Introduction to Computer Programming

ASE 301 / COE 301

Unique Number: 13590

Fall 2017

Instructor: Amir Shahmoradi

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office hours: Mon 4-5 pm, Fri 3-4 pm

Lecture meeting times: MWF 9 - 10 am

Lecture meeting place: UTC 4.110

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| office hours: | Mon 3 pm – 4 pm  Fri 10 am – 11 am  Fri 11 am – 12 pm | Mon 11 am – 12 pm  Tue 1 pm – 2 pm | Tue 4 pm –5 pm  Wed 4 pm – 5 pm  Thu 11 am – 12 pm |

**COURSE OBJECTIVES / ACADEMIC LEARNING GOALS**

The primary objective of this course is to learn basic computer programming

concepts and apply them to engineering computations. By the end of the course, you should have a good understanding of programming practices and be able to analyze engineering/mathematical problems and develop computational solutions for them, potentially collaboratively within a team. We will achieve this by learning how to program in MATLAB, Fortran, and C++. No prerequisites are required, although some knowledge of calculus and linear algebra is useful.

**COURSE SCHEDULE**

The following is a tentative outline of the topics to be covered.

* Version Control Systems (VCS): Principles of professional project management and collaborative programming with the use of Git.
* Programming History – operating systems – roundoff and truncation errors – number systems.
* Principles of Programming using MATLAB: The MATLAB development environment; syntax rules; variables and data types; conditionals; looping; input/output; functions; M files; functions; matrix operations; plotting; symbolic calculations; file processing; etc.
* Compiled languages: Fortran and C++. general syntax rules; variable types; conditionals and looping; functions and subroutines; arrays; input/output;

**COURSE TEXTBOOKS**

No textbook is required for this course. Online class lecture notes will be used as reference. However, the following is a list of textbooks for those who are interested to self-educate themselves or go beyond class syllabus.

**MATLAB:**

1. Chapman, 2016, MATLAB Programming for Engineers.
2. Attaway, 2014, Matlab: A Practical Introduction to Programming.
3. King, 2017, MATLAB Programming for Biomedical Engineers and Scientists.
4. Van Loan, 2010, Insight through Computing, A MATLAB Introduction.
5. Driscoll, 2009, Learning MATLAB.
6. Higham, 2005, Matlab Guide.
7. Moler, 2004, Numerical Computing with Matlab.

**Fortran:**

1. Metcalf, 2011, Modern Fortran Explained.
2. Chivers, 2012, Introduction to Programming with Fortran.
3. Chapman, 2017, Fortran for Scientists and Engineers.
4. Clerman, 2012, Modern Fortran: Style and Usage.

**C++:**

1. Gottschling, 2016, Discovering Modern C++: An Intensive Course for Scientists.
2. Horstmann, 2011, C++ For Everyone.

## COURSE LOGISTICS

Grading:

Homework: 25% (Each assignment might not be weighted the same)

Random Weekly Quizzes: 25%

Midterm Exam: 25%

Final Exam: 25%

Homework Policy:

There will be approximately one homework per lecture. Assignments will be due before lecture begins, and should be added to an online repository determined by the instructor. No late assignment will be accepted. No exceptions to the homework policy will be made without prior instructor approval.

Examinations:

The midterm exam will cover the topic from the beginning of the semester to the date of exam. The final exam will be more focused on the topics covered after midterm exam.

Attendance:

Regular attendance is expected. Any absence requires prior approval from the instructor, or compelling evidence of illness or an official letter from the university administration. Student attendance will be randomly checked.

Scholastic dishonesty: All students are responsible for upholding the University rules on scholastic dishonesty. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University.  Since such dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced.   For further information, visit the Student Judicial Services web site <http://deanofstudents.utexas.edu/sjs/>, and the General Information Catalog information <http://catalog.utexas.edu/general-information/> .

Other matters: The University of Texas at Austin provides, upon request, appropriate academic adjustments for qualified students with disabilities. Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the Services for Students with Disabilities area of the Division of Diversity and Community Engagement at 471-6259 as soon as possible to request an official letter outlining authorized accommodations.  For more information, contact that office at 471-6259, Video Phone 410-6644, or <http://www.utexas.edu/diversity/ddce/ssd>.

