

ME 581 Fall 2011: Computer Access, Usage, and Reporting

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Abstract

This class involves computer programming, that is, writing, compiling, and debugging your own computer programs to test and explore the various numerical methods and algorithms we will be learning about this semester. In addition, analysis of the results will require you to prepare graphical and tabular output of your data. Depending upon your preferences and your desire to learn new things there are several ways you can set up your computer programming environment. This document attempts to provide you with details for some of these options. It also has some **recommendations** for reporting your numerical methods findings.

Computer Programming Environment

There are several options with regard to establishing your computer programming environment. As mentioned in the syllabus you are required to compile and run your programs on one of the four ME linux machines (`air`, `wind`, `water`, `steam` .ecn.purdue.edu) which you should all have accounts on.

1. If you are **on campus** you could sit down in front of one of these machines, login, and work directly in the Linux environment. Or if you prefer to work from your own computer you can follow the steps below.
2. If you are **off campus** you can login remotely to one of these machines using the secure shell network protocol either from your own Mac, Windows or Linux machine. On Mac, you can open a terminal (under Applications/Utilities) and type `ssh username@fire.ecn.purdue.edu` where username is your Purdue username. On Windows you can download and install open-source ssh clients and do the same.
3. If you would like to recreate the Linux environment from your home machine (assuming you are currently running Windows) I recommend installing Ubuntu Linux as a dual boot on your machine. The easiest and fastest way to do this is via the following link: <http://www.ubuntu.com/download/ubuntu/windows-installer>. This is what I did for my Windows 7 laptop and I love it. With Ubuntu Linux on your home machine you can edit, compile (e.g. install gfortran by `sudo apt-get install gfortran`), and run your codes from the convenience of your own machine even without an internet connection. If you are unfamiliar with Linux this a great way and opportunity to learn (you are already learning numerical methods and Fortran programming this semester so why stop there).

Report Format and Preparation

"The purpose of computing is insight, not numbers". This famous quote by the great numerical analyst Hamming reminds us that the reason we do scientific computation is to provide insight into some phenomena or design we are studying. Quantitative accuracy is often times elusive for complex problems but we can still learn something from these computations. Hence, understanding the algorithm, writing/debugging the code, and obtaining the results is only half the job. Analyzing the results and performing parametric studies is usually when something useful comes out of the computations. For this class, handing in a printout of the code and output data is not enough. A short write-up is required to show me you understand the algorithm and know what you did. The format should be similar (but smaller in length) to a typical journal article. That is, it should contain *abstract*, *introduction*, *numerical methods*, *results*, *discussion*, and *summary* sections. The abstract tells me what you did and what you found. The introduction provides some background and motivation for the problem to be solved and some of the various numerical methods options available to solve the problem. The numerical methods section provides specific details of the numerical methods being studied and the algorithm you coded up as well as pertinent code details. You should provide enough information so that a person reading your write-up could code up the algorithm and reproduce your results. The results section is a straight forward presentation of your results without any discussion. The discussion section discusses the results presented in the results section with regard to accuracy and efficiency and compares one method to the next or the effect of parametric studies. The summary section summarizes what you have done and draws conclusions about what you have found (typically with regard to accuracy vs. efficiency of the numerical methods being studied).

I am sure most of you use Word for your document preparation. I would like to suggest you consider \LaTeX since you are already using Linux and it comes free with Linux. You just type `pdflatex filename` at the command line to typeset your document. You can also run \LaTeX from Windows using TeXMaker and MikTeX (google it) and on Mac using TeXShop (which is what I am using this semester to create my notes etc. for this class). Either way your write-up should be clear and concise and look professional. This means any figures/graphs, data output, etc. should be done nicely with proper labels, legends, and tabular formatting.

Grading of Homework/Computer Projects

As we get farther along in the semester the computer programming exercises may get a bit more involved. This is when the write-up becomes very important. I will typically apply a 60/40 split as far as grading your computer program/results and your write-up, respectively. So please do a good (but concise job).