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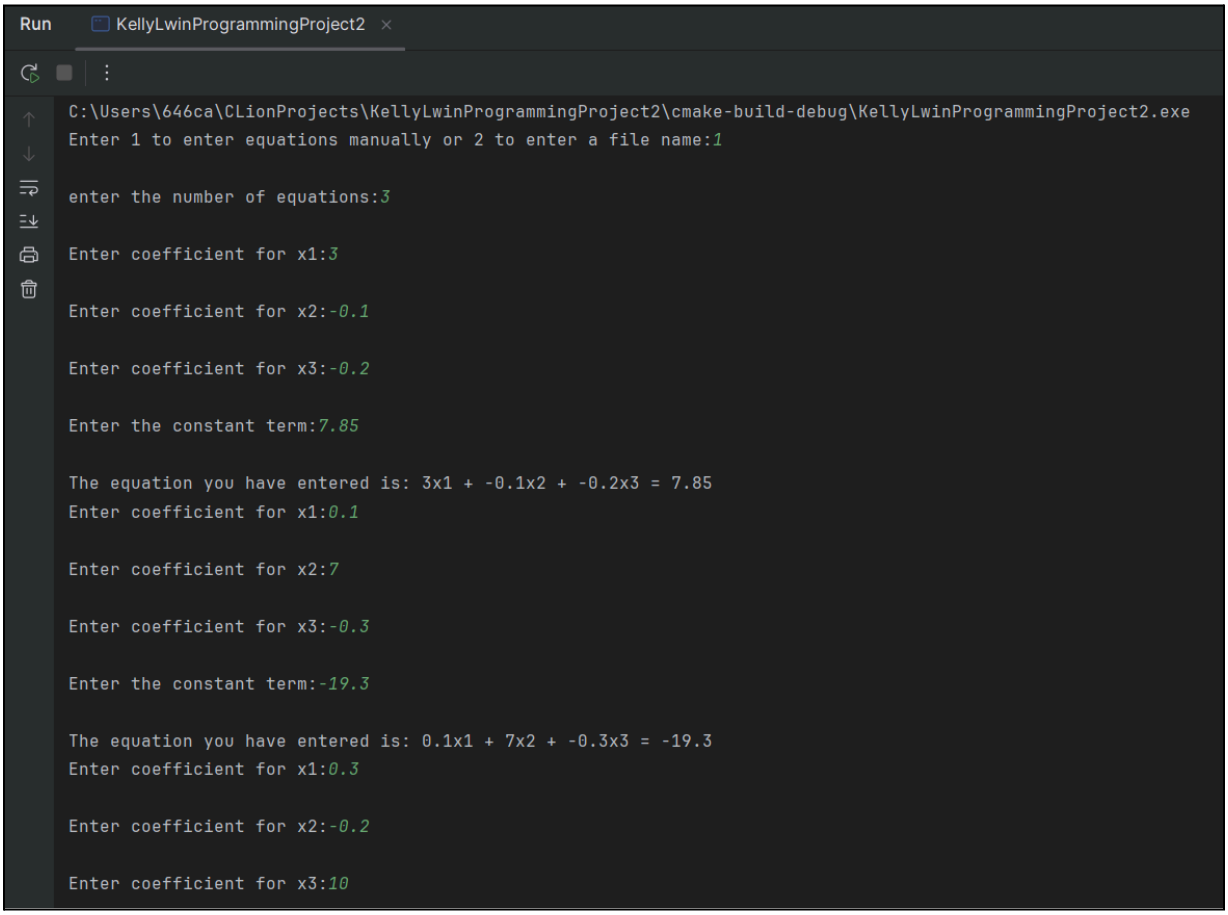
