ES 2 “Computing for Engineers” Exemption Exam

What is ES 2?
ES 2 “Computing for Engineers” is a required course for all students majoring in engineering. It is usually taken in the Spring semester of the freshman year. ES 2 provides an introduction to computer programming (in Matlab) and provides an introduction to numerical methods that are widely used in engineering. By the end of the class students will be able to develop their own Matlab projects for analyzing data using techniques such as numerical differentiation and integration, matrix solutions for fitting models to data, and basic optimization.

The Tufts University bulletin describes ES 2 as:

An introduction to engineering problem-solving with the aid of computational software. Emphasis upon efficient and accurate calculations, rudimentary numerical and data analysis methods including curve fitting, optimization, equation solving, computer calculus, and statistics. Examples drawn from a variety of engineering disciplines show the uses of iteration, number representation, arrays, modularization, and structured programming techniques. The characteristics of object-oriented programming, event-driven control, and graphical user interfaces are also explored.

Prerequisites: MATH 32 (formerly MATH 11), Co-requisite: MATH 36.

First-year engineering students arrive at Tufts with very varied experiences in programming. Some students have little or no programming experience while others have written many lines of code in a variety of programming languages. ES 2 targets students who do not have significant programming experience and are not familiar with numerical methods.

Waiving the ES 2 Requirement
The ES 2 requirement may be waived for students who have significant programming experience and know how to use the numerical techniques listed in the exam description below. The ES 2 Exemption Exam is offered in late October prior to Spring registration. The purpose of the exam is to identify those students who would gain little benefit from taking ES 2 so that they can be directed to a more appropriate course to take the place of ES 2.

The ES 2 Exemption Exam and Preparation Materials
The topics addressed in the exam include:

- Programming Basics – user input of data, assignment statement, use of variables and variable types, program control statements, logical and relational conditions, loops, arrays, functions and sub procedures, use of common intrinsic functions, and formatting program output.
- An understanding of how to apply these tools to data analysis.
The answers to programming questions are may be given in one of the following languages: Matlab, C, C++, or Java.

Preparation: In terms of Matlab, a good resource for test prep will be lectures 1 and 2 of the MIT OpenCourseWare 6.094, found at http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-094-introduction-to-matlab-january-iap-2010/.

The exemption exam will not go into great detail on numerical methods, but some review/study of basic methods will definitely help you. From the ES-2 textbook, Applied Numerical Methods with Matlab by Steven Chapra, the following concepts are worth reviewing:
- Differentiation – Chapter 4.3 (both 2nd and 3rd editions)
- Matrix/vector products and solving sets of linear equations – Chapter 8.1-8.2 (both 2nd and 3rd editions)
- Integration via trapezoidal rule - Chapter 17.3 in 2nd edition, or 19.3 in 3rd edition

In addition, selected lectures from last year’s ES-2 covering matrix manipulations will be posted on https://sites.tufts.edu/btracey.

What to Expect in the Exam
You will be asked to write snippets of program code in your choice of one of the languages listed above. The exam will be assessed on the basis of your general knowledge. Minor programming syntax details may be overlooked. You may bring notes or a reference book to the exam but computer or phone access will not be allowed.

What if I Pass the Exemption Exam?
If you pass the Exemption Exam, you will not be required to take ES 2. You will not receive academic credit for ES 2 but will be required to take another accepted engineering course of your choice in its place.

Need more information?
Please contact your academic adviser if you have any questions about appropriate course substitutions upon exemption. Questions regarding exam content should be directed to Brian Tracey (brian.tracey@tufts.edu) in the Department of Electrical and Computer Engineering.