1. Consider the following relations and functional dependencies. Convert all relations to BCNF (if there are two relations each one needs to be decomposed). Relations: `R1(S,T,U,V,W)`, `R2(S,U,Y)`. Functional dependencies: $S \to TU$, $S \to V$, $S \to W$, $SU \to Y$, $TU \to W$, $U \to W$, $U \to S$.

2. Provide a "real life" schedule for each of the following anomalies:

   (a) Dirty Read (Reading uncommitted data)

   (b) Unrepeatable Read (RW)

   (c) Lost Update (WW)

3. Given the following schema of a relation R(A,B,C,D,E) with the following functional dependencies: $AB \rightarrow C$, $C \rightarrow D$, $D \rightarrow B$, $D \rightarrow E$, and the following data:

| A | B | C | D | E |
|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 2 |
| 1 | 2 | 3 | 1 | 2 |
| 1 | 3 | 5 | 2 | 5 |
| 2 | 1 | 2 | 3 | 2 |
| 2 | 2 | 3 | 1 | 2 |
| 2 | 3 | 7 | 2 | 5 |
| 3 | 1 | 1 | 3 | 2 |
| 3 | 2 | 4 | 1 | 2 |
| 3 | 3 | 5 | 2 | 5 |

(a) Decompose R into tables in BCNF.

(b) Project the data of the original table into the new tables.

(c) Join the data of the new tables to obtain one table and compare it to the original data.

4. Assume that $R(A, B, C, D, E, F)$ has been decomposed into $S(A, C, E, F)$ and other relations. If the dependencies for $R$ are: $AB \rightarrow C$, $C \rightarrow E$, $E \rightarrow B$, $B \rightarrow F$, $F \rightarrow D$.

   (a) Find **ALL non-trivial** functional dependencies that hold in $S$

   (b) Determine the keys and superkeys of $S$

   (c) For each one of your functional dependencies from part a) indicate if it is a BCNF violation, a 3NF violation or no violation (with respect to S).

5. Consider the following relation and functional dependencies. Convert the given relation to 3NF.

**Relation:**

$$R(L, I, T, P, S, G)$$

**Functional dependencies:**

$$
\begin{aligned}
L &\rightarrow I \\
TP &\rightarrow L \\
TI &\rightarrow P \\
LS &\rightarrow G \\
TS &\rightarrow P \\
TPI &\rightarrow LP
\end{aligned}
$$