C++ Assignment 2 **Jiecheng Song**
AMS 595 SBID:111783762
Prof. Barbara Chapman Lab Date: 12/03/2017
TA: Xiaoyu Li Due Date: 12/03/2017

Introduction to the code

When we execute the code, it will ask us to input the N, which will be the max times of the iterations. After input, what the number you input will show and the difference (RMS) of the last two iterations will show, as well as the execution time. If what you input is not positive or not a number, the default level of accuracy and the difference (RMS) of the last two iterations and the execution time will be shown.
Since I found if we set N as an integer, if we input string or other type variables into N, N will be recognized as 0, so we use if N is over 0 as a condition to decide to use max times iterations or default level of accuracy.

Performances of Jacobi Method

```
ubuntu@ams595-vzufkl:~/shared> g++ jacobi_jiechengsong.cpp
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
100
what you input is:100
The difference is:0.0644083
Total time is 0.129085 seconds
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
1000
what you input is:1000
The difference is:0.00875477
Total time is 1.06206 seconds
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
abcdef
what you input is:0
the level of accuracy is 1e-05
the difference is 9.99815e-06
the number of iterations is 13738
Total time is 14.5432 seconds
```

Figure 1: examples for function test

```
ubuntu@ams595-vzufkl:~/shared> g++ jacobi_jiechengsong.cpp
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
0
what you input is:0
the level of accuracy is 1e-06
the difference is 9.99509e-07
the number of iterations is 18311
Total time is 18.8292 seconds
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
5000.03
what you input is:5000
The difference is:0.000815471
Total time is 5.0774 seconds
ubuntu@ams595-vzufkl:~/shared> g++ jacobi_jiechengsong.cpp
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
-5
what you input is:-5
the level of accuracy is 1e-07
the difference is 9.99706e-08
the number of iterations is 22883
Total time is 23.1533 seconds
```

Figure 2: examples for function test

Performances of Gauss-Seidel Method

```
ubuntu@ams595-vzufkl:~/shared> g++ gaussseidel_jiechengsong.cpp
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
1000
what you input is:1000
The difference is:0.00822528
Total time is 2.33358 seconds
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
10000
what you input is:10000
The difference is:8.75684e-07
Total time is 10.4523 seconds
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
c++
what you input is:0
the level of accuracy is 1e-05
the difference is 9.99999e-06
the number of iterations is 7582
Total time is 7.5686 seconds
```

Figure 3: examples for function test

```
ubuntu@ams595-vzufkl:~/shared> g++ gaussseidel_jiechengsong.cpp
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
0
what you input is:0
the level of accuracy is 1e-06
the difference is 9.9919e-07
the number of iterations is 9869
Total time is 9.8093 seconds
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
8000.345
what you input is:8000
The difference is:6.56392e-06
Total time is 7.72631 seconds
ubuntu@ams595-vzufkl:~/shared> g++ gaussseidel_jiechengsong.cpp
ubuntu@ams595-vzufkl:~/shared> ./a.out
Please input the number of iterations:
0
what you input is:0
the level of accuracy is 1e-07
the difference is 9.99387e-08
the number of iterations is 12155
Total time is 12.0531 seconds
```

Figure 4: examples for function test

Conclusion

We can find that using Gauss-Seidel Method will cost similar time with Jacobi Method with the same max iteration times. But with the same level of accuracy, it will also cost less time and times of iterations.