The task was to develop a program in C++ to ask the user to input a date (in the form of `YYYY-MM` between `1919-01` and `2013-07`) and in the event the user entered an incorrect date, the program will ask the user to try again. Given a valid date, the program will output the BAA rate as well as the difference between the rate on that date and the average rate across all dates.

To tackle this problem, I created two helper functions. The first was a function to calculate the average given a vector, and the second function would take in a date, a date vector, and a BAA rate vector, and output the corresponding BAA rate on that date. Since both the BAA rate and date vectors were of equal length, I iterated through the date vector until it matched with the input date and used that index to slice out the BAA rate corresponding to input date. Further, in the main function output, I used the `ifstream` method to read in the csv data. The csv data consisted of time series data of Moody's yield on seasoned corporate bonds across all industries (BAA). The csv file was read line by line using the `getline` method. At each line, if the first value of the line (which was of type character) was alphanumeric, we would proceed to parse the string as needed. Otherwise, the program would read the next line. If the string was being parsed, the program would split the line based on the “,” delimiter and append what’s to the left of the comma (the date) to the date vector. Similarly, what’s to the right of the comma was appended to the rates vector (after cleaning the string further since it included the unnecessary `\r` at the end of it). The vectors appended the necessary values using the `push\_back` method. The string cleaning procedure utilized the `find` and the `substr` methods.

Once the necessary vectors were created, the program would ask the user for an input using the `cin` method and the program would print walkthrough statements using the `cout` method. When the user inputs a date, the program reads in that value using the `getline` method. It then uses the helper function to match the date with a rate and output the rate (`find\_rate`. Further, it utilizes the `average` helper function to average all the rates and calculated the difference between the rate on the input date and the average rates. In the event that the user was to input an invalid date, the program would catch that mistake since the `find\_rate` helper function would return -1. This was done using an if statement.

The average BAA rate across all dates from 1919-01 to 2013-07 was 7.05. The differences between the rates and the average rate ranged from -4.11 and 10.13. The differences averaged around 0, which makes sense since subtracting the mean essentially mean-centers the data. The BAA rate spiked in the early 1930s and spiked again in the 1980s, the former being a result of The Stock Market Crash of 1929 (Black Tuesday) and the latter leading up to the 1987s Black Monday crash.

Examples:

Input: 2012-11

Output: Rate: 4.51, Diff: -2.5414

Input: 2020-01

Output: Date entered is invalid! Please enter a valid Date (between 1919-01 and 2013-07 in the form YYYY-MM)