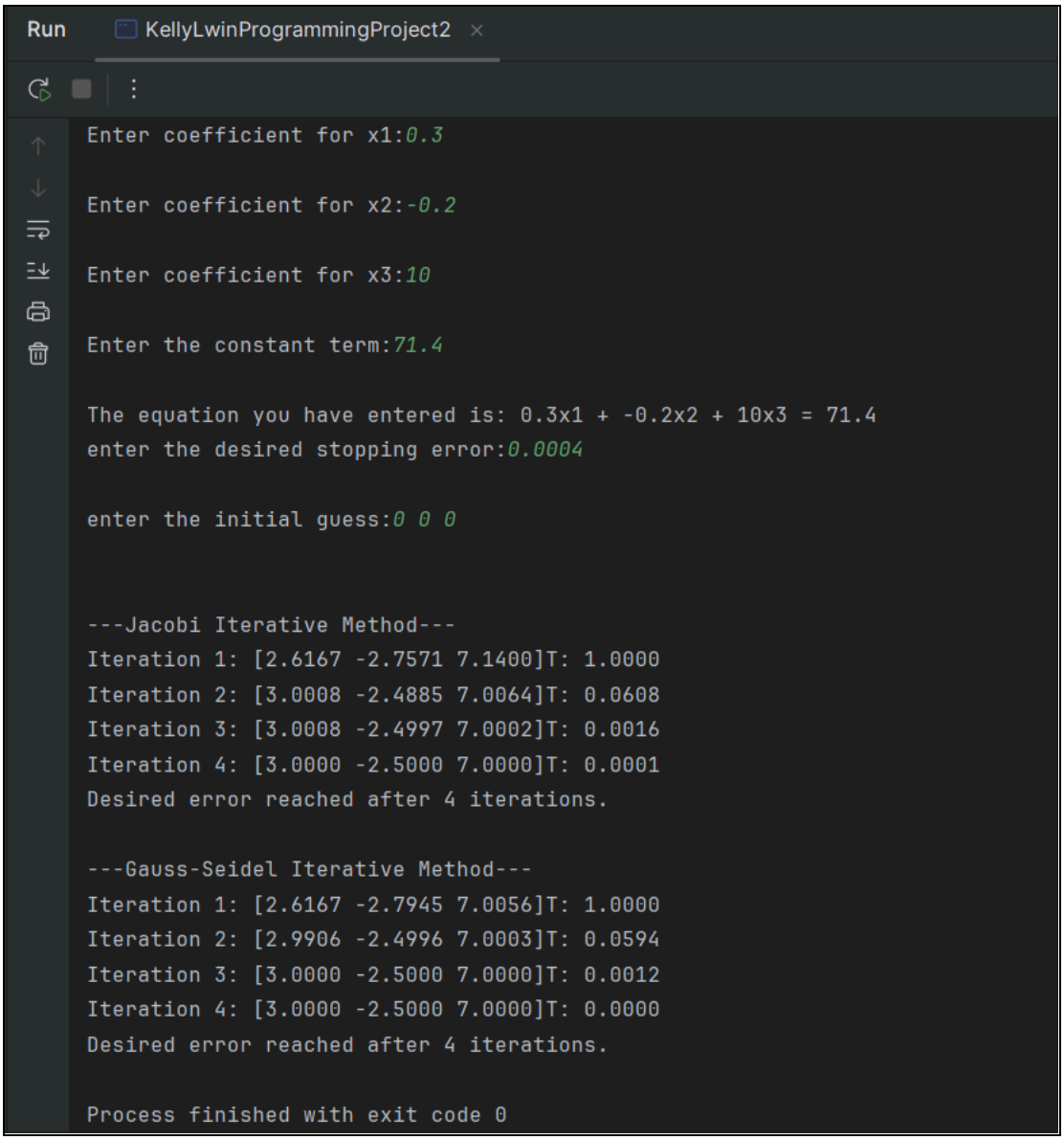
Course: Numerical Methods (CS3010)

