MATH 340 PROGRAMMING IN MATH

Fall 2022

Schedule Number: 22384, 22385, 22386, 22387

COURSE INFORMATION

**Class Days:** MW

**Class Times:** 9:00-9:50

**Class Location:** GMCS 301 **Mode of Delivery:** Lecture

**Instructor:** Prof. Chris Curtis

**Instructor’s Email:** ccurtis@sdsu.edu

**Instructor’s Office Hours:** Wed 2-4, Th 1-2

**Instructor’s Office Hours Location:** MSLC

**Teaching Assistant (TA):** Gianni Pucillo

ADDITIONAL COURSE INFORMATION

I'll try to respond to emails within 2 working days, my email is ccurtis@sdsu.edu. For quick questions, the turnaround time may be much shorter. For questions that involve, say, the clarification of course concept, you may want to meet during office hours (see above for days and time for office hours).

*Homework is posted on my Github. Notebooks can be accessed via the Canvas link to nbviewer.*

COURSE DESCRIPTION

Introduction to programming in mathematics. Modeling, problem solving, and visualization.

ENROLLMENT INFORMATION

Prerequisites: MATH 245 (or equivalent) with a grade of C or better in each course; or Instructor's permission

COURSE MATERIAL

REQUIRED TEXTS: COURSE NOTES

OPTIONAL TEXTS

• Python Programming and Numerical Methods: A Guide for Engineers and Scientists. Authors: Qingkai Kong, Timmy Siauw, Alexandre Bayen. 1st Edition, Paperback ISBN: 9780128195499; eBook ISBN: 9780128195505Publisher: Elsevier Science & Technology

• Single Variable Calculus: Early Transcendentals 8th Edition, by James Stewart. ISBN 978-1-305-27033-6; ISBN-10: 9781305270336; ISBN-13: 978-1305270336. Publisher: Cengage

STUDENT LEARNING OUTCOMES

The overarching outcomes in this course will be for students to, using the Python programming language, (i) Learn the `science' of computer programming. (ii) Learn the `art' of computer programming. (iii) Represent abstract mathematics as computer code and translate computer code into mathematics. (iv) Visualize and describe data. (v) Learn in what ways modern computing is done. This will be accomplished by achieving the following.

1. Procedural Programming in Python: Students will define and use

i. data types

ii. conditional statements

iii. while and for loops

iv. functions

Since no one of these topics is useful without the other, synthesis is critical. Problems will build in complexity from week to week as new skills are learned to promote an integrated view of programming.

2. Basic Data Structures: For storing and manipulating data, students will use

i. NumPy arrays

ii. lists

iii. tuples

iv. dictionaries

The students will use "Pythonic" data manipulation techniques such as list comprehension and lambda functions. Basic sorting techniques and their analysis will be covered and implemented. Students will be required to synthesize these techniques with other learning outcomes so that, for example, students master the use of appropriate control structures for different data types and problems involving data. Taken together with the Procedural Programming outcome, this ensures students learn the 'science' of computer programming.

3. Doing Mathematics on Computers: Throughout the course, students will practice translating problems and notation in mathematics into algorithms via the Python language. The reverse skill of translating code into mathematical notation will be studied and practiced as well. While this will be a focus throughout the course, the last third of the course is devoted to realizing abstract mathematical frameworks in the form of Python.

4. Data Visualization and Manipulation: Students will learn how to read and write to files. They will make several types of plots and use the plotting capabilities available in Matplotlib. Students will be required to synthesize various techniques in order to produce different plots of data, and written interpretations of said plots will be a part of assignments. Taken together with the Doing Mathematics outcome, students will have ample opportunity to practice the 'art' of computer programming.

5. Working in Modern Computing Environments: Students will use the features of various programming environments to solve problems and present their work. They will use stand-alone interpreters such as Canopy. They will use web-based interpreters such as Jupyter. They will use Jupyter to present results in mathematics by taking advantage of the LaTeX markup language. Thus, students will also be exposed to the breadth of ways in which programming is done.

