AME 20214–Introduction to Engineering Computing
Fall 2014

Prof. Joseph M. Powers–Instructor
365B Fitzpatrick Hall of Engineering
powers@nd.edu
http://www.nd.edu/∼powers
631-5978
Office hours: 4-5PM, MW

John Hollkamp–T. A.
jhollkam@nd.edu
http://www.nd.edu/∼jhollkam

Margot Hughan–T. A.
mhughan@nd.edu
http://www.nd.edu/∼mhughan

Syazana Mohd Yazid
smohdyaz@nd.edu
http://www.nd.edu/∼smohdyaz

Laura Paquin-T. A.
lpaquin@nd.edu
http://www.nd.edu/∼lpaquin

Brian Sabino–T. A.
bsabino@nd.edu
http://www.nd.edu/∼bsabino

Nathan Spulak–T. A.
nspulak@nd.edu
http://www.nd.edu/∼nspulak

TA office hours: Su,M,Tu,W, 7-10 PM, Engineering Library, Fitzpatrick Hall

Course web site: http://www.nd.edu/∼powers/ame.20214

Listserver address: ame20214-01-fa14@acadlist.nd.edu. When e-mail is sent to this address, the entire class will be receive a copy of the mail.

Course time and location: Thursday 3:30 PM-4:45 PM, 102 DeBartolo.

Prerequisites: EG 10112

Catalog description, from the registrar's web page: "Introduction to the UNIX operating system and the Fortran programming language with applications to engineering computing."

Comments: The course will consist of a survey of elements of programming, scientific computing, and technical writing with an advanced text formatter. Topics will be as listed in the catalog with some additional material interspersed. The required text provides a useful complement to the lectures. In addition to giving a good introduction to the novice, the text also has much advanced material that may prove useful in later years.

Topics

- UNIX and Linux: directory structure, text editors, simple commands,
- Fortran 90, 95, 2003: compiled versus interpreted languages, data types, precision, arrays, input/output, functions, subroutines, object-oriented programming, modules, and scripting.
- Engineering/physics/calculus-based computing problems with emphasis on the forced mass-spring-damper and explicit numerical methods of solution,
- Technical writing and text formatting with LaTeX,
- Engineering plotting with MATLAB,
- Brief introduction to C, HTML, Mathematica, Python, Excel, VBA.

Required text available in bookstore and online

I. Chivers and J. Sleightholme, 2012, *Introduction to Programming with Fortran with Coverage of Fortran 90, 95, 2003, 2008 and 77*, Second Edition, Springer, London. (`online version`.)

Useful auxiliary texts

W. E. Mayo and M. Cwiakala, 1995, *Programming with Fortran 77*, Schaum's Outlines, McGraw-Hill, New York.

M. Metcalf, J. Reid, and M. Cohen, 2011, *Modern Fortran Explained*, Oxford U. Press, New York.

N. S. Clerman and W. Spector, 2012, *Modern Fortran: Style and Usage*, Cambridge U. Press, New York.

W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery, 1992, *Numerical Recipes in Fortran 77*, Second Edition, Cambridge U. Press, New York. (also available in an online version, some software installation required, `http://apps.nrbook.com/empanel/index.html#`)

Computing Hardware and Software

The course will require a significant use of a computer, writing of original source code, and generation of computational results. The course will help the student gain proficiency with both `Fortran` and the `UNIX` operating system; in addition several other software tools will be introduced. In principle, all or nearly all assignments will be able to completed on laptops, once necessary software is installed. Some assignments may be facilitated through use of the university's computational facilities. *A large number of common systematic problems can be attributed to issues associated with the laptop; many of these issues are eliminated if the student sits at the actual terminals at university facilities.*

Required Work and Grading

Exams will be closed book, closed notes and held in class. The final exam will be comprehensive.

Completion of a set of detailed homework sets will be required. All homework will be graded and returned. Homeworks must be *typeset* on *one side only* of 8 1/2" by 11" paper with no frayed edges. Multiple pages must be stapled. For the first few homeworks, `MS Word` or equivalent is acceptable. Most later homeworks will require the student to fully typeset with the LaTeX text formatter. In all homeworks you should *briefly* restate the problem, state what method you used, give a professional quality computer-generated plot when useful, summarize all necessary analysis, and clearly identify any final answers. Include copies of any original codes you wrote. Neatness, spelling, plots, effective communication, and especially *brevity* are considered in grading as well as the final answer itself.

Plots are of particular importance in this course, for both their æsthetics and substance. A portion of your grade will depend on how efficiently and effectively graphical results are presented. Some rules follow. All plots must be computer-generated. All plots must have axes labeled with units when appropriate. *The size of the fonts on the plots should be similar to those elsewhere on the page.* Much smaller or much larger fonts are unacceptable. Large plots taking up a single page are unacceptable. Whenever possible, combine several curves onto one set of axes, especially when making direct comparisons of results. Use different line styles where appropriate. Use color sparingly, but effectively. Reference to all plots must be made in the body of your homework.

Grades will be assigned based on students' performance on examinations and homework. Pertinent information is as follows:

Homework	50	
Midterm Exam	20	16 October 2014, in class
Final Exam	30	Wednesday, 17 December 2014, 10:30 AM-12:30 PM
Total	**100**	

Honesty Policy

Entering Notre Dame you were required to study the on-line edition of the Academic Code of Honor, to pass a quiz on it, and to sign a pledge to abide by it. The full Code and a Student Guide to the Academic code of Honor are available at: `http://honorcode.nd.edu`. Perhaps the most fundamental sentence is the beginning of section IV-B:

The pledge to uphold the Academic Code of Honor includes an understanding that a student's submitted work, graded or ungraded –examinations, draft copies, papers, homework assignments, extra credit work, etc. –must be his or her own.

