

Restructuring MAT22AL (Linear Algebra Computer Laboratory) Website

PreTextT, XML, HTML, CSS, and Python

Davis, CA

April 2021 - Present

- Currently working under UC Davis Professor Ali A. Dad-del
 - Restructuring MAT22AL (Discrete Mathematics Computer Laboratory) coursework website through front-end development tools including PreTextT, HTML, CSS, and Python
- Built web applications in an agile and iterative way using agile methodologies and Git/Github

Week 1

UC Davis

Davis, CA

21 April 2021: 10 hours

- Utilized **Git Bash** for compiling through this command line: `xsltproc/xsltproc.exe mathbook/xsl/pretext-html.xsl test.xml`
- Utilized **Visual Studio Code** for coding **XML**, **HTML**, **CSS**, and **Python** files
- While working with **PreTeXT** and **XML**, I noticed how the formatting is nearly identical to a book. Every number below "Front Matter" represents a chapter, and the front matter precedes the main text of a book
 - **ERROR BUG LOG:** I am having difficulties changing the label of Front Matter to the rather ideal "Course Information." I believe Front Matter cannot be changed
 - **ERROR BUG LOG:** For some reason, I am not able to utilize the bold tags to bold keywords such as "MAT 22AL", "MAT 22A" and "MATLAB."

The picture below the ordering of LAB Assignments from 1-10. An abstract of the class is provided, alongside the title of the class and the professor's name who is teaching the course. The buttons of UP, NEXT, and PREV work according to their function.

MAT22AL: Linear Algebra Computer Laboratory

Professor Ali A. Dad-del

< Prev ▲ Up Next >

Front Matter

1 LAB 1

2 LAB 2

3 LAB 3

4 LAB 4

5 LAB 5

6 LAB 6

7 LAB 7

8 LAB 8

9 LAB 9

10 LAB 10 (Extra Credit)

Front Matter

1 LAB 1

2 LAB 2

- Made improvements to sections and understood the mechanics of PreTeXT a lot more through trial and error.
 - Fixed the first bug and learned the differences in XML and PreTeXT compared to other front-end tools.
 - **ERROR BUG LOG:** I am having difficulties adding an image or pdf to the designated section.
 - Ex: Lab1.pdf -> Section Lab1

The picture below demonstrates the major changes to the user interface.

MAT 22AL: Linear Algebra Computer Laboratory

Professor Ali A. Dad-del, TA Zhiqian Du

<ul style="list-style-type: none"> ContentsCourse InformationDue DatesGradesHow to Access Graded AssignmentsLate Enrollment1 LAB 12 LAB 23 LAB 34 LAB 45 LAB 56 LAB 67 LAB 78 LAB 89 LAB 910 LAB 10 (Extra Credit)	<h1>MAT 22AL: Linear Algebra Computer Laboratory</h1> <p>Professor Ali A. Dad-del University of California - Davis daddel@math.ucdavis.edu</p> <p>TA Zhiqian Du University of California - Davis simdu@ucdavis.edu</p> <p>April 21, 2021</p> <p> MAT 22AL (Computer Laboratory For Linear Algebra) is a one-unit course for students enrolled in MAT 22A (Elementary Linear Algebra). The labs offered in this course are designed to help linear algebra students in two areas: First, the use of computers in computations related to linear algebra. Second, enhance students' understanding of basic concepts and ideas of linear algebra for MAT 22A students. These labs are not self-contained. They should be used as a supplement for an Elementary Linear Algebra course. For each lab, there is a list of prerequisite topics, which need to be studied before doing the labs using any standard textbook. A little basic knowledge about working with computers is helpful. The labs are designed to use MATLAB. No familiarity with MATLAB is required. MATLAB command will be introduced gradually.</p>
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<ul style="list-style-type: none"> MAT 22AL: Linear Algebra Computer LaboratoryProfessor Ali A. Dad-del, TA Zhiqian Du	<h1>MAT 22AL: Linear Algebra Computer Laboratory</h1> <p>Professor Ali A. Dad-del, TA Zhiqian Du</p> <table border="1"><tr><td style="vertical-align: top; padding-right: 10px;"><ul style="list-style-type: none"> ContentsCourse InformationDue DatesGradesHow to Access Graded AssignmentsLate Enrollment1 LAB 12 LAB 23 LAB 34 LAB 45 LAB 56 LAB 67 LAB 78 LAB 89 LAB 910 LAB 10 (Extra Credit)</td><td style="padding: 10px;"><ul style="list-style-type: none">Course InformationDue DatesGradesHow to Access Graded AssignmentsLate Enrollment1 LAB 1</td></tr></table>	<ul style="list-style-type: none"> ContentsCourse InformationDue DatesGradesHow to Access Graded AssignmentsLate Enrollment1 LAB 12 LAB 23 LAB 34 LAB 45 LAB 56 LAB 67 LAB 78 LAB 89 LAB 910 LAB 10 (Extra Credit)	<ul style="list-style-type: none">Course InformationDue DatesGradesHow to Access Graded AssignmentsLate Enrollment1 LAB 1
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The picture below demonstrates the use of `<alert>` to bold. I confused it with `` or `<bold>` from HTML/CSS.

