University of California, Berkeley
College of Engineering
Spring 2023

E7 – Introduction to Computer Programming for Scientists and Engineers

1. Course objectives

E7 is an introductory course on computer programming for lower-division students in science and engineering. The principal goal of the course is to teach basic computer programming concepts and apply them to computer-based problem-solving methods. The course stresses hands-on computer programming using MATLAB, a powerful high-level programming environment.

2. Course Format

E7 consists of classroom lectures, computer laboratory sections, and classroom discussions. The faculty instructor delivers lectures and discussions, while graduate student instructors (GSIs) supervise laboratory sections.

Lectures begin on **Wednesday January 18th** and are held Mondays and Wednesdays in **155 Dwinelle Hall**. The lecture time is from 4pm to 5pm. Discussions begin on **Friday, January 20th,** and will be held in **155 Dwinelle Hall** every Friday (4pm-5pm). During the discussion we will cover additional exercises, present and discuss the upcoming homework/laboratory assignments, and answer questions. The first discussion session will introduce the logistics of the course. Laboratory sections begin starting **Monday, January 23rd.**

IMPORTANT: To register for E7, you must be enrolled in a laboratory section. Also, you may only attend the laboratory section in which you are officially enrolled.

3. Teaching Staff

Contact information for the course instructor and GSIs are given below.

Professor **Reza Alam** (reza.alam@berkeley.edu), 6111 Etcheverry Hall.
Office hours: MW 5pm-6pm

Head GSI: **Qi Zheng** (qizheng@berkeley.edu).
Office hours: Tuesday 13:00 -14:00 and Wednesday 13:00 - 14:00. 5139 Etcheverry Hall
(Administrative and grading matters pertaining to the course should be addressed to the Head GSI.)

Minnie Chen (minniechen@berkeley.edu)
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4. E7 Course Websites

E7 course website at bCourses

The E7 course website is hosted at **bCourses** https://bcourses.berkeley.edu (you can also access this site via calcentral.berkeley.edu). bCourses is UC Berkeley's instructional site (powered by Canvas). There you can find lecture slides, course announcements, homework and laboratory assignments, lecture notes and other course materials such as sample codes and videos. You are responsible for reviewing and reading announcements, homeworks, assignments, and other course materials.

Each week, we will release the laboratory assignment over bCourses. You will also be provided with the assignment .pdf document & tempelated .m Matlab files for offline Matlab coding. You will have to input and submit your codes on bCourses Assignment by the assignment due date and time (Fridays 3 pm). You can submit your solutions for as many times as you wish before the deadline, but only your last submission grade will be recorded. Please note that it is NOT the highest score among the submissions that is recorded, but the *last submission*.

E7 discussion website at Ed Discussion

We have also set up an E7 discussion website at "Ed Discussion". The E7 instructors and GSIs strongly encourage you to post technical questions on this site, as opposed to communicating with GSIs by private email. The E7 instructors and GSIs will periodically visit this site and will attempt to respond to questions from students as quickly and accurately as possible. Links to unauthorized documents and direct answers to homework questions are not allowed.

5. Programming Language and Course Textbook

The programming language of this offering of E7 is Matlab. The E7 lab will be held in 203 - McLaughlin. We highly recommend (but do not require) that you obtain the latest Student Version of Matlab, which can be obtained (free) via UC Berkeley's Software Central.

There is no required textbook for this course. The Matlab application has ample built-in help and tutorials; the same help and tutorials can be also found on the Mathworks web site, along with detailed manuals that you can download for free. There are numerous great textbooks on Matlab. we suggest exploring the library and online resources (e.g. google books, Amazon, etc) for the best one that matches your style. Few examples include:
Applied Numerical Methods with Matlab (Custom) by Steven C. Chapra (any edition)
MATLAB Primer, by Timothy A. Davis
MATLAB: A Practical Introduction to Programming and Problem Solving by Stormy Attaway
You are welcome to ask for the instructor's opinion.

6. Laboratory Assignments

There will be approximately 12 laboratory assignments (generally due every week). **All assignments must be turned in no later than 3:00 pm on the Friday of the week they are due**. Here is some important information:

(i) The procedure for working on your assignments will be explained during the Discussion Session on Friday, January 20th. Weekly laboratory assignments will be available for download (on Fridays) in the form of a PDF file. The auto-grader in bCourses will grade your work and will print out your scores for each problem and error information, if any. You can submit your solution files multiple times until the deadline and only your last submission will be preserved.

