# MAT 331: Mathematical Problem Solving with Computers

**Prof. Scott Sutherland** Stony Brook, Fall 2019

**General Information:** This course serves as an introduction to computing for the math student. It fulfills the TECH objective of the Stony Brook Curriculum, and can also fulfill WRTD with concurrent enrollment in MAT 459.

After a general introduction to the use of the computers, we will turn to more mathematical problems. The emphasis of this course is on the "problem solving" portion of the title: we will take a series of problems and try to find solutions (or approximate solutions), keeping in mind that we have access to computers. We will discuss the problems and development of necessary mathematics, and then we will turn to the computers to explore and work out the solutions.

**Prerequisites:** C or better in multivariable calculus ( MAT203, AMS261, or MAT307). The course will also likely use material which may be covered in more advanced classes, but all relevant math background will be covered. No previous computer programming experience is necessary or assumed.

**Contact Info:** Math 5-112 / 631-632-7306 / `scott.sutherland` at `stonybrook.edu`
for office hours, see `www.math.stonybrook.edu/cards/sutherlandscott.html`

**Grader:** Juan Ysimura, Math P-133.

**Class Meets:** TuTh 11:30–12:50 in Harriman 320.

**Text:** The text for this course is a set of notes I wrote some time ago with Santiago Simanca. These are available on the class web page; I keep hoping I will have time to update them; if that happens, I will. You might find it useful to obtain a book about Maple, although the internet can also be your friend here. Most of what you need will be covered in class, but it is often useful to have a reference at hand.

**Computers:** We will rely heavily on Maple (a program that can do algebra, calculus, graphics, etc.), although if other tools are better suited to the task, we may make use of them. No previous experience with computers is needed. Maple is available for most computer platforms (Windows, Macintosh, Linux); Stony Brook students can download a copy from SoftWeb at `http://softweb.cc.stonybrook.edu?mpl`, in the "University Licensed Applications" section. In addition, you can use any of the campus SINC sites, or you can access the Virtual SINC site.

**Projects and Exercises:** There will be a number of "exercises" assigned, as well as three or four projects. An "exercise" is like a homework assignment– something that you should be able to do in a few minutes or at most a few hours. Every week or two, there will be a set of exercises posted, from which you can choose which ones to do. You must complete *at least half* of these exercises over the course of the semester. They all count for the same amount of points, whether they are easy or difficult. Part of the purpose of the problem is to help you learn how to determine what is "easy" and what is "hard".

A "project" is more like a term paper— you will be expected to devote a significant amount of time to doing it, as well as taking care with the presentation.

Working together on the projects is encouraged, although, each student will be responsible for turning in his or her own write-up of the problem and solution. This should contain a detailed description of the problem or topic, what means were used in solve it, and the solution. These write-ups should be produced by each student individually, and should be detailed enough so that someone who has not taken the class can read and understand them, and will believe the solution is correct. Half of the grade for a project depends on the clarity of the exposition, and half on the correctness.

**Grading:** Your grade will be based on the projects, the exercises, and in-class participation. In total, the exercises count as one project. There will be no exams. Both the expository and computational aspects of the project write-ups will be graded and count equally.

**Learning Outcomes:** This course fulfills the "Understand Technology (TECH)" objective of the Stony Brook Curriculum. This has the following learning outcomes:

1. Demonstrate an ability to apply technical tools and knowledge to practical systems and problem solving.
2. Design, understand, build, or analyze selected aspects of the human-made world. The "human-made world" is defined for this purpose as "artifacts of our surroundings that are conceived, designed, and/or constructed using technological tools and methods."

In addition, you can enroll in MAT459 and use two of your projects (if they are done well enough) to fulfill the "Write Effectively within Ones's Discipline (WRTD)" objective, which has the following learning outcome.

1. Collect the most pertinent evidence, draw appropriate disciplinary inferences, organize effectively for one's intended audience, and write in a confident voice using correct grammar and punctuation.

The necessary outcomes of this course is to understand how to appropriately use computer resources to explore, explain, and understand a number of aspects of undergraduate mathematics.

**Americans with Disabilities Act:** If you have a physical, psychological, medical or learning disability that may impact your course work, please contact the Student Accessibility Support Center, located at ECC (Educational Communications Center) Building, Room 128 (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

**Academic Integrity:** Each student must pursue his or her academic goals honestly and be held personally accountable for all submitted work. Representing another person's work as your own is **always wrong**. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at www.stonybrook.edu/commcms/academic_integrity/.

**Critical Incident Management:** Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

**Course Evaluation:** Each semester Stony Brook University asks students to provide feedback on their courses and instructors through an online course evaluation system. The course evaluation results are used by the individual faculty, department chairs and deans to help the faculty enhance their teaching skills and are used as part of the personnel decision for faculty promotion and tenure. No individually identifiable data are ever reported back to the university or instructor. Students who have completed previous evaluations can view all faculty ratings at: classie-evals.stonybrook.edu/.