MAT 22AL (Computer Laboratory For Linear Algebra) is a one-unit course for

The picture below demonstrates the use of png files from the original pdf files.

Course Information	22A students. These labs are not self-contained. They should be used as a supplement for an Elementary Linear Algebra course. For each lab, there is a list of prerequisite topics, which need to be studied before doing the labs using any standard textbook. A little basic knowledge about working with computers is helpful. The labs are designed to use MATLAB . No familiarity with MATLAB is required. MATLAB command will be introduced gradually.
Due Dates	
Grades	
How to Access Graded Assignments	
Late Enrollment	
1 LAB 1	
2 LAB 2	
3 LAB 3	
4 LAB 4	
5 LAB 5	
6 LAB 6	
7 LAB 7	
8 LAB 8	
9 LAB 9	
10 LAB 10 (Extra Credit)	

MATH 22AL: Computer Lab For Linear Algebra
Dr. Daddel

Course Description: MATH 22AL is an online course, with one Mandatory meeting at the beginning of the quarter which is announced in campus class schedule. Due the COVID-19 pandemic this mandatory session is Recorded and is available to enrolled student. You can do the LABS on your computer by following the instructions on each lab.

Required work: There are 9 assignments, each due 5:00 PM on due date of the Labs. Please check the due dates on course website.

Grading: To receive a pass you need to complete, submit and pass at least 8 labs. Also having 7 Pass and 2 Bairy Pass will be a passing grade for the course.

There are no midterms or final. Each lab needs about two hours of work, this time might vary depending on how fast you work on computer and how prepared you are in terms of Linear Algebra concepts. No late assignment will be accepted

Prerequisite:

- Have taken Linear Algebra or taking it concurrently.
- Having Basic knowledge about working with computers.*

* A little of basic knowledge about working with computers is helpful. You need to know how to log in a Unix machine and use an editor (vi, pico, ...). If you have a Campus Computer Account and check your e-mail, you are probably using a Unix machine. The labs are designed to use MATLAB. No familiarity with MATLAB is required. MATLAB commands will be introduced gradually.

Registration and Enrollment : you must

1. Be enrolled in a section of MAT 22A (concurrently this quarter) and in a section of MAT22AL via SISWEB.
2. Registered on line by visiting the following web page to obtain your username and Password
<http://www.math.ucdavis.edu/comp/class-accts>
3. Have your user name and your password with you when going to the first lab meeting.

Where to get help:

- Your MATH 22AL Instructor will be holding Zoom office hours on Tuesday and Thursday 10 AM -12PM to answer your questions.