(ii) Owing to the size of the class, late assignments will not be accepted *under any circumstances.* We will drop two of your lowest homework grades from the final grade calculation. For example, if for your assignments you receive all 100 but one 50 and one homework not submitted due to, say, a severe flue, then your homework grade that enters your final grade calculation will be 100 (because we drop your two lowest homework grades which are 50 and 0 for no submission.). This is to cover unexpected events or emergencies that you may face throughout the semester. Therefore, you do not need to contact us if you cannot turn in up to two homeworks.

(iii) It is acceptable to discuss with your classmates the material contained in the assignments. However, we require that you complete all assignments on your own. **Copying someone else's work or allowing your work to be copied constitutes cheating and will result in zero credit for the entire assignment and additional disciplinary action (see the Academic Honesty section below).**

List of labs
Lab 011 Mon/Wed 12-14 pm: Dalmir Hasic, Haofu Xu
Lab 012 Mon/Wed 10am-12 pm: Haofu Xu, Minnie Chen
Lab 013 Mon/Wed 8-10 am: Minnie Chen
Lab 014 Tue/Thu 8-10 am: Dalmir Hasic
Lab 015 Tue/Thu 10am-12 pm: Caglar
Lab 016 Tue/Thu 12-14 pm: Prashant Pujari
Lab 017 Tue/Thu 14-16 pm: Xuan Hu
Lab 018 Tue/Thu 16-18 pm: Xuan Hu
Lab 019 Mon/Wed 18-20 pm: Caglar
Lab 020 Tue/Thu 18-20 pm: Prashant Pujari

7. Midterms and Final Examinations

There will be two 50-minute midterm examinations during the Friday discussion times. **The tentative dates for the midterms are respectively March 3rd and April 7th, both from 4pm-5pm**. **There will be a 3-hour final examination on Friday, May 12, 8-11 am.** You will be required to provide your ID before entering the examination rooms. ALL DATES ARE TENTATIVE. IT IS YOUR RESPONSIBILITY TO FOLLOW CLASS, DISCUSSION SECTIONs AND BCOURSES ANNOUNCEMENTS FOR THE LATEST UPDATES. If for a serious reason, you cannot make either of exams, it is your responsibility to send supporting documents at least 3 weeks before the exam, and discuss with the instructor whether an exception can be made. Because this is a crowded course, and to be fair to everyone, exceptions are rarely made.

8. Academic Honesty

The student community at UC Berkeley has adopted the following Honor Code: *"As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others."* Your E7 instructors join you in pledging to adhere to this code.

Please note that copying programming code (even if it is only a portion of a larger program) constitutes cheating and we plan to deploy software that will detect when code has been copied. Cheating will result in a 0 on the assignment and a report submitted to The Center for Student Conduct.

9. Grades and Grading

The course grade will be assigned based on the following percentages:

30% Homework Assignments
15% Midterm 1
20% Midterm 2
35% Final

If you find any discrepancies between the issued grades and the grades posted on bCourses, please bring them to the attention of one of your laboratory GSIs immediately. Alternatively, you can visit the Head GSI's office hours.

If you feel that a midterm problem is graded incorrectly, write a short paragraph outlining your stance and turn it to your laboratory GSI or the head GSI, along with the original examination. You have one week from the date that exams are first returned to submit a regrade request. Any re-grades request submitted after the deadline will not be accepted.

10- Tentative Syllabus

Course Introduction	Plotting; 3D Plots
MATLAB as a calculator, scripts and cells and publish	Statistics (Histograms, Probability, Normal Distribution)
Machine precision	Probability
One-dimensional Arrays; Character Strings	Induction/Recursion
Functions, User-defined and built-in functions	Linear Algebra (Intro and Matrix Methods)
Function handles, anonymous functions	**Midterm 2 Exam**
Subfunctions and nested functions	Basic Fitting; Regression, Interpolation
Two-dimensional arrays; polynomials	Numerical Differentiation
Relational operators; logical operators; conditionals	Numerical Integration
Definite and Conditional Loops	Ordinary Differential Equations
Debugging,	Boundary Value Problems
Midterm 1 Exam	Modeling engineering systems using differential equations
Cell Arrays; Structure Arrays	**Final Examination**

