MCS 221, Linear Algebra

Spring 2019, 11:30–12:20 MTuThF, OHS 318

Instructor: Imre Tuba
Office: Olin Hall 312
Phone: (507) 933-7009
E-mail: `ituba@gustavus.edu`

Office hours: 2:30-3:30 on Mon and Thu, 4-5 on Tue, and 12:30-1:25 on Fri.
Prerequisites: Completion of calculus I (either MCS-119 or MCS-121). It is strongly recommended that you have taken MCS-228 before MCS-221 or that you take it concurrently.
Required text: Sheldon Axler. Linear Algebra Done Right, 3rd edition.
Supplementary texts: A First Course in Linear Algebra by Robert A. Beezer and Linear Algebra Done Wrong by Sergei Treil. Both are free and can be accessed via links from the class website. Beezer's book is for a lower-level course than ours, but covers some more computational aspects of linear algebra that we are supposed to learn and are not in Axler's book. We will use Beezer's book as our primary source when we cover those topics. I'd say Treil's book is aimed at a somewhat more advanced audience; the arguments are terser and expect that the reader can fill in the details, and in general, there are fewer examples. There is of course a lot of overlap between Treil's and Axler's books, as there would be between any two introductory linear algebra textbooks. Perusing it along with the Axler text is a good way to learn linear algebra. Treil also covers some topics Axler does not, but both Axler and Treil have a lot more than we can possibly cover in a semester-long course.
Course objective: This is an introductory course in linear algebra, which covers both computational aspects and the theoretical foundations of linear algebra. We will study vectors, vector spaces, matrices, linear transformations, eigenvalues and eigenvectors, and perhaps a few other topics. We will learn some standard computational applications of these, but we will also learn the basic concepts, definitions, and theorems rigorously, which means that we will do many proofs. In fact, one of the major goals of the course is to sharpen your proof writing skills. You will have to be able to use linear algebra to solve the kinds of computational problems we cover, e.g. linear equations in several variables, and also to state precise definitions, come up with examples, prove theorems covered in class and in the text, and prove or disprove unfamiliar statements in linear algebra whose level and sophistication are comparable to the material in lecture and on the homework.
Website: `https://homepages.gac.edu/~ituba/mcs221s19`. I will also use Moodle to post your grades periodically.
Class attendance: This is not distance education. You are expected to attend and participate in every class. If you skip class you will miss the chance to learn skills that will be tested on the exams. If you keep skipping class, I will think that you are not serious about your education and will remember that when I assign your grade at the end of the semester.
On work outside class: Have you ever wondered why taking three classes (12 units) qualifies you as a full time student? That's only 10 hours per week in class. The reason is that you are expected to do a lot of work on your own outside class. In fact, the rule of thumb of college education is that for every hour you spend in class, you should expect to spend three hours studying outside class. That is how 12 units makes full time: 10 hours in class and 30 hours studying outside class each week. That means you'll need to spend about 10 hours a week studying outside the classroom for this course. That is if you are well-prepared for the course. If your math background is lacking, then you'll have to spend more time. I am not kidding.

Homework and reading will be posted on the class website regularly. You will be able to follow the progress of the course using the website. HW is an essential part of your learning. Take it very seriously. It is extremely important that you keep up with the HW. If you do not, you will quickly find yourself lost in class and at a great disadvantage during exams. Treat the HW as a learning opportunity, rather than something you need to get out of the way. Reread, revise, and polish your solutions until they are correct, concise, efficient, and elegant. This will really deepen your understanding of the material. You won't do well in a math class without doing all of the HW. Attending class and reading your textbook are necessary but not sufficient conditions for passing the course.

Mostly of your homework will consist of exercises in the textbook. Your work on these exercises will be tested on quizzes and exams. Every quiz and half of every exam will consist of exercises straight from this kind of homework. After the due date, they can show up on quizzes/exams. I strongly suggest that you write up and turn in your homework by the due date. I will correct your work but will not assign a score to it. This is so you treat the homework as a learning opportunity rather than a means of evaluation. In fact, you can turn in your offline homework to me any time for feedback. I will comment on it and turn it back to you as soon as I can. If you'd like, you can then correct your mistakes and turn it in again for me to check.

There is an obvious winning strategy. Do the HW, seek feedback on it, revise it, and keep your HW notes neat and organized. The familiarity you gain with the exercises by doing this will let you do the quizzes with ease. It will also let you complete half of each exam quickly and move onto the other half of the exam. The experience you gain by keeping up with your homework will be invaluable in doing that other half of the exam. On the other hand, if you do not keep up with your HW, you will face many unfamiliar problems under time pressure on quizzes and exams. This is very difficult and your grade will likely reflect it. Clearly, if you don't turn in homework, I can't give you feedback on your work, no matter how much I want.