Week 2 UC Davis

Davis, CA

29 April 2021: 10 hours

- Utilized **Git Bash** for compiling through this command line: `xsltproc/xsltproc.exe mathbook/xsl/pretext-html.xsl test.xml`
- Utilized **Visual Studio Code** for coding **XML**, **HTML**, **CSS**, and **Python** files
- Had an extremely time-consuming problem as I could not create subsections under the header, constantly compiling with warnings
 - The solution was to change the format from article to book
 - PreTeXT gives two formats (article and book)
- Changed the order of the chapters (Blue margin)
 - Created sections under the chapters to match Professor's examples
 - Course information is without the abstract
 - Cut-down unnecessary <p>
 - **ERROR BUG LOG:** Cannot use the provided TeX files provided by professor. Spent a lot of time doing research on utilizing the files on the lab section.

The picture below demonstrates the major changes to the user interface.

MAT 22AL: Linear Algebra Computer Laboratory

Professor Ali A. Dad-del, TA Zhiqian Du

≡ Contents

< Prev ▲ Up Next >

1 LAB 1

- Notes
- Content and Objectives
- Starting LAB
- Instruction
- Saving, Editing and Submitting your work
- More on the topics covered
- Historic Notes

2 LAB 2

- Notes
- Content and Objectives
- Starting LAB
- Instruction
- Saving, Editing and Submitting your work
- More on the topics covered
- Historic Notes

3 LAB 3

Chapter 1 LAB 1

Welcome to **Lab 1** of the Linear Algebra Computer Laboratory course. Below are a few resources to look at in order to start and complete this lab.

- 1.1 Notes
- 1.2 Content and Objectives
- 1.3 Starting LAB
- 1.4 Instruction
- 1.5 Saving, Editing and Submitting your work
- 1.6 More on the topics covered

MAT 22AL: Linear Algebra Computer Laboratory

Professor Ali A. Dad-del, TA Zhiqian Du

≡ Contents

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1 LAB 1

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MATH 22AL: Computer Lab For Linear Algebra
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Course Description: MATH 22AL is an online course, with one Mandatory meeting at the beginning of the quarter which is announced in campus class schedule. Due the COVID-19 pandemic this mandatory session is Recorded and is available to enrolled student. You can do the LABS on your computer by following the instructions on each lab.

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<http://www.math.ucdavis.edu/comp/class-accts>
3. Have your user name and your password with you when going to the first lab meeting.

Where to get help:

- Your MATH 22AL Instructor will be holding Zoom office hours on Tuesday and Thursday 10 AM -12PM to answer your questions.
- You may attend his office hours as he will announce it by e-mail.
- There a few Videos of different steps of using computer from Mandatory session, which are available in course website.Click on Late enrollment.

The picture below demonstrates the major changes to the user interface.

The screenshot shows a course navigation interface. On the left is a sidebar with a dark blue header containing the text "Contents". Below this are several sections, each with a blue header and a list of items:

- Introduction**
- Course Information**
- 1 LAB 1** (selected, highlighted in blue)
 - Notes
 - Content and Objectives
 - Starting LAB
 - Instruction
 - Saving, Editing and Submitting your work
 - More on the topics covered
 - Historic Notes
- 2 LAB 2**
 - Notes
 - Content and Objectives
 - Starting LAB
 - Instruction
 - Saving, Editing and Submitting your work
 - More on the topics covered
 - Historic Notes
- 3 LAB 3**
 - Notes
 - Content and Objectives
 - Starting LAB
 - Instruction
 - Saving, Editing and Submitting your work
 - More on the topics covered
 - Historic Notes
- 4 LAB 4**
 - Notes

Below the sidebar, there is a dark grey footer bar with the text "Authored in PreTeXt" and "POWERED BY MathJax".

