Linear Algebra

MATH 202, Spring 2016
Section 02

Instructor: Stephen Flood

Office: DMF 443, in the Center for Science & Mathematics (near the Rondileau Campus Center).

Office Hours: Monday 11:00-12:00 and Tuesday/Thursday 3:30-4:30.
Open Door Policy: If my door is open, then I am happy to answer quick questions!

Email: `stephen.flood@bridgew.edu`
Email Policy: I try to respond to questions by some time the next business day.

Textbook: *Linear Algebra and its Applications* 5th edition by Lay, Lay, and McDonald.

As of 1/16/16, it was avaliable at Amazon.com for around $80 (Used) and $15 (Rental)
`http://www.amazon.com/Linear-Algebra-Its-Applications-5th/dp/032198238X/`

If you already bought a copy from the bookstore, ask them about their "Price Match Program"

Important Websites

1. **My Website:** General information about this section, including my office hours, and some study aids will be posted at `http://www.mathlogic.org/stephenflood/teaching.html`

2. **Online Homework:** Online homework will be posted on WeBWorK at
`http://bridgewater.mathlogic.org/webwork2/`
Use your university username (e.g. jsmith12). Your initial password is your 6 digit Student ID number. You **must** change your password after logging in (click on the "Password/Email" button on the left).

   Send me an email if you cannot log in, and I will make sure you are in the system.

3. **Email:** It is important to regularly check your Bridgewater email.

Course Description

Prerequisite: MATH 180; and MATH 142 or MATH 152 or MATH 162; MATH 162 may be taken concurrently
Topics: Vector spaces, linear transformations, matrices, systems of linear equations and determinants.

Learning Outcomes. By the end of the course, you will be able to:

1. Represent every system of linear equations in *four different ways.*
2. Solve a given linear system. Describe the set of solutions both numerically and geometrically.
3. Use 1. and 2. to (i) decide if one vector is a linear combination of a set of other vectors, (ii) find the *span* of a set of vectors, and (iii) decide if a set of vectors is linearly independent or linearly dependent
4. Describe the properties of a linear transformation.
5. Know the connection between matrices and linear transformations.
Use this to rephrase the concepts from #1-3. in the language of functions.
6. Manipulate matrices algebraically, and explain these operations using the language of functions.

7. Explain the definition and properties of vector spaces and subspaces.
8. Express concepts from #1-6. using the language of vector spaces and subspaces.

9. Determine eigenvalues and eigenvectors of a matrix.
10. Use eigenvalues & eigenvectors to see what happens when you repeatedly apply a linear transformation.
11. State similarities and differences between the main topics in the course.

Formats and Procedures

The course consists of 3 parts

1. In class lectures, worksheets, & quizzes (4 hours/week)[1]
2. Regular Homework Assignments (8-12 hours/week)
3. Studying to prepare for homework and quizzes (normally ∼4 hours/week, but more before an exam).

The suggested study times for the *average* student (see any website about studying in college). If you are weak in mathematics, you will require more time, but **please talk to me** and I can help you work more efficiently. You can also find useful advice online:

- Math Study Skills: http://mathcs.slu.edu/undergrad-math/success-in-mathematics

Grades

Your grade will be earned as follows. There is no extra credit.

Exam I and II	20% *each*
Mini Exam / Project	10%
Homework & Quizzes	20%
Final Exam	30%
Total	100%

Exams, homework, and quizzes will be graded for correctness, completeness, and clarity. The more clear your explanation and organization, the more points you will earn! This also means that points may be deducted for confusing organization and poor handwriting, as well as for incomplete or incorrect work.

How to succeed in this class

Linear Algebra is about a mixture of *Concepts*, *Computations*, and *Communication*.

Some problems on the homework simply practice ideas covered in class. Other problems will combine the "computations" and "concepts" in *a variety of new ways.* To succeed, you will also need to *communicate* clearly. You *must* clearly organize your work in each "computation" problem. In the "concept" problems, you must give clear explanations, and use correct terminology and notation.

From time to time **you will** become stumped by a problem. In this case, **you should** come to my office hours, drop by my office, or email me to ask for a hint or explanation.

[1] Because of the University's Academic Calendar, the two sections of this course will not always be aligned. To keep things uniform, I will refer to the nth 50-minute lecture as "class #n".

Exams

There will be two full length in-class exams and one final exam. There will be an additional, shorter exam or project with schedule TBA. The final exam will be cumulative: anything we've studied is fair game. The in-class exams generally cover the material since the last exam. No calculators are permitted on any exam, unless otherwise stated.

No makeup exams are scheduled. If you miss an exam for a valid reason (documented illness, documented family emergency, etc.), your exam grade will be determined by averaging the other exams. At my discretion, I may choose to assign a makeup exam instead.

Tentative dates are given in the Approximate Calendar of Study, below. *Please contact me before the exam* if you will need to miss it. It is much harder to document "valid reasons" after you have missed the exam.

Quizzes

There will be occasional quizzes. These will be short assignments, and their main purpose is to give you a chance to use, practice, and explore the concepts and tools that we are learning.

In class quizzes and graded worksheets will be announced in advance, and cannot be made up.

Homework

The best way to learn mathematics is to get a lot of practice with (i) performing computations, (ii) using and connecting concepts, and (iii) writing clear explanations.