10-1. List of Slides

Notes 1 Basics	1. Matlab basics 2. Matlab as a calculator 3. Saving and loading files in Matlab
Notes 2 Arrays	1. Introduction to arrays 2. Row and column vectors 3. General two-dimensional arrays
Notes 3 Strings and Logicals	• Strings • Relational operators • Logical variables and operators
Notes 4 Conditional Statements	• If, else, elseif statements • Switch and case statements • Try and catch statements
Notes 5 for and white loops	• for loops • while loops • calculating the machine eps
Notes 6 Functions	• The concept of a function • MATLAB functions • User defined functions
Notes 7: Functions Advanced	1. Function that act on functions through function handles 2. More on the function handle 3. Anonymous functions 4. Subfunctions
Notes 8 Cell and Structure Arrays	• Defining and manipulating cell arrays • Defining and manipulating structure arrays
Notes 9 Handle Graphics	• 2D plots • Plotting 3D Curves • Surface plots • plot handle
Notes 10 Statistics	• Histograms, data representation and approximate mass probability • Continuous random variable and probability density function (pdf) • Normal pdf, mean and standard deviation
Notes 11 Probability	1. Basic concepts of probability 2. Using randi (and rand) to model discrete random variables with uniform probability
Notes 12 Recursion vs iteration	
Notes 13 Debugging, Induction	• Hints and suggestions for debugging your code.
Notes 14 Matrix Algebra and Linear Algebraic Equations	1. Linear algebraic equations 2. Basic matrix algebra 3. Solving linear algebraic equations with MATLAB (# of unknowns = # of equations)
Notes 15 Linear Algebraic Equations and Least Squares Solution	1. Solutions of linear algebraic equations 2. Least squares solution

Notes 16 Interpolation	1. Interpolation 2. Linearization and Taylor Series
Note 17 Interpolation (Advanced)	1. Cubic Spline 2. Review of bisection and Newton's method
Notes 18 Numerical Techniques	1. Numerical Differentiation 2. Numerical Integration
Note 19 Ordinary Differential Equations	1. Introduction to ordinary differential equations 2. Numerical solution of ordinary differential equations using Matlab 3. Examples
Notes 20 Numerical Integration Algorithms	1. Review of ordinary differential equations 2. Numerical integration algorithms: – Euler – Modified Euler (predictor-corrector) 3. Examples
Notes 21 Boundary Value Problems	1. Solving boundary value problems using linearity properties 2. Setting event function in Matlab ODE solvers

11- Semester at a Glance

	Su	M	Tu	W	Th	F	Sa
Jan				18 (L1)	19	20 (L2)	21
Jan	22	23 (L3)	24	25 (L4)	26	27 (L5)	28
Jan/Feb	29	30 (L6)	31	1 (L7)	2	3 (L8)	4
Feb	5	6 (L9)	7	8 (L10)	9	10 (L11)	11
Feb	12	13 (L12)	14	15 (L13)	16	17 (L14)	18
Feb	19	20 (Holiday)	21	22 (L15)	23	24 (L16)	25
Feb/March	26	27 (L17)	28	1 (L18)	2	3- Midterm I	4
March	5	6 (L19)	7	8 (L20)	9	10 (L21)	11
March	12	13 (L22)	14	15 (L23)	16	17 (L24)	18
March	19	20 (L25)	21	22 (26)	23	24 (L27)	25
March/Apr	26	27 (SP R.)	28	29 (SP R.)	30	31 (Holiday)	1
Apr	2	3 (L28)	4	5 (L29)	6	7-Midterm II	8
Apr	9	10 (L30)	11	12 (L31)	13	14 (L32)	15
Apr	16	17 (L33)	18	19 (L34)	20	21 (L35)	22
Apr	23	24 (L36)	25	26 (L37)	27	28 (L38)	29
Apr/May	30	1 (RRR)	2	3 (RRR)	4	5 (RRR)	6
May	7	8	9	10	11	12- Final	13