The main content area on the right has a light gray background and contains the following sections, each with a right-pointing arrow:

- Introduction**
- Course Information**
- 1 LAB 1**
- 2 LAB 2**
- 3 LAB 3**
- 4 LAB 4**
- 5 LAB 5**
- 6 LAB 6**
- 7 LAB 7**
- 8 LAB 8**
- 9 LAB 9**
- 10 LAB 10 (Extra Credit)**
- Due Dates**
- Grades**
- How to Access Graded Assignments**
- Late Enrollment**
- Resources**

- Utilized **Git Bash** for compiling through this command line: `xsltproc/xsltproc.exe mathbook/xsl/pretext-html.xsl test.xml`
- Utilized **Visual Studio Code** for coding **XML**, **HTML**, **CSS**, and **Python** files

- As I attempt for hours to understand LaTeX and pdfs, there has been a problem for the tool to read pdf files. I switched the pdf files to pngs and separated them into their own respective categories, as well as reformatting Labs 1 and 2

The picture below demonstrates the major changes to the user interface.

MAT 22AL: Linear Algebra Computer Laboratory
Professor Ali A. Dad-del, TA Zhiqian Du

Contents

- Introduction
- Course Information
- 1 LAB 1**
 - Notes
 - Content and Objectives
 - Starting Your Work
 - Entering Vectors
 - Entering Matrices**
 - Combining Commands
 - Working with Entries
 - Diagonal Matrices
 - Constructing Large Matrices
 - Creating Vectors (1)
 - Creating Vectors (2)
 - Creating Vectors (3)
 - Row Operations
 - Saving, Editing and Submitting your work
- 2 LAB 2**
 - Notes
 - Content and Objectives
 - Starting Your Work

< Prev ▲ Up Next >

1.5 Entering Matrices

MATLAB: University of California, Davis
Computer LAB for Linear Algebra Dr. Daddel
LAB 1 Instruction

MATH 22AL Lab # 1

Ways to enter a matrix in MATLAB
Press Enter after each type.

Note: You need a space between the row entries and a semicolon between the rows.

Type	<code>A = [1 2 3; 3 4 5; 4 5 6]</code>	This will create a 3 x 3 matrix
Type	<code>B = eye(4).</code>	to create a 4 by 4 identity matrix.
Type	<code>C = rand(4)</code>	to create a 4 by 4 matrix with randomly generated entries distributed uniformly between 0 and 1.
Type	<code>D= rand(4,3)</code>	to get a 4 by 3 random matrix .
Type	<code>who</code>	to see a list of your variables.
Type	<code>clear D</code>	to clear the variable D .
Type	<code>who</code>	to see if D is cleared or not
Type	<code>D=rand(5)</code>	to create a 5 by 5 random matrix.
Type	<code>D=10*D</code>	to multiply every entry of D by 10.
Type	<code>D=round(D)</code>	to get a random matrix with integer entries.

MAT 22AL: Linear Algebra Computer Laboratory
Professor Ali A. Dad-del, TA Zhiqian Du

Contents

- Questions
- Diagonal Matrices
- Symmetric and Skew Symmetric Matrices
- Answer the Following Questions (2)**
 - Solve the Linear System
 - Using MATLAB's Command X=A \ b to Solve a Linear System
 - Saving, Editing and Submitting your work
- 3 LAB 3**
 - Notes
 - Content and Objectives
 - Starting LAB
 - Instruction
 - Saving, Editing and Submitting your work
 - More on the topics covered
 - Historic Notes
- 4 LAB 4**

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2.11 Answer the Following Questions (2)

MATLAB: University of California, Davis
Computer LAB for Linear Algebra Dr. Daddel

MATH 22AL Lab # 2

0.1 what happens if you add, subtract or multiply symmetric matrices?:

Note: To enter transpose of a matrix A in MATLAB you need to type `A'`.
Recall that a matrix A is called symmetric if $A = A'$.

Type	<code>S + T</code>	to get a symmetric matrix.
Type	<code>S - T</code>	to get a symmetric matrix.
Type	<code>ST</code>	to get a skew symmetric matrix.
Type	<code>TS</code>	to get a skew symmetric matrix.

