

# Math/CS 466/666

Instructor:

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email:

Please contact me through [WebCampus](#)

Office:

DMS 238 and through Zoom (preferred) by appointment

Course Textbook:

[Hosking, Joe, Joyce and Turner, \*First Steps in Numerical Analysis\*, 2nd Edition, Arnold, 1996.](#)

The textbook is available at

<https://archive.org/details/firststepsinnume0000unse>

Used printed copies are on Amazon for around \$13 and from other sources as well.

This course focuses on the use of a computer to approximate solutions to the continuous problems in mathematics such as calculus, derivatives, integrals, linear algebra and differential equations. Digital computers are discrete devices that can approximate the continuum of real numbers with something called floating point arithmetic.

Our first topic involves understanding the properties and limitations of this approximation. The most important is the idea of loss of precision.

Computers can also be used to solve problems in discrete mathematics and combinatorics. This is not the focus of this course. There are CS courses that focus on such techniques.

We will cover both Theory and Practical Computation. As a result there will be two midterm exams: One on theory and one about using the computers in the lab. The theory exam will be first and before the first half of the course. The computer exam will be near the end of the semester.

The reason the practical exam is near the end is to give people time to become familiar with the computer and also because there is no computer component on the final.

The programming language I will teach is called Julia. You are free to use other languages--in the lab and on your homework, but if you run into trouble or bugs I can better help with Julia.

It's also easier to help one another if everyone in the class is using the same programming language.

Julia programming language

Cross between performance of C/C++/Fortran with the interactivity of Python/Matlab/Basic.

Note integer division is represented by the unicode character

$\div$

Don't worry about integer division, because we seldom need it for the kind of problems we will focus on. At the same time, if you are setting up an editing environment on your home computer, you may want to make sure your editor can handle unicode characters and easily type that division symbol.

I've listed a number of resources for this class, however, I will follow the book by Hosking, Joe, Joyce and Turner in the lectures. The goal is to cover most of the book.

The book is organized in Steps, each of which can be covered in about one day. Some steps are optional and this is indicated by a star in the title. In order to finish the book, I may skip some of those sections.

Let's look in the book to see what's coming:

The sections in the book are

**ERRORS**

**NONLINEAR EQUATIONS**

**SYSTEMS OF LINEAR EQUATIONS**

**THE EIGENVALUE PROBLEM**

**FINITE DIFFERENCES**

**INTERPOLATION**

**CURVE FITTING**

**NUMERICAL DIFFERENTIATION**

**NUMERICAL INTEGRATION**

**ORDINARY DIFFERENTIAL EQUATIONS**

The total number of steps is 35. That's a lot of steps but 7 or them are optional, so really 28. We may skip Step 34 as well depending on time. Some steps are super short and can be combined. I'll post a tentative schedule this week.