2023 Spring Semester

Spring Semester Begins	Tuesday, January 10, 2023
Academic and Administrative Holiday	Monday, January 16, 2023
Instruction Begins	Tuesday, January 17, 2023
Academic and Administrative Holiday	Monday, February 20, 2023
Midpoint grading rosters open for instructors	Tuesday, February 21–Wednesday, March 15, 2023 (9AM)
Spring Recess	Monday, March 27–Friday, March 31, 2023
Academic and Administrative Holiday	Friday, March 31, 2023
Cal Day	Saturday, April 22, 2023
Formal Classes End	Friday, April 28, 2023
Reading/Review/Recitation Week	Monday, May 1– Friday, May 5, 2023
Last Day of Instruction	Friday, May 5, 2023
Golden Bear Welcome	May 6, 2023
Final Examinations	Monday, May 8–Friday, May 12, 2023
Spring Semester Ends	Friday, May 12, 2023
Commencement	Saturday, May 13, 2023
Academic and Administrative Holiday	Monday, May 29, 2023

12- Other Course Policies

Health: If you are ill, please do not attend in-person activities. Instead, keep up with the class by borrowing notes from a friend, and reach out to GSIs and the instructor for help.

Inclusion: We are committed to creating an environment welcoming of all students where everyone can fulfill their potential for learning. To do so, we intend to support a diversity of perspectives and experiences and respect each others' identities and backgrounds (including race/ethnicity, nationality, gender identity, socioeconomic class, sexual orientation, language, religion, ability, etc.). To help accomplish this:

- If you feel like your performance in the class is being impacted by a lack of inclusion, please contact the instructors, an academic advisor, or the departmental Faculty Equity Advisor (https://engineering.berkeley.edu/about/equity-and-inclusion/faculty-equity-advisers/).
An anonymous feedback form is also available at https://engineering.berkeley.edu/about/equity-and-inclusion/feedback/.
- If you feel like your performance in the class is being impacted by your experiences outside of class (e.g., family matters, current events), please don't hesitate to come and talk with the instructor(s) or academic advisors in Engineering Student Services. We want to be a resource for you.
- There is no tolerance for sexual harassment or violence. If your behavior harms another person in this class, you may be removed from the class or the University either temporarily or permanently.
- If you have a name and/or pronouns that differ from your legal name, designate a preferred name for use in the classroom at: https://registrar.berkeley.edu/academic-records/your-name-records-rosters.
- As a participant in this class, recognize that you can be proactive about making other students feel included and respected.

Collaboration: You are encouraged to form study groups and work together to understand course material, but all of your work submitted for a grade should be your own. There are ways to make your work personal and unique even when it seems that there is only one way to correctly answer a question, and the instructors will support you in learning these methods. Collaboration is especially encouraged via the official online forum for this course, which includes everyone.

Study Groups: The official online forum for this course is available through Ed Discussion. We ask that you use this whenever possible instead of informal tools such as group chats; doing so increases transparency and inclusion.

We also remind you that it is especially important in these venues to choose your words carefully to ensure that you are supportive to your classmates and the instructional team.

Student Conduct: Ethical conduct is of utmost importance in your education and career. The instructors, the College of Engineering, and U.C. Berkeley are responsible for supporting you by enforcing all students' compliance with the Code of Student Conduct (https://sa.berkeley.edu/code-of-conduct) and the policies listed in the CoE Student Guide (https://engineering.berkeley.edu/students/undergraduate-guide/policies-procedures/). The Center for Student Conduct is your central source for guidance in these matters (https://sa.berkeley.edu/conduct).

Incomplete Grades: Incomplete grades must be resolved in a timely manner in less than a year or will automatically lapse to an F grade. Exceptions to the timeline can be made in both directions (shorter or longer) according to the instructor's judgment. The campus policy on incomplete grands can be reviewed here: https://registrar.berkeley.edu/faculty-staff/grading/incomplete-grades/

Accommodation policy: We honor and respect the diversity in our student body, and thus are committed to ensuring you have the resources you need to succeed in our class. If you need accommodations that provide equitable access, (e.g. religious observance, physical or mental health concerns, insufficient resources, etc.) please check https://diversity.berkeley.edu/ and, if needed, discuss with your specific case with the course instructor.

13- Resources

For academic performance:
The Center for Access to Engineering Excellence or CAEE (227 Bechtel Engineering Center; https://engineering.berkeley.edu/student-services/academic-support) is an inclusive center that offers study spaces, nutritious snacks, and tutoring in >50 courses for Berkeley engineers and other majors across campus. The Center also offers a wide range of professional development, leadership, and wellness programs, and loans iclickers, laptops, and professional attire for interviews.

