>INSTRUCTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mueller</td>
<td>C1</td>
<td>Heinz</td>
</tr>
<tr>
<td>Meier</td>
<td>C1</td>
<td>Heinz</td>
</tr>
<tr>
<td>Meier</td>
<td>C2</td>
<td>Paul</td>
</tr>
<tr>
<td>Schmidt</td>
<td>C1</td>
<td>Peter</td>
</tr>
</tbody>
</table>

Decompose the data according to the three given possibilities and join them together afterwards.

(a) \( \text{Teach}1 (\text{STUDENT, INSTRUCTOR}) \) \( \text{Teach}2 (\text{STUDENT, COURSE}) \)
(b) \( \text{Teach}1 (\text{COURSE, INSTRUCTOR}) \) \( \text{Teach}2 (\text{COURSE, STUDENT}) \)
(c) \( \text{Teach}1 (\text{INSTRUCTOR, COURSE}) \) \( \text{Teach}2 (\text{INSTRUCTOR, STUDENT}) \)

6. Voluntary/extra task: Given the following functional dependencies over the schema \( R(A,B,C,D) \):

\[
A \rightarrow C, \quad B \rightarrow CD
\]

Which of the following decompositions is lossless and/or dependency preserving?

- \( R_1(A, B), R_2(A, C, D) \)
- \( R_1(A, C), R_2(B, C, D) \)
- \( R_1(A, B), R_2(B, C, D) \)
- \( R_1(A, B, C), R_2(B, C, D) \)

Good Luck!