

Math 103: Topics in Math for the Liberal Arts

Section , Spring 2016

Prerequisite: Elementary Algebra at the level of Rutgers Math 025, or equivalent.

A real mastery of elementary algebra and other basic skills is crucial to success in this course.

Math 103: Topics in Mathematics for the Liberal Arts, is taken primarily by students majoring in liberal arts and social science disciplines. The course investigates a variety of areas in which mathematics is concretely applied, in a way which is both engaging and accessible to students who do not necessarily have strong interests in the sciences. These topics include the mathematics of voting, the measurement of power, apportionment, fair division of goods, fair distribution of goods, and exponential growth in nature and finance.

Learning goals:

Math 103 fulfills both the Quantitative Information (QQ) and Mathematical or Formal Reasoning (QR) learning goals of the SAS Core Curriculum:

QQ: Formulate, evaluate, and communicate conclusions and inferences from quantitative information.

QR: Apply effective and efficient mathematical or other formal processes to reason and to solve problems.

In particular, students who complete course successfully will be able to

- determine winners of elections under four different voting methods, and use these to rank the candidates
- understand that different voting methods applied to the same election can produce different results
- determine whether particular election results violate certain mathematically precise notions of fairness
- understand that every voting method eventually violates one of these notions of fairness
- analyze the power dynamics in a weighted voting system, and compute how power is actually distributed, by the Banzhaf and Shapley-Shubik methods
- understand and be able to compute how actual power is distributed in systems such as the UN Security Council
- understand the flaws of proportional voting schemes
- apply different apportionment methods actually used in the history of the US Congress,
- apply apportionment methods in both political and other contexts
- analyze certain paradoxical scenarios arising in apportionment, such as the Alabama Paradox
- understand and apply the Divider-Chooser, Lone Divider, and Lone Chooser methods for dividing valuable continuous goods fairly
- understand and apply the Method of Sealed Bids and Method of Markers for distributing valuable discrete goods fairly
- understand that if these methods are applied correctly, all players are guaranteed fair shares
- understand and apply the notion of compound interest
- understand and apply the notion of annuity to solve problems related to loans and savings plans
- apply these notions to other contexts than financial ones, especially to population growth and decline
- be able to articulate their understanding of the above items, in clear English

By considering a range of topics in some concrete mathematical detail, the course aims to convince the student majoring in a liberal arts discipline that mathematics has a broad range of genuinely relevant applications, many of them outside the physical sciences, and that mathematical research into these areas is ongoing. A major course goal is for students to find the mathematics presented in the course to be interesting, engaging, and accessible, even for those who are convinced that mathematics is not their strongest subject.

Text: *Topics in Mathematics for the Liberal Arts*, Part 1, 2013, by Michael Weingart and Alice Senerees, and *Topics in Mathematics for the Liberal Arts*, Part 2, 2013, by Michael Weingart. The chapters of this book, written specifically for this course by two Rutgers faculty members, will be made available on Sakai at no cost to the student. The motivation for writing this book, and making it available to students at no cost, was both to provide course materials which are well suited to the goals of the course, and to address the significant issue of high textbook costs.

Meeting times:**Instructor:****Email:**

Calculator: A scientific calculator will be needed for both homework and examinations. Computers and calculators with typewriter keyboards or built-in computer algebra systems, such as the TI-89 and TI-92, will not be permitted on exams. Cell phones, tablets, and other cellular or internet capable devices are strictly prohibited on exams, and the consequences of attempting to use one, or even having one visible during an exam, are serious (see the item below on academic integrity).

Online resources: This course makes extensive use of Sakai, accessible at sakai.rutgers.edu. Students can log in with their ordinary Rutgers NetID and password. Students in all sections will need to use Sakai to access the textbook, to submit their homework and view feedback on it, and to view fully worked out solutions to the homework problems. Sakai is also used as a way of posting announcements, exam review materials, or grades. Some sections also use the Chat Room for online discussions about the subject matter of the course.

Academic Integrity: All Rutgers students are expected to be familiar with and abide by the academic integrity policy (<http://academicintegrity.rutgers.edu/academic-integrity-at-rutgers>). Violations of the policy are taken very seriously. During exams, cell phones and tablets must be turned off (not just silenced), and completely put away; having a cell phone or tablet visible during the exam will automatically be reported as an academic integrity violation, with a minimum penalty of receiving a 0 on the exam.

Homework: There will be regular homework assignments, all of them available on Sakai under “Assignments 2”. Due dates for each assignment will be indicated on Sakai. Since the solutions to each homework assignment will be posted in the Resources section of Sakai shortly after the assignment is due, **late homework will not be accepted**.

All written work must be submitted online via the Assignments 2 area of Sakai; it may not be submitted on paper, nor by email, and there are no exceptions under any circumstances.

