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Notes:

- Replace *URL* in **Database.java** with the correct hostname and database name for testing. If you do not, the program will not be able to resolve the host.
- Replace *USER* and *PASSWORD* in **Database.java** with your credentials for testing. If you do not, the program will error out with an authentication error.
- This program was developed and successfully tested using Eclipse IDE. It *may* not work for Visual Studio Code due to how that IDE reads .jar files.

Test Cases (using the University Database):

- Case 1: If $R \cap S = \emptyset$
  - $advisor \bowtie instructor$
    - $advisor \cap instructor = \emptyset$, therefore Case 1.
- Case 2: If $R \cap S$ is a key for R
  - $department \bowtie instructor$
    - $department \cap instructor = \{dept\_name\}$
      - $\{dept\_name\} \neq \emptyset$, therefore, not Case 1.
      - $\{dept\_name\}$ is a key for $department$, therefore, Case 2.
- Case 3:
  - The case for $R \cap S$ referencing S is symmetric.
  - a) If $R \cap S$ in S is a foreign key in S referencing R
    - Not possible with the given database tables of the university database.
  - b) If $S \cap R$ in R is a foreign key in R referencing S
    - $instructor \bowtie department$
      - $department \cap instructor = \{dept\_name\}$
        - $\{dept\_name\} \neq \emptyset$, therefore, not Case 1.
        - $\{dept\_name\}$ is not a key for $instructor$, therefore not Case 2.
        - $\{dept\_name\}$ is not a foreign key of $department$ referencing $instructor$. Therefore, not Case 3a.
        - $\{dept\_name\}$ is a foreign key of $instructor$ referencing $department$. Therefore, Case 3b.
- Case 4: If $R \cap S = \{A\}$ is not a key for R or S
  - [Over-estimating] $instructor \bowtie course$
    - $instructor \cap course = \{dept\_name\}$
      - $\{dept\_name\} \neq \emptyset$, therefore, not Case 1.
      - $\{dept\_name\}$ is not a key for $instructor$, therefore not Case 2.

- $\{dept\_name\}$ is not a foreign key referencing either $instructor$ or $course$. Therefore, not Case 3a or Case 3b.
- $\{dept\_name\}$ is not a key for $course$, therefore Case 4.

- [Under-estimating] $section \bowtie time\_slot$
  - $section \cap time\_slot = \{time\_slot\_id\}$
    - $\{time\_slot\_id\} \neq \emptyset$, therefore, not Case 1.
    - $\{time\_slot\_id\}$ is not a key for $section$, therefore not Case 2.
    - $\{time\_slot\_id\}$ is not a foreign key referencing either $section$ or $time\_slot$. Therefore, not Case 3a or Case 3b.
    - $\{time\_slot\_id\}$ is not a key for $time\_slot$, therefore Case 4.

Note: The relations specified in the above test cases are order sensitive. Reversing the order *may* trigger a different case instead of the intended one.