Solutions to Homework #1 - Section 2

2.1 Retrieve the names of all borrowers who do not have any books checked out.
   CardNoSet ← \( \Pi_{\text{Card\#No}} (\text{BORROWER}) - \Pi_{\text{Card\#No}} (\text{BOOK\_LOANS}) \)
   Result ← \( \Pi_{\text{Name}} (\text{CardNoSet \& BORROWER}) \)

2.2 How many copies of the book titled 'How to Avoid Publicity' are owned by the library branch whose name is 'Charles Village'?
   CVillageID ← \( \Pi_{\text{Branch\#ID}} (\sigma_{\text{Branch\#Name}=\text{\"Charles Village\"}} (\text{LIBRARY\_BRANCH})) \)
   BookHowTo ← \( \Pi_{\text{Book\#ID}} (\sigma_{\text{Title}=\text{\"How to Avoid Publicity\"}} (\text{BOOK})) \)
   Result ← \( \Pi_{\text{Num\_Copies}} (\text{CVillageID \& BOOK\_COPIES \& BookHowTo}) \)

2.3 List the card numbers and names of all borrowers who have checked out every book in the Charles Village branch at least once.

Buse Has Solution

2.4 List the title and publisher of every book that has never been borrowed by someone living in Towson

2.5 List the card numbers and names of all borrowers who have checked out the same book more than once.

2.6 List all branches that do not have any copies of 'How to Avoid Publicity'.

2.7 For each book authored (or coauthored) by 'Miley Cyrus', retrieve the title and the number of copies owned by the library branch whose name is 'Towson South'.
   TowsonSouthID ← \( \Pi_{\text{Branch\#ID}} (\sigma_{\text{Branch\#Name}=\text{\"Towson South\"}} (\text{LIBRARY\_BRANCH})) \)
   BookOfMiley ← \( \Pi_{\text{Book\#ID}} (\sigma_{\text{Author\#Name}=\text{\"Miley Cyrus\"}} (\text{BOOK\_AUTHORS})) \)
   Result ← \( \Pi_{\text{Title,Num\_Copies}} (\text{BookOfMiley \& BOOK\_COPIES \& TowsonSouthID \& BOOK}) \)

2.10 For each book that is loaned out from the 'Charles Village' branch and whose Due Date is today, retrieve the book title, the book author, the publisher's address, the borrower's name, and the borrower's address.
   CVillageID ← \( \Pi_{\text{Branch\#ID}} (\sigma_{\text{Branch\#Name}=\text{\"Charles Village\"}} (\text{LIBRARY\_BRANCH})) \)
   DueCVillage ← \( \Pi_{\text{Book\#ID,Card\#No}} (\sigma_{\text{Due\_Date}=\text{\"10–28–99\"}} (\text{CVillageID \& BOOK\_LOANS})) \)
   BookDetail ← \( \text{BOOK \& Publisher\_Name=Name PUBLISHER \& BOOK\_AUTHORS} \)
   BookInfo ← \( \Pi_{\text{Book\#ID,Title,Author\_Name,PCity,Country}} (\text{BookDetail}) \)
   CardInfo ← \( \Pi_{\text{Card\#No,Name,Address}} (\text{BORROWER}) \)
   DetailedResult ← \( \text{DueCVillage \& BookDetail \& CardInfo} \)
   Result ← \( \Pi_{\text{Title,Author\_Name,City,Country,Name,Address}} (\text{DetailedResult}) \)

2.20 How many copies of the book titled it 'My Judicial Experience' are owned by each library branch (give branch name and total copies)?
   BookMyMJE ← \( \Pi_{\text{Book\#ID}} (\sigma_{\text{Title}=\text{\"My Judicial Experience\"}} (\text{BOOK})) \)
   NumMJE ← \( \Pi_{\text{Branch\#ID,Num\_Copies}} (\text{BookMJE \& BOOK\_COPIES}) \)
   Result ← \( \Pi_{\text{Branch\#Name,Num\_Copies}} (\text{NumMJE \& LIBRARY\_BRANCH}) \)
2.1 Retrieve the names of all borrowers who do not have any books checked out
\[
\{ t \mid \exists b \in \text{BORROWER} \quad \\
\quad t[\text{Name}] = b[\text{Name}] \\
\quad \wedge \neg \exists l \in \text{BOOK LOANS} \quad \\
\quad l[\text{CardNo}] = b[\text{CardNo}] \} \}
\]

2.2 How many copies of the book titled \textit{How to Avoid Publicity} are owned by the library branch whose name is 'Charles Village'?
\[
\{ t \mid \exists c \in \text{BOOK COPIES} \quad \\
\quad t[\text{NumCopies}] = c[\text{NumCopies}] \\
\quad \wedge \exists l \in \text{LIBRARY BRANCH} \quad \\
\quad l[\text{BranchName}] = \text{"Charles Village"} \wedge l[\text{BranchID}] = c[\text{BranchID}] \\
\quad \wedge \exists b \in \text{BOOK} ( \\
\quad b[\text{Title}] = \text{"How to Avoid Publicity"} \wedge b[\text{BookID}] = c[\text{BookID}] )) \}
\]

2.10 For each book that is loaned out from the 'Charles Village' branch and whose DueDate is today, retrieve the book title, the book author, the publisher's address, the borrower's name and the borrower's address.
\[
\{ t \mid \exists b \in \text{LIBRARY BRANCH} ( \\
\quad b[\text{BranchName}] = \text{"Charles Village"} \\
\quad \wedge \exists l \in \text{BOOK LOANS} ( \\
\quad l[\text{DueDate}] = 10 - 28 - 99 \\
\quad \wedge \exists b \in \text{BOOK} ( \\
\quad b[\text{BookID}] = b[\text{BookID}] \wedge l[\text{Title}] = b[\text{Title}] \\
\quad \wedge \exists pr \in \text{PUBLISHER} ( \\
\quad pr[\text{Name}] = b[\text{PublisherName}] \wedge l[\text{PublisherCity}] = pr[\text{City}] \wedge l[\text{PublisherCountry}] = pr[\text{Country}] \\
\quad \wedge \exists ba \in \text{BOOK AUTHORS} ( \\
\quad ba[\text{BookID}] = b[\text{BookID}] \wedge l[\text{Author}] = ba[\text{AuthorName}] \\
\quad \wedge \exists br \in \text{BORROWER} ( \\
\quad br[\text{CardNo}] = b[\text{CardNo}] \wedge l[\text{Name}] = br[\text{Name}] \wedge l[\text{BorrowerAddress}] = br[\text{Address}]) )) ) ) \}
\]

2.19 How many copies of the book titled \textit{My Judicial Experience} are owned by each library branch (give branch name and total copies)?
\[
\{ t \mid \exists b \in \text{BOOK} ( \\
\quad b[\text{Title}] = \text{"My Judicial Experience"} \\
\quad \wedge \exists c \in \text{BOOK COPIES} ( \\
\quad c[\text{BookID}] = b[\text{BookID}] \wedge l[\text{NumCopies}] = c[\text{NumCopies}] \\
\quad \wedge \exists l \in \text{LIBRARY BRANCH} ( \\
\quad l[\text{BranchName}] = l[\text{BranchName}] \wedge c[\text{BranchID}] = l[\text{BranchID}] ))) \}
\]