Databases

(a) What is the difference between a key and a functional dependency? [3 marks]

(b) The schema $R(A, B, C, D, E)$ has the following functional dependencies.

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

(i) What are all of the keys of $R$? [3 marks]

(ii) Which functional dependencies violate Boyce–Codd Normal form (BCNF)? [3 marks]

(iii) Which functional dependencies violate Third Normal form (3NF)? [3 marks]

(iv) Find a lossless-join decomposition of $R$ into BCNF relations. [8 marks]