When confronted with an apparent violation, I will enforce the appropriate University regulations to the best of my ability. I will also try to make my expectations clear. By and large, though, these issues are out of my control and as such I do not seek out violations. Instead, I depend upon your basic integrity to prevent any problems.

In brief my expectations are as follows. I encourage you to discuss "big picture" aspects of the homework amongst one another as you formulate your solutions *individually*. "Big picture" aspects might include inquiries into how to use a text editor or how to save a file in a post script format. *In contrast, students are expected to write their own source code and homework reports and not share their code or reports with other students. Your* written work should represent *your* understanding of the problem. In practice this means copying (in whole or in part) another student's homework, exam, computer program, or paper is *not* permitted. I also consider it unacceptable to copy work from a student who was in the class in a previous year. *If a student approaches you requesting what you consider to be too much help, the appropriate answer is to refer the student to either the TAs or me.* There is an extensive set of office hours available for all students. It is as much a violation of the honor code to inappropriately give information as to receive it.

In your written reports, be careful to correctly use quotation marks for words that did not originate with you. Paraphrasing should be held to a minimum, but if used, the paraphrased section should be specifically identified and unambiguously cited. It is not sufficient to simply list a reference but not indicate where a specific quotation or paraphrase was employed. In addition all sources used should be fully cited. As is done in the scientific literature, you should *briefly* acknowledge in writing any significant discussions or interactions you had regarding the work you submit. As a general principle, I do not accept the justification that you were not sure of my intentions. If you feel you may be in an ethical grey area, then you should consult with me *before* acting.

Computer programming classes are often troubled by integrity issues, especially with regard to what constitutes appropriate and inappropriate collaborations. Let me attempt to illuminate my thoughts on this with an artistic parable. Consider three aspiring art students who have enrolled in the Rembrandt Academy of Art, taught by none other than Rembrandt himself. Those students are Mark Rothko, Pablo Picasso, and Jackson Pollack. Let us also imagine that Rembrandt has instituted an honor code policy similar to that of AME 20214. I could imagine the following dialogue illustrating a set of students in *full* compliance with the policy.

REMBRANDT: Students. Take your place in front of your individual easels. Your assignment is to generate an oil painting of a polygon. Begin.
ROTHKO: Is a rectangle a polygon?
PICASSO: I'm pretty sure it is. But I've got another question. Is cube a polygon?
ROTHKO: Not sure, why don't you ask the teacher?
PICASSO: How about it R., is a cube a polygon?

REMBRANDT: You'll have to look that one up on your own. The library is open.
POLLACK: What's a polygon?
PICASSO (back from the library): I really didn't understand all that math, but I think it's a many sided figure.
POLLACK: I don't get it, I'll just put something together and see what happens. Does anyone have any spare oil paint? I've only got water colors.
ROTHKO, PICASSO: Sure, you can have some of mine.
Each student then generates and submits their paintings, acknowledging their discussions, which received the following grades and remarks from Rembrandt.
ROTHKO: "97/100. Clearly a depiction of rectangles which do constitute polygons, but a little rough around the edges, and the problem statement only wanted one polygon. But all in all, good job! R."
PICASSO: "75/100. The geometry is exciting, but the notion of a polygon being represented missed the mark a little. Certainly merits partial credit, especially for its beauty. R."
POLLACK: "50/100. I love the enthusiasm, and oil paint was clearly used, but I'm not sure you got the idea of the polygon across. R."
END.

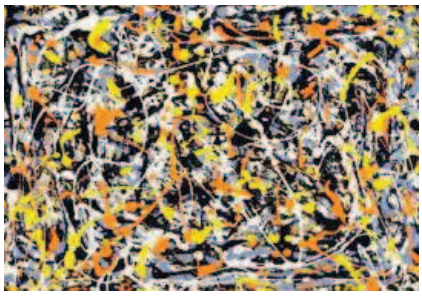
Now even if our aspiring art students fully understood what a polygon was, I would expect very different outcomes on each of their submissions, by the fact that they are unique individuals with their own style. In any case, I think you get the point. Our art students can speak with one another about "nuts and bolts" issues, but when it comes time to put brush to canvas, the expectations are that the students do their own work.

In constructing the artistry of your own 20214 homeworks (and many more in your time at ND and in your career), I expect you to compose in front of your own easel (the computer) and generate your own art work (written reports documenting your engineering computing exercises). The more your documents share in common with those of your peers, the more one is likely to question whether or not you did your own work and learned the material. Indeed, there are only so many ways to write a DO loop, or PRINT statement, but that is not what I'm speaking of. There will also be other times in your career and ND and beyond in which it is fully expected that you do group work. Your best advice is to know the rules of the game and follow them.

Certainly this issue of how to deal with collaboration is a challenging one. I hope my policy to be a fair one, but it requires some nuances. In contrast, the administratively easy/lazy approach is to adopt a policy at either extreme: 1) No discussion of any sort between students, or 2) Full collaboration admitted, with the possibility of large group submissions of common work. I think both options are bad for students actually learning material.

M. Rothko

P. Picasso



J. Pollack