

Journal of Chelsie Wollett for Spring 2008

Chelsie Wollett

April 23, 2008

1 Week of April 3, 2008

1.1 New Equation

I started off this quarter by getting a completely new equation for finding the determinant of a sum,

$$| \mathbb{A} + \mathbb{B} | = \sum_{r=0}^n \sum_{\alpha, \beta} (-1)^{s(\alpha) + s(\beta)} \det(\mathbb{A}[\alpha|\beta]) \det(\mathbb{B}(\alpha|\beta)).$$

My task this quarter is to work with Benigno to find if this formula works more efficiently than the one that Dr. Martin came up with previously.

2 Week of April 10, 2008

2.1 Examples

I spent the week verifying the new equation for 2×2 matrices and then solved the 3×3 case which I was unable to find last quarter. I have begun typing up those examples in *L^AT_EX*. My next task is to try to generalize the formula for more than 2 matrices.

3 Week of April 17, 2008

3.1 General Case

My goal for the week was to try to modify our formula to work for more than two matrices. If successful, I was to try to come up with the formula for any number of matrices. During our small group meeting last week, Dr. Mohlenkamp gave me an idea of where to start. He thought I should try to take one matrix out at a time in the place of \mathbb{B} above, until I had all the matrices by themselves. I was at a total loss on how that would work, however. I might have set myself up for failure. My brain was dead-set that this way was impossible. That you couldn't try to separate out the matrices like that, because they all depended upon each other in order to do the $[\alpha|\beta]$ operation. After struggling for the weekend though, Benigno and I met and discussed the problem. After he thought about it for a minute, he came up with a formula that he thought would work. His formula involves putting this equation inside of itself depending on how many matrices you are working with. I was still a little skeptical, but I did an example on paper using three 2×2 matrices and it worked

out. We are unsure if the notation is proper and if this is absolutely right, but it looks like a great step in the right direction.

4 Week of April 24, 2008

4.1 Lots of Sigmas

Last week, Benigno and I came up with an idea for how to write the determinant of a sum of three matrices. We were very excited because after a quick check using 2×2 matrices, the formula seemed to work. My goal for the week was then to check to see if our power that we were raising (-1) to was correct. In order to check this, I needed to work with larger matrices. However, as I was trying to check our formula, I found that we had a different, more major, error. Our inner summation was causing certain terms to be left out of the final output. We need to fix this before we can move on to check other parts of the formula.

5 Week of May 1, 2008

5.1 Back to the Beginning

As far as I understand it, the determinants group was first formed to find the determinant of a sum in order to work with our electron groups. These groups' interactions are shown in a certain determinant. It ends up that there is an Identity Matrix, and then pairs on the off diagonals. For example,

$$\begin{vmatrix} \mathbb{I} & \mathbb{L}_{12} & 0 \\ \mathbb{L}_{21} & \mathbb{I} & \mathbb{L}_{23} \\ 0 & \mathbb{L}_{32} & \mathbb{I} \end{vmatrix}.$$

So, we have been trying to generalize the formula to work for this matrix and separate it into three certain matrices: The identity matrix, and a matrix for L_{mn}, L_{nm} .

6 Week of May 8, 2008

6.1 Negatives Galore

We feel pretty confident in our formula. We're pretty sure that given any number of matrices, they can be put into our formula and we can find the determinant of their sum. Except for one part. We know how the initial negative one raised to a power works, we know what the power is. For the other summations, we are unsure if the power works the same way or not. This is the part where Benigno and I disagree. He thinks the formula states that the rows and columns can be relabeled as 1, 2, 3...(etc.) I disagree with him. I think that if we renumber our rows and columns, we run the risk of losing or gaining a negative. I've been trying to put off doing an example for fear that it will take forever. But it looks like that's the only step left to take. I'm going to have to do an example and see what happens in each step to know what happens to the negative one.

7 Week of May 15, 2008

7.1 -1 Unmasked

So, after 7 weeks of trying to decide how our -1 really worked, I decided to do an example. It turns out that many of the things we wanted to be true, are in fact true. Our exponent works the exact same with our second negative one as it does with the first. We can also re-label the rows and columns as 1,2,3.... Last week I thought that the second negative one should only matter in the case where the first matrix did not exist. I was right. In the cases where we keep rows and columns from our first matrix, the first -1 takes care of the sign, and thankfully, in our equation, the second -1 is always positive in these cases. So we may be able to simplify our equation so we don't waste time computing subsequent -1 terms.

8 Week of May 22, 2008

8.1 Poster Work

I spent the week working on slides for a poster with Benigno. I have noticed I have a procrastination problem. I found this out while working on my presentation for Nebraska last quarter. But, when working with someone else, this is an even bigger problem. As a pair, we waited too long to get started. Now, we have no time to meet to really fix any mistakes or add anything new at the same time. Conflicting schedules will make it hard to get together before Friday. If we had started earlier, we might have been able to accomplish more. Of course, we haven't really done a large quantity of work this quarter. We've made a lot of steps, but most of it has been to revamp our formula to suit our needs. In a presentation, we do not need to go through all the excess steps, just show the final formula and describe what it means. So, hopefully we can pull off an awesome poster by Friday.

9 Week of May 29, 2008

9.1 More Insight to the -1

I was a little quick to think that the first -1 would take care of everything. Looking back at the examples I noticed that there are terms where the second -1 needs to be there to make the term negative. So, we'll have to keep the negative one there and compute it for each part of the recursive formula. Benigno and I also finished up our slides for the poster. I learned how to do slides without using Beamer, and realized that using pictures with miktex is a pain. I'm going to look into that, and try to find out why landscape and pictures wouldn't work out for me.

10 Week of June 5th, 2008

10.1 End of the Quarter

The final task is to finish up a final report with Benigno about how the quarter went and what we figured out. We procrastinated again so the report is going to encompass a lot of emails. As far as our tasks, I feel that we made a lot of headway this quarter. We covered a lot of ground with deriving a formula. We didn't quite figure out if there is an easier formula for our electron matrices, but we have a lot of knowledge to work with.