There will also be some homework online, using Webwork, which you can access via a link from the class website. On this homework, you will get instant feedback. You will typically have several attempts to solve a problem. Use them judiciously. Check your work and try to make sure your solution is correct before submitting it. If you are careless, you will quickly run out of attempts. The winning strategy is to start working on your homework early, so if Webwork keeps rejecting your solutions, you have time to find the mistakes, and possibly to seek help. Your score on Webwork will be part of your grade in the class.

Collaboration on the HW: Limited collaboration with your fellow students in the class is OK. But see the section on Academic Integrity! The idea is to let you discuss and critique each other's ideas and not to let you split the workload. Keep collaboration constructive and reasonable. You should fully understand the solution and write it up on your own. Your understanding of the material will be tested on the exams.

If you are approached by another student from the class who wants to copy your HW notes, think twice before generously sharing. You will feel bad if your crafty buddy outscores you on an exam by exploiting your and everybody else's collective wisdom without doing work of his/her own.

Discussion sections: I strongly encourage you to organize a weekly session to work with (not copy from!) your fellow students on problems in class and on the homework. This will help you keep up with your work and get ideas and feedback from others who are grappling with the same exercises as you. You may find that the sense of companionship motivates you to work.

Exams: There will be two in-class exams on Mar 15 and Apr 18, as well as a final exam. If you skip an exam, you will normally not be able to make it up, unless you have a compelling (e.g. medical) and documented excuse. Forgetting that there is an exam or being unprepared for it are not considered compelling excuses. Your in-class exam score will be computed as 2/3(higher

score)+1/3(lower score).

Final exam: 1:00-3:00 on Fri, May 24 in OHS 318. The final exam is an important part of your obligations at Gustavus. Do not make travel/vacation plans that prevent you from taking the final exam at the time assigned by the registrar. If you have more than two final exams scheduled for the same day, let me know well in advance.

Grading scheme:

Homework and quizzes	30%
In-class exams	20% each
Final exam	30%

A score of 80% or more will guarantee an A- or better, 60% a B- or better, 40% a C- or better, and 20% a D- or better.

On independent work: Problem solving skills are developed by practicing a lot, not by watching other people solve problems. Learning math is much like learning to ride a bicycle in that you learn by doing it and not by watching someone else do it. Expecting to learn math without doing exercises on your own is like expecting to learn to ride a bicycle without ever sitting on a bicycle. Attending class and reading the textbook won't be enough to do well on the exams. You should work through every example and argument in the book and in your class notes and expect to have to re-read everything several times. It's slow, but then your reading list for this class is short.

On academic integrity: Using unauthorized aids–including help from another person–on exams and to complete assignments constitutes cheating. Representing someone else's work as your own–even if you make minor changes to it, or reword it–is plagiarism. Cheating and plagiarism are violations of academic integrity and university policy. The consequences are serious, ranging from receiving a failing grade on an assignment in question to expulsion from the College. Don't do it, it's not worth it. If you are in doubt whether what you are doing is legitimate, it is better to ask me.

According to the College's Academic Honesty Policy and the Honor Code (`https://gustavus.edu/general_catalog/current/acainfo`, it is your responsibility not only to not commit any act of academic dishonesty yourself, but also to report every instance of academic dishoqnesty that you know of.

Quality of work: It is important that you work neatly on the assignments. The quality of your work will affect your grades on the exams. Quality has to do with how easy it is for someone else to read your solution to a problem. It is not enough to do the math right, you must also communicate it well.

Students with disabilities: Gustavus Adolphus College is committed to ensuring the full participation of all students in its programs. If you have a documented disability, or you think you may have a disability of any nature (e.g., mental health, attentional, learning, chronic health, sensory, or physical) and, as a result, need reasonable academic accommodation to participate in class, take tests or benefit from the College's services, then you should speak with the Accessibility Resources staff, for a confidential discussion of your needs and appropriate plans. Course requirements cannot be waived, but reasonable accommodations may be provided based on disability documentation and course outcomes. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact Accessibility Resources as early as possible. Accessibility Resources (`https://gustavus.edu/advising/disability`) is located in the Center for Academic Resources and Enhancement. Accessibility Resources Coordinator, Katy Clay, (`clayk@gustavus.edu` or x7197), can provide further information.

If you need special arrangements, let me know <u>well in advance</u> so we can plan to accommodate your needs.