## Matrix Algebra

Text: 7.7-7.8
Lecture Notes: 4
Lecture Slides: N/A

| Quote of Short Homework Three |  |
| :---: | :---: |
| All these squawking birds won't quit. Building nothing, laying bricks |  |
|  | The Shins : Caring is Creepy (2001) |
|  | 1. Goals |

The goal of this assignment is to practice determinant and matrix inversion calculations. Specifically, this will take place within the context of a so-called $L U$-Decomposition, which can be used to demonstrate fundamental properties of inverse matrices and determinants. After this assignment the student should:

- Understand how inversions and determinants of products.


## 2. Objectives

To achieve the previous goals the student will meet the following objectives:

- Read section 7.7-7.8 of the text book paying particular attention to pages 309-311, 317-318 and 320-322. Specifically, if the students fail to follow the in-class examples then they should work through the steps example 2 from section 7.7 and example 1 of section 7.8.
- Compute matrix inversions and determinants for specific matrices.


## 3. Problems

Given the following matrices,

$$
\mathbf{A}=\left[\begin{array}{rrr}
1 & -2 & 3 \\
2 & -5 & 12 \\
0 & 2 & -10
\end{array}\right], \quad \mathbf{L}=\left[\begin{array}{rrr}
1 & 0 & 0 \\
2 & 1 & 0 \\
0 & -2 & 1
\end{array}\right], \quad \mathbf{U}=\left[\begin{array}{rrr}
1 & -2 & 3 \\
0 & -1 & 6 \\
0 & 0 & 2
\end{array}\right]
$$

(1) Verify that $\mathbf{A}=\mathbf{L U} .{ }^{1}$
(2) Verify that $\operatorname{det}(\mathbf{L} \mathbf{U})=\operatorname{det}(\mathbf{L}) \operatorname{det}(\mathbf{U})$.
(3) One can show that,

$$
\mathbf{A}^{-1}=\left[\begin{array}{rrr}
-13 & 7 & 9 / 2 \\
-10 & 5 & 3 \\
-2 & 1 & 1 / 2
\end{array}\right]
$$

Verify that $\mathbf{A}^{-1}=(\mathbf{L} \mathbf{U})^{-1}=\mathbf{U}^{-1} \mathbf{L}^{-1}$.

[^0]
[^0]:    ${ }^{1}$ This is called the LU decomposition of $\mathbf{A}$ and is useful for numerical computations with matrices. The $\mathbf{L}$ matrix contains a 'record' of the row-steps used to arrive at the echelon-form $\mathbf{U}$. For more information one can see section 20.2 pages 841-842.