Date: March 23rd, 2025

Assignment: Programming Project 2 Report

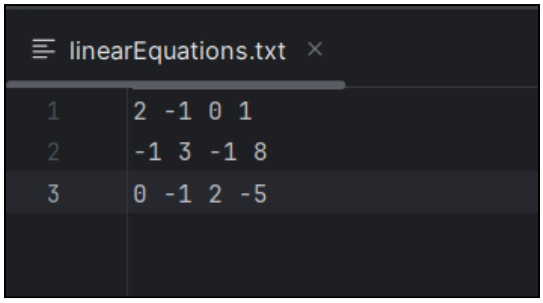
Test 1 (using the coefficients the user enters themselves)



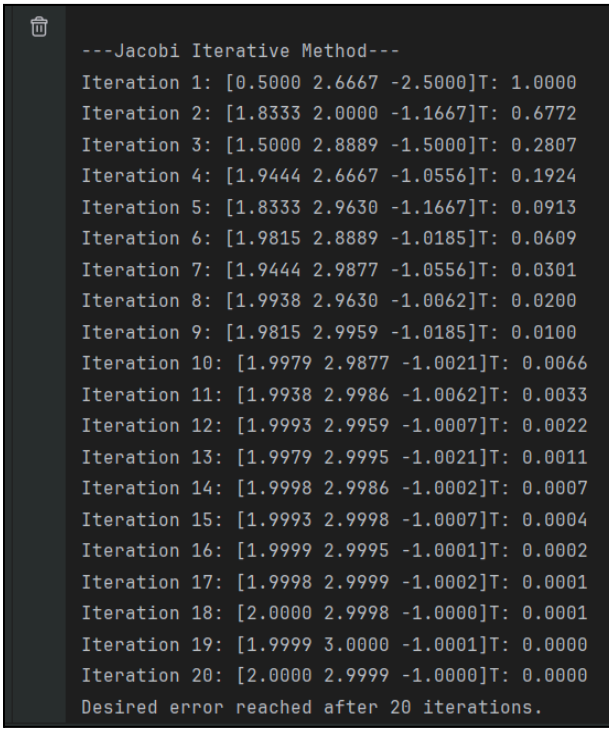

Run
KellyLwinProgrammingProject2
Enter coefficient for x1:0.3
Enter coefficient for x2:-0.2
Enter coefficient for x3:10
Enter the constant term:71.4
The equation you have entered is: 0.3x1 + -0.2x2 + 10x3 = 71.4
enter the desired stopping error:0.0004
enter the initial guess:0 0 0
---Jacobi Iterative Method---
Iteration 1: [2.6167 -2.7571 7.1400]T: 1.0000
Iteration 2: [3.0008 -2.4885 7.0064]T: 0.0608
Iteration 3: [3.0008 -2.4997 7.0002]T: 0.0016
Iteration 4: [3.0000 -2.5000 7.0000]T: 0.0001
Desired error reached after 4 iterations.
---Gauss-Seidel Iterative Method---
Iteration 1: [2.6167 -2.7945 7.0056]T: 1.0000
Iteration 2: [2.9906 -2.4996 7.0003]T: 0.0594
Iteration 3: [3.0000 -2.5000 7.0000]T: 0.0012
Iteration 4: [3.0000 -2.5000 7.0000]T: 0.0000
Desired error reached after 4 iterations.
Process finished with exit code 0

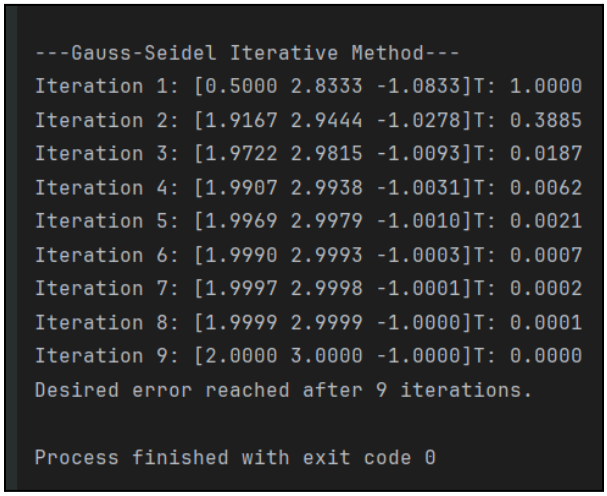
Test 2 (user enters the file name of the file that has the coefficients)

Input file content:



Program Output:



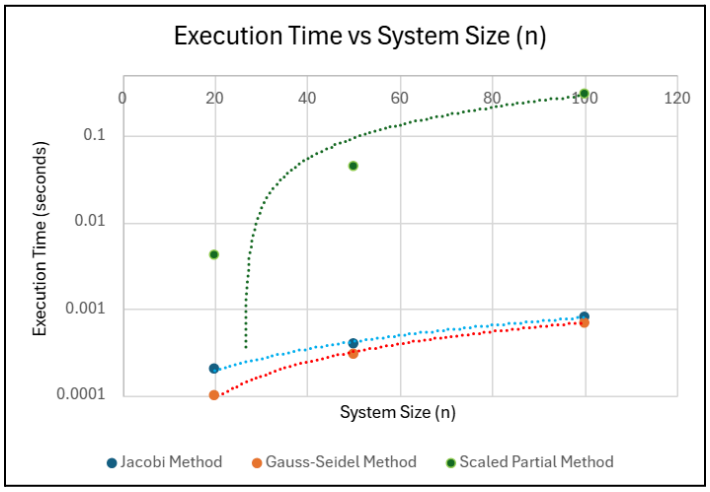


Extra Credit

```
Run  KellyLwinProgrammingProject2
C:\Users\646ca\CLionProjects\KellyLwinProgrammingProject2\cmake-build-debug\KellyLwinProgrammingProject2.exe

n = 20:
jacobi time: 0.0002 seconds
gauss-seidel time: 0.0001 seconds

n = 50:
jacobi time: 0.0004 seconds
gauss-seidel time: 0.0003 seconds

n = 100:
jacobi time: 0.0008 seconds
gauss-seidel time: 0.0007 seconds

Process finished with exit code 0
```

```
Run  KellyLwin_CS3010_ProgrammingProject1
C:\Users\646ca\CLionProjects\KellyLwin_CS3010_ProgrammingProject1\cmake-build-debug\KellyLwin_CS3010_ProgrammingProject1.exe

n = 20:
Gaussian Elimination with Scaled partial pivoting method time: 20: 0.0043 seconds

n = 50:
Gaussian Elimination with Scaled partial pivoting method time: 50: 0.0453 seconds

n = 100:
Gaussian Elimination with Scaled partial pivoting method time: 100: 0.3134 seconds

Process finished with exit code 0
```

I tested my programs with large values of n such as 20, 50, and 100 and random values for coefficients in the system. I did not run into any issues. Below is the graph of how the time increases as the number of equations increases for different methods.



The logarithmic scale is used so that Gauss-Seidel and Jacobi lines would not appear flat when visualizing.

- The Jacobi and Gauss-Seidel methods handle bigger systems well — their execution time grows slowly as the system size increases.
- In contrast, the Scaled Partial Method doesn't scale well — its execution time increases quickly and becomes much slower for larger systems.