## Your Expectations:

For the Fall 2017 offering of this course, we will cover the principles of computer programming using MATLAB programming language, as well as using important modern compiled languages that are widely used in scientific computation: Fortran and C++. Specifically, upon completion of this course students will be familiar with,

* programming paradigms,
* principles of software maintenance and collaborative project development,
* differences between compiled and interpreted programming languages,
* how to use MATLAB as a simple calculator,
* how to use MATLAB as an advanced scientific computation and graphics toolbox,
* how to compile and write scientific code in modern compiled languages such as Fortran and C++,
* how to formulate cast a scientific problem in the form of a computational programming algorithm.

## Course Schedule:

The following is the tentative schedule of topics to be covered, and will be continuously updated. The exam dates are final.

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| Wed Aug 30 | Student-professor connection day; course outline |
| Fri Sep 01 | Programming history and paradigms |
| Mon Sep 04 | NO CLASS: LABOR DAY HOLIDAY |
| Wed Sep 06 | VCS: setting up your Git Version Control System and Github account |
| Fri Sep 08 | VCS: advanced topics in Version Control System; |
| Mon Sep 11 | MATLAB: installation and setup for beginners –HW 1 |
| Wed Sep 13 | MATLAB: values, variables, and types I |
| Fri Sep 15 | MATLAB: values, variables, and types II |
| Mon Sep 18 | MATLAB: branching and control statements – HW 2 |
| Wed Sep 20 | MATLAB: functions I |
| Fri Sep 22 | MATLAB: functions II |
| Mon Sep 25 | MATLAB: functions III – HW 3 |
| Wed Sep 27 | MATLAB: free discussion |
| Fri Sep 29 | MATLAB: loops, array computing, and vectorization |
| Mon Oct 02 | MATLAB: input/output (I/O) I – HW 4 |
| Wed Oct 04 | MATLAB: input/output (I/O) II, Exception Handling |
| Fri Oct 06 | MATLAB: plotting I |
| Mon Oct 09 | MATLAB: plotting II – HW 5 |
| Wed Oct 11 | MATLAB: root finding and optimization |
| Fri Oct 13 | MATLAB: differential equations |
| Mon Oct 16 | MATLAB: deterministic integration – HW 6 |
| Wed Oct 18 | MATLAB: Monte Carlo integration |
| Fri Oct 20 | MATLAB: statistical analysis |
| Mon Oct 23 | MATLAB: OOP I – HW 7 |
| Wed Oct 25 | MATLAB: OOP II |
| Fri Oct 27 | MATLAB: OOP III / semester final project description |
| Mon Oct 30 | NO LECTURE: MID-TERM EXAM |
| Wed Nov 01 | C++/Fortran: compiler installation and setup |
| Fri Nov 03 | C++/Fortran: values, variables, and types I |
| Mon Nov 06 | C++/Fortran: values, variables, and types II – HW 8 |
| Wed Nov 08 | C++/Fortran: branching statements I |
| Fri Nov 10 | C++/Fortran: branching statements II |
| Mon Nov 13 | C++/Fortran: loops I – HW 9 |
| Wed Nov 15 | C++/Fortran: loops II |
| Fri Nov 17 | C++/Fortran: array computing, and vectorization I |
| Mon Nov 20 | C++/Fortran: array computing, and vectorization II – HW 10 |
| Wed Nov 22 | NO CLASS: THANKSGIVING HOLIDAYS |
| Fri Nov 24 | NO CLASS: THANKSGIVING HOLIDAYS |
| Mon Nov 27 | C++/Fortran: dynamic memory allocation – HW 11 |
| Wed Nov 29 | C++/Fortran: pointers |
| Fri Dec 01 | C++/Fortran: functions and subroutines I |
| Mon Dec 04 | C++/Fortran: functions and subroutines II – HW 12 |
| Wed Dec 06 | C++/Fortran: input/output (IO) |
| Fri Dec 08 | C++/Fortran: standard libraries / intrinsic procedures |
| Mon Dec 11 | ICP wrap-up: course summary, advice for your future career – HW 13 |