Math 128 A Summer 2018 Course Syllabus

1 General Information

Lectures: MTWTh 11:00 am - 1:00 pm at 310 Hearst Mining Hall
Instructor: Kai-Chieh Chen
Office Hours: Mon 2:00 - 3:30 pm, Wed 2:00 - 3:30 pm at 812 Evans Hall
Email: `kaichiehchen@berkeley.edu`
Course Website: `http://math.berkeley.edu/~kaichieh/128a2018.html`
Textbook: R. L. Burden and J. D. Faires, *Numerical Analysis*, 9th ed., Brooks-Cole, 2011.
MATLAB:

(1) Availability: free for Berkeley students. Please submit the license request on UC Berkeley Software Central website. You may also try to use the open software **Octave**, whose syntax is very similar to MATLAB's.

(2) S. R. Otto and J. P. Denier, *An Introduction to Programming and Numerical Methods in MATLAB*, Springer. (ebook is available for Berkeley students)

Please be sure that you own the correct edition of the textbook as most homework will be assigned from it. You could purchase the book from the Cal Student Store or Amazon.com. All mathematical questions should be directed to the instructor, while all administrative questions should be directed to Thomas Brown (`brown@math.berkeley.edu`).

2 Schedule

Week	Date	Topics	Homework Assigned
1	June 18	1.1	HW1: **1.1** 1b, 2bc, 4ad, 5, 6, 9, 14, 26, 27, 28.
	June 19		
	June 20	1.2, 1.3, 2.1	HW2: **1.2** 1a, 2b, 4cd, 12, 24. **1.3** 1a, 6ad, 7bc, 8, 15ab. **2.1** 6a, 8, 10, 14, 15, 20. **2.2** 3, 4, 11, 12, 19, 20.
	June 21		
2	June 25	2.2, 2.3, 2.4	**2.3** 6be, 8be, 16. **2.4** 6, 7, 8ab, 10.
	June 26		
	June 27	2.5, 2.6, 3.1	HW3: **2.5** 1cd, 12ab, 14, 15, 16. **2.6** 2fh, 4fh. **3.1** 2a, 4a, 6a, 8a, 21. **3.2** 3, 4.
	June 28		
3	July 2	3.2, 3.3, 3.4	**3.3** 10, 17. **3.4** 6a, 10, 11, 12.
	July 3		
	July 5	3.5, 3.6	HW4: **3.5** 1, 2, 20, 26. **3.1** 23. **3.6** 4, 5.
4	July 9	4.1, 4.2, 4.3	**4.1** 1, 2, 5c, 6c, 8c, 22, 24, 28, 29. **4.2** 1ab, 2ab, 5, 8, 9.
	July 10		
	July 11	Review	No New Material
	July 12	Midterm	
5	July 16	4.4, 4.5, 4.6	HW5: **4.3** 2ad, 4ad, 6ad, 8ad, 15, 16, 18, 25. **4.4** 2bc, 4bc, 13, 14, 16, 20. **4.5** 2ab, 8, 10, 14, 15. **4.6** 2ab, 9.
	July 17		
	July 18	4.7, 4.8, 4.9	HW6: **4.7** 1de, 2de, 5, 6, 8. **4.8** 3(i)ce, 4ce, 7(i)ce, 10. **4.9** 2ab, 4ab, 6, 7, 8. **5.1** 1ad, 2ad, 6, 8ad, 9.
	July 19		

Week	Date	Topics	Homework Assigned
6	July 23	5.1, 5.2, 5.3	**5.2** 2ab, 4ab, 9, 10, 15.
	July 24		**5.3** 9ab, 10ab, 11.
	July 25	5.4, 5.5	HW7: **5.4** 2ab, 6ab, 14ab, 30, 31, 32. **5.5** 3ab, 5.
	July 26	5.6, 5.7, (5.8)	**5.6** 1ab, 12, 14. **5.7** 2bc. (**5.8** 1b.)
7	July 30	5.9, 5.10	**5.9** 4ab. **5.10** 1, 2, 4, 5, 8.
	July 31	5.10, 5.11	**5.11** 1ab, 11, 12, 15.
	Aug 1	6.1, 6.2	HW8: **6.1** 5a, 9, 10, 15. **6.2** 2ab, 4ab, 8ab.
	Aug 2	6.3, 6.4	**6.3** 6ac, 10, 12ab. **6.4** 2ac, 6, 8, 9, 10, 11.
8	Aug 6	6.5, 6.6, (7.1)	**6.5** 4ab, 8ab, 10, 11. **6.6** 2ab, 4ab, 12ab, 16, 24, 25.
	Aug 7		(**7.1** 1ac, 2, 4ac, 7, 8.)
	Aug 8	Review	
	Aug 9	Final	

3 Grading

Grades are computed by taking 12% homework, 10% quiz, 18% programming assignments, 25% midterm, 35% final. The final exam score will override lower midterm score, so it's possible the final exam may count for 60%. The final letter grades will be based on a curve.