Important guidelines for submitting homework:

1. To access Sakai, be sure that you have an active email account and know your NetID and password.
2. The order of the homework problems in your submitted work should be the same as the order in which they are listed in the assignment on Sakai.
3. If you upload a file, it must be in one of the following formats: .doc, .docx, .pdf, or .jpg. Files which are not in this format, and which the instructor cannot open, will be given a grade of 0.
4. If you need to scan your homework assignment, the campus computer labs and libraries do have scanners, and there are technical assistants there if you need help. **Note:** Scanned documents should be saved as pdf files.
5. A popular technique for producing images of handwritten work is to photograph each page, or each half of each page, using a cell phone. This is acceptable.
6. It is entirely your responsibility to make certain that the file you upload has the appearance you intend. Please check this by opening the file after you have uploaded it, and see that it does open, that the image is right side up and generally readable, etc. If the file format is incorrect or the image is blurry, you will be given a grade of 0.
7. If you ever have technical difficulties with Sakai, especially in uploading homework, please contact the excellent and very responsive Sakai help desk at sakai@rutgers.edu or 848-445-8721.
8. Do not wait until the last hour to upload your homework, since the system may be unexpectedly busy.
9. Whether you upload a file or type your answers into the textbox, be sure to hit “submit” at the bottom of the screen to submit your assignment.
10. You will very quickly get a confirmation email from the Sakai system that your assignment was submitted. Make sure that you get this confirmation email, because it is your responsibility to make sure that your submission goes through.
11. If you do not receive the confirmation email, your work probably did not go through, in which case you should log back in to confirm that your work was posted, and if it wasn't posted then you should resubmit.

Unless specified otherwise, **you must write your answers in complete, grammatically correct English sentences**. Being able to do this is a crucial aspect of quantitative literacy, which goes beyond mere computational proficiency.

Doing the homework is crucial to learning the subject thoroughly, and the system of electronic submission makes it possible for you to get feedback quickly on whether you have done the homework correctly. You are permitted, and in fact encouraged, to work together on homework problems, but all written work which you submit must ultimately be your own.

Quizzes: [at the discretion of the instructor]

Exams: There will be [two or three] midterm exams and a comprehensive, cumulative final exam. [Whether there are two or three midterm exams is at the discretion of the instructor.]

Missing an exam is a serious matter, and should only occur as a result of a genuine, verifiable emergency situation.

"Verifiable" means that there should be a doctor's note, notice of court appearance, etc. indicating that you were unable to attend at the time of the exam. If circumstances beyond your control prevent you from attending an exam, it is important that you contact the instructor as quickly as possible.

Makeups: There are no makeup quizzes or exams. As noted above, under truly compelling circumstances an absence from a quiz or exam can be excused, but instead of having a makeup, the portion of the final exam pertaining to the content of the missed midterm exam will count correspondingly more heavily.

Date and time of the final exam: [see <https://scheduling.rutgers.edu/scheduling/exam-scheduling/final-exam-schedule>]

Grading: The overall course grade will be based on the results of the exams, written homework, and quizzes given in class, according to the following scheme:

Homework and quizzes	20%
Midterm Exams (combined)	40%
Final Exam	40%

Attendance, and the classroom setting: You are expected to attend all class meetings, whose content will go far beyond a mere rehashing of the textbook. The classroom setting will involve a fair amount of active learning, and your full participation and engagement are necessary for you to learn effectively. If you entertain the notion that you can succeed in the course by learning the material on your own, please think again.

Using your cell phone or other device to send or view texts, or to surf the internet, or for any other purposes not directly related to your in-class work, is not acceptable. Doing so is very distracting to you and to others, and is truly inappropriate. This is excellent news for you, and everyone else, since you have all paid a significant amount of money to be here, and there are ample opportunities for conversation and texting and using Facebook and Twitter and Instagram and Snapchat and Yik Yak outside of class time.

Caution: The information in this syllabus is subject to change, as announced in class or via email/Sakai. No major changes are anticipated, but you are expected to attend class and check email regularly.

Extra help: If you are having difficulty, please take advantage of the opportunity to visit office hours. Do not hesitate to ask questions by email, or in the Sakai Chat Room. The Rutgers Learning Centers also provide drop-in, free tutoring for Math 103, according to a schedule accessible at <http://lrc.rutgers.edu/content/tutoring>.

A few friendly words of advice:

Never fall behind in a math course!!!! The ideas we will discuss need time to sink in, and are very difficult to learn quickly right before an exam, so it is important to clear up your confusions sooner rather than later.

An excellent way to improve your understanding of the subject is to study and work on homework together with classmates. Explaining mathematical ideas to others is often the most effective way to sort out your own confusions and clarify your understanding; you don't know just what it is that you don't know until you try explaining it to someone else.

You are also warmly invited to ask questions in class, which students are far too hesitant to do in math courses, or in office hours, or by email, or in the Sakai Chat Room! **I very much want you to succeed in this course.**

Student-Wellness Services:**Just In Case Web App**

<http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901 / www.rhscaps.rutgers.edu/

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / www.vpva.rutgers.edu/

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Scarlet Listeners

(732) 247-5555 / <http://www.scarletlisteners.com/>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.