0.2 Answer the following questions:

- Which one of these matrices are symmetric?
- What type of matrix will we get if we add (multiply) two symmetric matrices?
- Can we get symmetric matrices by adding two non-symmetric matrices?

Jonathan Trans

Week 3 - Day 2

UC Davis

<https://www.linkedin.com/in/jonathantrans/>

jbtrans@ucdavis.edu | 209-319-6752 | Davis, CA.

Davis, CA

8 May 2021: 5 hours

- Utilized **Git Bash** for compiling through this command line: `xsltproc/xsltproc.exe mathbook/xsl/pretext-html.xsl test.xml`
- Utilized **Visual Studio Code** for coding **XML**, **HTML**, **CSS**, and **Python** files
- As I attempt for hours to understand LaTeX and pdfs, there has been a problem for the tool to read pdf files. I switched the pdf files to pngs and separated them into their own respective categories, as well as reformatting Labs 3 and some extensive renaming for the png and rearranging.
- Extensive research on formatting / making tables.

The picture below demonstrates the major changes to the user interface.

The screenshot shows a LaTeX editor interface. On the left, a vertical sidebar lists navigation items: 'Answer the Following Questions', 'Diagonal Matrices', 'Symmetric and Skew Symmetric Matrices', 'Answer the Following Questions (2)', 'Solve the Linear System', 'Using MATLAB's Command X=A \ b to Solve a Linear System', and 'Saving, Editing and Submitting your work'. Below this is a section titled '3 LAB 3' containing 'Notes', 'Content and Objectives', 'Starting Your Work', 'Plotting Graphs', and 'M-Files' (which is highlighted). Further down is another section titled '4 LAB 4' with 'Notes'. The main content area on the right is titled '3.5 M-Files'. It includes sections for 'MATLAB' (with 'Computer LAB for Linear Algebra' and 'Dr. Daddel'), 'MATH 22AL' (with 'Lab # 3'), and '7 M-Files'. A 'Note:' box contains information about MATLAB m-files. A code block shows the 'rowchange.m' script. Below the code, instructions say to save it as 'rowchange.m' and to use the display function to print variables to the screen.

Answer the Following Questions

Diagonal Matrices

Symmetric and Skew Symmetric Matrices

Answer the Following Questions (2)

Solve the Linear System

Using MATLAB's Command $X=A \ b$ to Solve a Linear System

Saving, Editing and Submitting your work

3 LAB 3

Notes

Content and Objectives

Starting Your Work

Plotting Graphs

M-Files

Linear Transformations

Matrix Multiplication

Saving, Editing and Submitting your work

4 LAB 4

Notes

3.5 M-Files

MATLAB: University of California, Davis

Computer LAB for Linear Algebra Dr. Daddel

MATH 22AL Lab # 3

7 M-Files

Note:

MATLAB can execute a sequence of statements stored in an ordinary text file with a .m extension. Because of this extension, such files are called "m-files".

One type of m-file is the function m-file. The first line of a function m-file must define the m-file as a function, specify its name, and specify its input and output variable names. A function m-file's function name and file name must be identical.

For example, a function named "changerows" must be stored in a file named "changerows.m". When a function has more than one output variable, the output variables are enclosed by brackets: for example, `[m, n] = size(A)`. If your m-file is not in the working directory (this will default to your home directory), you must specify the path to it.

Using a text editor (e.g., pico), create the following file and save it as `rowchange.m`

```
function rowchange(A, c, d)
display(A)
r = A(c,:);
A(c,:) = A(d,:);
A(d,:) = r;
display(A)
```

(The `display` function prints a variable to the screen.) After saving the file, reopen MATLAB if it was not already open (do not forget to use the

Week 4 - Day 1

UC Davis

Davis, CA

10 May 2021: 6 hours

- Utilized **Git Bash** for compiling through this command line: `xsltproc/xsltproc.exe mathbook/xsl/pretext-html.xsl test.xml`
- Utilized **Visual Studio Code** for coding **XML**, **HTML**, **CSS**, and **Python** files
- As I attempt for hours to understand LaTeX and pdfs, there has been a problem for the tool to read pdf files. I switched the pdf files to pngs and separated them into their own respective categories, as well as reformatting Labs 4, 5, and 7

The picture below demonstrates the major changes to the user interface.