Homework: is due every Thur at the beginning of the class. If you are not able to submit your homework at the required time then you can leave it outside my office **at any time before it is due**. **Please email me if you intend to leave your homework outside my office**.

Although collaboration on homework is welcome and encouraged, if you are working with another student, please state that you have done so (eg. if you work with E. Nother on a particular question just write "This question was completed with E. Nother."). However, all homework assignments **must be written up individually**. Failure to declare collaboration with another student will result in a grade penalty (and it is remarkably simple to tell when students have copied each other). Also, if you have used a textbook or online notes to help you understand/solve a problem, please cite a reference (eg. if you used pages 52-60 of Prof. X's online lecture notes just write "This question used p.52-60 of Prof. X's online lecture notes, available at `www.math.com/~profx/linalg`).

Notice that there are some problems which can and are suggested to be done by using MATLAB. For these problems, it is okay for you to only write down the command you use to call the m file and the result. It is not required to provide the MATLAB m file or describe its pseudocode.

Each homework will be graded on a scale of $0-3$ points with 0 = no effort, 1 = effort with some progress, 2 = good progress, 3 = good solution. You will only need to submit your solutions to those problems marked as *graded problems*. For the other problems, we will discuss during the lectures.

Programming Assignments: there are two programming assignments based on MATLAB language, each is worth 9% of the grade. Again, group discussions are encouraged, but each student has to write his/her own codes without copying others. There will be a grade penalty if two students have essentially the same codes (e.g. only differ in variable names). The description and the due date of each programming assignment is shown in the next section below.

Quiz: is on every Thur except for the Midterm and the Final week. Every quiz is always based on the material covered **from last Wednesday to this Tuesday**. The lowest quiz score will be dropped when computing the grade.

Midterm: in class. **July 12, 2018**. Covers the material mentioned in the lectures from Chapter 1 to Chapter 3. No make-up midterm. One page (one-sided) A4 cheat sheet is allowed.

Final: in class. **August 9, 2018**. Mainly covers the material mentioned in the lectures from Chapter 4 to Chapter 6, and also §7.1. No make-up final. One page (one-sided) A4 cheat sheet is allowed.

4 Programming Assignment 1

Due: **July 6 11:59 PM, 2018**.

Provided the quartic equation

$$ax^4 + bx^3 + cx^2 + dx + 1 = 0 \tag{1}$$

where $a, b, c, d \in \mathbb{R}$ and $a < 0$. Create a MATLAB m file to find all the roots of equation (1) **using the methods discussed in class**. Students who use the root formulae for quartic equations or any of the following matlab built-in functions will automatically get 0 score for this project.

```
fzero, roots, solve, eig, eigs
```

Moreover, the number of iterations of any loop in your code, if there is any, cannot exceed 1000.

You should turn in a file `quarticxxx.m` containing at least a MATLAB function of the form

```
function [rts] = quarticxxx(a,b,c,d)
```

where `xxx` is your student id and `rts` is the vector of roots. Your program will be tested against at least 2000 quartic equations, including ones with large coefficients and ones with double or triple roots. You will get partial credit for each "correct" root, in the sense that it is accurate to within a relative error of at most 10^{-5} when compared to the roots function in MATLAB.

I will release a test program which will generate a possible score out of 100 for your code. Please submit your m file via our bcourse website before the deadline.

5 Programming Assignment 2

Due: **Aug 3 11:59 PM, 2018**.

Construct a m file that uses the adaptive quadrature by combining composite Trapezoidal rule and Romberg integration (see **4.6** Exercise 9) to approximate an integration for any given function.

You should turn in a file `adapTrapxxx.m` containing at least a MATLAB function of the form

```
function Value = adapTrapxxx(f,a,b,e)
```

where `xxx` is your student id and `Value` is the approximation of $\int_{\mathtt{a}}^{\mathtt{b}} \mathtt{f(x)dx}$ with tolerance `e` by using the adaptive quadrature as mentioned above.

I will release a test program which will generate a possible score out of 100 for your code. Please submit your m file via our bcourse website before the deadline.