Graded Homework will be assigned from every class, and collected each week. Your assignment grade will depend on two things. (1) Part of your grade is based on whether *all problems were attempted* with complete and clear work, and (2) Part of your grade is based on *grading a few problems for correctness* of your answer and work.

In addition to the graded homework, you also have recommended homework: read the book and do as many practice problems as you can. You can find a list of recommended practice problems on the course page.

Group Work and Study Aids

You have many excellent resources available to aid you as you work. For example, *you can ask me any and all questions during office hours!* You also have answers to the odd numbered problems in the textbook.

Group work can be helpful. **But** I strongly encourage you to *work on problems yourself first*, before discussing them with your peers. Probably the best way to check that you understand a problem is to ask this question: "Can I reproduce the solution and explain it to a classmate a whole 10 minutes after I finished the problem?" Try this with the people you are studying with, and have them check your reasoning.

But always remember: you will benefit the most if you *make a serious effort to solve the problems on your own* before you obtain hints or other assistance.

Students with Disabilities

At BSU, we are committed to making our facilities, services, and programs accessible to all students in compliance with applicable law. Students with disabilities who desire reasonable accommodations should contact the Disability Resources Office to discuss the availability of reasonable accommodations or to obtain documentation guidelines. They are located in the Maxwell Library Ground Floor (AAS). You should also contact me by email or during office hours to discuss accommodations due to a documented disability.

Final Letter Grades

The final letter grade cutoffs are as follows:

Percentage:	94	90	87	83	80	77	73	70	60	0
Letter Grade:	A	A-	B+	B	B-	C+	C	C -	D	F

`NOTE: Official grades cannot` ***`and will not`*** `be changed once posted.`[2]

Academic Integrity

Academic honesty is expected of all students. Plagiarism and cheating are subject to academic penalty, which may result in a grade of F for the whole course. In fact, *a violation may result in a reduced grade, suspension, or dismissal from the university.*

You must not not cheat, fabricate, plagiarize, or facilitate academic dishonesty. If you passively engage in cheating (i.e. allowing others to cheat off you) you may receive the same consequences as the person copying.

Important Dates

Last day to add/drop: January 27, 2016. *Last day to withdraw:* April 8, 2016.

Tentative Exam Dates (subject to change!)

Section 02: February 18, March 29. Mini Exam date TBA.

Final Exam Date: Tuesday, May 10 11:00 AM 1:00 PM

[2] Unless there was an error in the grade computation

Approximate Calendar of Study

This schedule is a preliminary outline, and you should expect it to change from time to time.

Lesson		Date	Section	Topic	Remarks
1	1	20-Jan	1.1	Systems of Linear Equations	
	2		1.1 & 1.2	Systems of Equations II and Row Reduction I	
2	3	25-Jan	1.2	Row Reduction and Echelon Forms	
	4		1.3	Vector Equations I	
	5		1.3	Vector Equations II	Quiz
3	6	1-Feb	1.4	Spanning Sets & Spaces and The Matrix Equation I	Graphical Coordinate Systems, Independence, and Dimension
	7		1.4	The Matrix Equation II	
	8		1.5	Solution sets of Linear Equations I	
4	9	8-Feb	1.5	Solution sets of Linear Equations II	
	10		1.7	Linear Independence	
	11		1.7	Linear Independence	
5	12	15-Feb		Exam 1 Review	
				Monday Class Schedule – No Wednesday Classes	
	13			Exam 1	*Tentative* Date
6	14	22-Feb	1.8	Linear Transformations	
	15		1.8	Linear Transformations	
	16		1.9	The Matrix of a Linear Transformation	
7	17	29-Feb	1.9	The Matrix of a Linear Transformation	
	18		2.1	Matrix Operations	
	19		2.1	Matrix Operations	
8		7-Mar		Spring Break – No Class	
				Spring Break – No Class	
				Spring Break – No Class	

Lesson		Date	Section	Topic	Remarks
9	20	14-Mar	2.2	Inverse of a Matrix	
	21		2.2	Inverse of a Matrix	
	22		2.3	Characterizations of Invertible Matrices	
10	23	21-Mar	3.1	Introduction to Determinants	
	24		3.2	Properties of Determinants	
	25			Exam 2 Review	
11	26	28-Mar		Exam 2	*Tentative* Date
	27		4.1	Vector Spaces and Subspaces	
	28		4.2	Null Spaces, Column Spaces, and Linear Transformations	
12	29	4-Apr	4.2	Null Spaces, Column Spaces, and Linear Transformations	Last day to Withdraw
	30		4.3	A Basis for a Vector Space	
	31		4.3	A Basis for a Vector Space	
13	32	11-Apr	4.4	Coordinate Systems	
	33		4.4	Coordinate Systems	
	34		4.5	Dimension of a Vector Space	*Tentative:* ***Mini Exam***
14	35	18-Apr	4.5	Dimension of a Vector Space	
	36		4.6	Rank	
	37		5.1	Eigenvectors and Eigenvalues	
15	38	25-Apr	5.1	Eigenvectors and Eigenvalues	
	39		5.2	The Characteristic Equation	
	40		5.2	The Characteristic Equation	
16				Final Exam Week	

Possible Additional Topics:

- §1.10 – Linear Models in Application
- §2.7 – Computer Graphics
- §3.3 – Cranmer's Rule, Volume, Linear Transformations
- §5.3 – Eigenvectors and Diagonalization