4 LAB 4

- Notes
- Content and Objectives
- Starting Your Work
- Working with MATLAB
- Using Gauss-Jordan Elimination to Calculate LU Factorization
- Saving, Editing and Submitting your work

5 LAB 5

- Notes and Objectives
- Starting Your Work
- Background Linear Combinations
- Using MATLAB
- Background Linear Combinations (2)
- Spanning Set of a Vector Space
- MATLAB Exercise
- Linearly Independent Vectors
- MATLAB Exercise (2)
- BASIS and MATLAB Exercise (3)

7 LAB 7

- Notes and Objectives
- Starting Your Work
- Background Reading: Introduction and Origin of Inconsistent Systems
- Example
- Background Reading: Minimizing Ax-b
- Orthogonal Projection of b onto W
- Background Reading: Least Square Lines and Example (2)
- Example (3)
- Exercises: Problem
- Exercises: Problem (2)
- Exercises: Problem (3)
- Exercises: Problem (4)
- Saving, Editing and Submitting your work

8 LAB 8

4.6 LU Factorization

MATLAB:

University of California, Davis

Computer LAB for Linear Algebra

Dr. Daddel

MATH 22AL

Lab # 4

9 LU Factorization

9.1 Reading

Using Gaussian elimination we can express any square matrix as the product of a permutation of a lower triangular matrix and an upper triangular matrix. $M = PLU$. If A is invertible, Usually we choose the lower triangular matrix L with diagonal entries 1 and if we choose both L and U to have diagonal entries 1, then we need a diagonal matrix in the middle and decomposition becomes as $M = PLDU$, which is unique. One of the applications of LU decomposition or factorization is in solving a linear system $AX = b$. This can be seen as $LUX = b$. Assume $UX = Y$ the linear system becomes as $LY = b$ which can be solved easily for Y . Then the system $UX = Y$ can be solved for X . You can read more on LU-Factorization in section 2.6 of your text book

9.2 Using MATLAB

You can find LU factorization of a matrix in MATLAB using `lu(A)`, the matrix L returned by MATLAB is a permutation of a lower triangular matrix.

9.2.1 Note

`[L,U] = lu(A)` stores an upper triangular matrix in U and a "potentially lower triangular matrix" (i.e. a product of lower triangular and permutation matrices) in L , so that $A = L*U$. A can be rectangular. `[L,U,P] = lu(A)` returns unit lower triangular matrix L , upper triangular matrix U , and permutation matrix P so that $P^*A = L*U$.

7.3 Background Reading: Introduction and Origin of Inconsistent Systems

MATLAB:

University of California, Davis

Computer LAB for Linear Algebra

Dr. Daddel

MATH 22AL

Lab # 7

4 Background Reading: Introduction.

Probably you know how to construct a curve through specified points. For example how to construct a line passing through two given points, or a parabola passing through three points. In general you can construct a polynomial of degree n that passes through $n + 1$ specified points. Such a polynomial is called **Interpolating polynomial**.

What happens if you have for example more than two points and you want to represent your data with a straight line?

In cases like this we face an **inconsistent system** of linear equations $Ax = b$. Instead of solving $Ax = b$ we try to find an x such that Ax is good approximation of b .

Week 4 - Day 2

UC Davis

Davis, CA

? May 2021: 4 hours

- Utilized **Git Bash** for compiling through this command line: `xsltproc/xsltproc.exe mathbook/xsl/pretext-html.xlsx test.xml`
- Utilized **Visual Studio Code** for coding **XML, HTML, CSS, and Python** files