COURSE ASSESSMENT AND GRADING

• Your final score will consist of homework (40%), exam 1 (10%), exam 2 (15%) and final exam (20%). Friday’s breakout activities are worth 15%. Homework is due on Fridays, please pay attention to the schedule since there may be exceptions to this rule. • Homework Policy: Work you submit should be Jupyter notebooks submitted to Google Drive. No late assignments will be accepted unless prior arrangements have been made. • Homework will be submitted via Google Drive. Students must adhere to the format for naming Jupyter notebook files when handing in their homework.

• There will be no extensions for exams.

• You are encouraged to work with one another to solve homework problems, but you should write solutions individually. Do not allow someone else to copy your work. If you suspect a student is cheating, please inform me. The Mathematics and Statistics Department expects academic honesty from our students, as laid out in the University Policies below. Violations will be reported to the Center for Student Rights and Responsibilities.

• Attendance to all lectures is required and will be recorded.

• The following grading scale will be used:

A 93% - 100% A- 90% - 92.9%

B+ 87% - 89.9% B 83% - 86.9% B- 80% - 82.9%

C+ 76% - 79.9% C 72% - 75.9% C- 68% - 71.9%

D+ 64% - 67.9% D 60% -63.9% D- 55% - 59.9% F Below 55%

TENTATIVE COURSE SCHEDULE

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| **WK** | **Dates** | **Schedule** | **HW & Exam** |
| 1 | Aug 22-26 | Course Overview; Python programming: Introduction, Jupyter Notebook, LaTeX | HW 1.1 Due 08/29  HW 1.2 Due 09/02 |
| 2 | Aug 29-Sep 2 | Python programming: Introduction; Approximations; Taylor 09/02 (7:59pm deadline) - Last day for students to add, drop, or change grading basis | HW 2 Due 09/09 |
| 3 | Sep 5-9 | Taylor Series; Taylor's Remainder Theorem | HW 3 Due 09/16 |
| 4 | Sep 12-16 | Conditionals; While Loops | HW 4 Due 09/23 |
| 5 | Sep 19-23 | Bessel Functions; While Loops | HW 5 Due 09/30 |
| 6 | Sep 26-Sep 30 | *For* Loops; Fibonacci Sequence | HW 6 Due 10/07 |
| 7 | Oct 3-7 | Floating Point Arithmetic; Exam 1 assigned | Exam 1 Due 10/14 |
| 8 | Oct 10-14 | Root Finding Problems | HW 7 Due 10/21 |
| 9 | Oct 17-21 | Integration: Trapezoid and Simpson’s Rule | HW 8 Due 10/28 |
| 10 | Oct 24-28 | Integration: Adaptive Quadrature | HW 9 Due 11/4 |
| 11 | Oct 31 – Nov 2 | Lagrange Interpolation | HW 10 Due 11/11 |
| 12 | Nov 7-11 | Divided Differences | HW 11 Due 11/18 |
| 13 | Nov 14-18 | Hermite Interpolation | **Thanksgiving 11/24-25** |
| 14 | Nov 21-25 | Linear Algebra, Exam 2 assigned | Exam 2 Due 12/02 |
| 15 | Nov 28 – Dec 2 | Linear Algebra | HW 13 Due 12/09 |
| 16 | Dec 5 – Dec 9 | Splines | **Final Due 12/19** |

CLASSROOM CONDUCT STANDARDS

SDSU students are expected to abide by the terms of the Student Conduct Code in classrooms and other instructional settings. Prohibited conduct includes:

• Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity. • Participating in an activity that substantially and materially disrupts the normal operations of the University or infringes on the rights of members of the University community.

• Unauthorized recording or dissemination of virtual course instruction or materials by students, especially with the intent to disrupt normal university operations or facilitate academic dishonesty. This includes posting of exam problems or questions to on-line platforms.

• Conduct that threatens or endangers the health or safety of any person within or related to the University community, including

1. physical abuse, threats, intimidation, or harassment.

2. sexual misconduct.

Violation of these standards will result in referral to appropriate campus authorities.