For disability accommodations:
The Disabled Student's Program (DSP 260 César Chávez Student Center #4250; 510-642-0518; http://dsp.berkeley.edu) serves students with disabilities of all kinds, including temporary disabilities (e.g., broken arm impacting ability to write). Services are individually designed and based on the specific needs of each student as identified by DSP's Specialists. If you have already been approved for accommodations through DSP, please know that DSP is ready to quickly adjust your accommodations if your situation changes.

For mental wellbeing:
Counseling and Psychological Services (CAPS, https://uhs.berkeley.edu/caps) is available as part of University Health Services (the Tang Center). Services are offered at many locations, including on-site in the College of Engineering (https://engineering.berkeley.edu/students/advising-counseling/counseling/). CAPS services are available to all students, regardless of insurance, and initial visits do not cost anything. CAPS has expanded allowing students to receive help immediately with same-day counseling (510-642-9494), online resources, and a 24/7 counseling line at (855) 817-5667. Short-term help is also available from the Alameda County Crisis hotline: 800-309-2131. If you, or someone you know, is experiencing an emergency that puts their health at risk, please call 911.

For basic needs (food, shelter, etc):
The Basic Needs Center provides housing, food, transportation support, among other support needed to thrive at UC Berkeley. https://basicneeds.berkeley.edu/ Specifically, the UC Berkeley Food Pantry (#68 Martin Luther King Student Union; https://pantry.berkeley.edu) aims to reduce food insecurity among students, especially the lack of nutritious food. Students can visit the pantry as many times as they need and take as much as they need while being mindful that it is a shared resource. The pantry operates on a self-assessed need basis; there are no eligibility

requirements. The pantry is not for students and staff who need supplemental snacking food, but rather, core food support.

For solving a dispute:
The Ombudsperson for Students (102 Sproul Hall; 642-5754; http://students.berkeley.edu/Ombuds) provides a confidential service for students in need of a neutral party to resolve University-related disputes (academic or administrative). The Ombudsman can provide information on policies and procedures affecting students, facilitate students' contact with services able to assist in resolving the problem, and assist students in complaints concerning improper application of University policies or procedures. All matters referred to this office are held in strict confidence.

For recovery from sexual harassment or sexual assault:
The Care Line or the PATH to Care Center (510-643-2005; https://care.berkeley.edu/care-line/) is a 24/7, confidential, free, campus-based resource for urgent support around sexual assault, sexual harassment, interpersonal violence, stalking, and invasion of sexual privacy. The Care Line will connect you with a confidential advocate for trauma-informed crisis support including time-sensitive information, securing urgent safety resources, and accompaniment to medical care or reporting.

14- Programming Practice Resources

1- The list here is an unofficial list of resources that may help you with more practice problems. I have not checked details of whether there are advertisements or else. It is your responsibility to check independently that all materials that you use are legally sound (e.g. copyright, etc).

2- If you see any issues with any of the items listed (copyright, link broken, etc), please let me know asap

3- If you know of a good resource, please let me know and I'll list it here so that others can benefit from.

https://tbp.berkeley.edu/courses/e/7/	Many students have access to past years homework and exams. (I don't!, but I found that the Tau Beta Pi website has uploaded some). Please reach out to your friends. Those who have access (of course if legally), please share it with your classmates.
Matlab Cody	according to mathworks "Cody is a free community game where you solve MATLAB coding problems. It is a fun way to challenge your skills and learn MATLAB. Coding problems cover all skill levels, from beginner to advanced. Two ways to play: Find and solve individual problems that interest you."
Self-paced online courses	offered by Mathworks.
MIT OCW Matlab Exercises	This is for an old offering (2012), but still, these are good practice problems, and the core of programming is the same no matter when.
10 free Matlab courses	by Yash Tiwari on Medium
matlabcoding.com	Looks like this website has a lot of materials, including lectures, practice problems sorted by subjects and more.
A Matlab Exercise Book	A very good introductory book by Ludmila I. Kuncheva and Cameron C. Gray (free to download)
2022 Complete Matlab Beginner Basics Course	Youtube play list, by Phil Parisi. He also have a Python course on his channel in case you are interested. For advanced students, see his advanced matlab playlist
LIst of books about Matlab	You can borrow most of these books from the library, some are even available electronically via UC Berkeley library (i.e. you can either download or read online from your computer).