ACADEMIC HONESTY

The University adheres to a strict policy prohibiting cheating and plagiarism. Examples of academic dishonesty include but are not limited to:

• copying, in part or in whole, from another's test or other examination;

• obtaining copies of a test, an examination, or other course material without the permission of the instructor; • collaborating with another or others in work to be presented without the permission of the instructor; • falsifying records, laboratory work, or other course data;

• submitting work previously presented in another course, if contrary to the rules of the course;

• altering or interfering with grading procedures;

• assisting another student in any of the above;

• using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);

• copying and pasting work from an online or offline source directly and calling it your own;

• using information you find from an online or offline source without giving the author credit;

• replacing words or phrases from another source and inserting your own words or phrases.

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities. Academic dishonesty will result in disciplinary review by the University and may lead to probation, suspension, or expulsion. Instructors may also, at their discretion, penalize student grades on any assignment or assessment discovered to have been produced in an academically dishonest manner.

STUDENTS WITH DISABILITIES

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Ability Success Center at (619) 594-6473. You can also learn more about the services provided by visiting the Student Ability Success Center website. To avoid any delay in the receipt of your accommodations, you should contact Student Ability Success Center as soon as possible. Please note that accommodations are not retroactive, and I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Ability Success Center.

STUDENT PRIVACY AND INTELLECTUAL PROPERTY

The Family Educational Rights and Privacy Act (FERPA) mandates the protection of student information, including contact information, grades, and graded assignments. I will not post grades or leave graded assignments in public places. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.

RELIGIOUS OBSERVANCES

According to the University Policy File, students should notify the instructors of affected courses of planned absences for religious observances by the end of the second week of classes.

MEDICAL-RELATED ABSENCES

Medical-related absences: Students are instructed to contact their professor/instructor/coach in the event they need to miss class, etc. due to an illness, injury or emergency. All decisions about the impact of an absence, as well as any arrangements for making up work, rest with the instructors. Student Health Services (SHS) does not provide medical excuses for short-term absences due to illness or injury. When a medical-related absence persists beyond five days, SHS will work with students to provide appropriate documentation. When a student is hospitalized or has a serious, ongoing illness or injury, SHS will, at the student's request and with the student’s consent, communicate with the student’s instructors via the Vice President for Student Affairs and may communicate with the student’s Assistant Dean and/or the Student Ability Success Center.

TURNITIN

Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. You may submit your papers in such a way that no identifying information about you is included. Another option is that you may request, in writing, that your papers not be submitted to www.turnitin.com. However, if you choose this option you will be required to provide documentation to substantiate that the papers are your original work and do not include any plagiarized material.

COPYRIGHT POLICY

SDSU respects the intellectual property of others and we ask our faculty & students to do the same. It is best to assume that any material (e.g., graphic, html coding, text, video, or sound) on the Web is copyrighted unless specific permission is given to copy it under a Creative Commons License. More information about the use of copy written material in education as part of the TEACH Act and Copyright Fair Use Guidelines. Whenever possible, you should attribute the original author of any work used under these provisions.

SDSU ECONOMIC CRISIS RESPONSE TEAM

SDSU Economic Crisis Response Team: If you or a friend are experiencing food or housing insecurity, or any unforeseen financial crisis, visit http://sdsu.edu/ecrt, email ecrt@sdsu.edu, or walk-in to Well-being & Health Promotion on the 3rd floor of Calpulli Center.

RESOURCES FOR STUDENTS

A complete list of all academic support services--including the Writing Center and Math Learning Center--is available on the Student Affairs’ Academic Success website. Counseling and Psychological Services(619-594-5220) offers confidential counseling services by licensed therapists; you can Live Chat with a counselor at http://go.sdsu.edu/student\_affairs/cps/therapist-consultation.aspx between 4:00pm and 10:00pm, or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.

LAND ACKNOWLEDGMENT

For millennia, the Kumeyaay people have been a part of this land. This land has nourished, healed, protected and embraced them for many generations in a relationship of balance and harmony. As members of the San Diego State University community, we acknowledge this legacy. We promote this balance and harmony. We find inspiration from this land, the land of the Kumeyaay.