Journal of Rob Vanyo for Winter 2008

Rob Vanyo

Winter Quarter 2008

Week of January 16, 2008

This Week's Progress

This week I began thinking about how to approach the writing of my program for my particular task, and also what sort of subroutines would be useful. In particular, I've begun reviewing various previous versions of the Setmaker program from Fall quarter to gain an understanding of how the point conversion from rank 3 to a 2-dimensional plottable point works, and how to generate a postscript plot (I'm not 100 percent clear on these because they were not my assigned task last quarter). I also feel that I gained a basic understanding of my example that I am to demonstrate–I am just unsure of how to pick my summands for the left half of the equation.

Next Week's Plans

In the next week, I plan on deciding how to choose the summands for the sum part of the equation, and also on writing some code.

Week of January 23, 2008

This Week's Progress

This week I adapted and incorporated some subroutines from last quarter's setmaker program into a new program that simply defines basepoints and plots them in a postscript file. Thus, I can now take a list of points and make it into a color-coded plot. There were initially a couple of errors, however, and although they were easily fixed, I do not understand why the fixes worked. I also still have some trouble understanding some aspects of the example I am to demonstrate with my final program.

Next Week's Plans

This coming week I plan to find out why the fixes in my program were necessary and why they worked. I also intend to gain the knowledge required to fully understand the example so that I may then write subroutines that demonstrate it. What I need to know, as in last week's journal entry, is how to pick the point, or the summands of the point, that my limit is to be approaching. I also need to find out or figure out methods of altering the path of the limit (for example, h approaching zero could really be represented as various sequences that approach zero as n approaches infinity).

Week of January 30, 2008

This Week's Progress

This week I wrote the subroutines necessary to generate pictures of the identity. I originally had problems with the subroutine that generates the sequence of points to be plotted, so I rewrote it entirely and it seemed to work, although the picture was uninteresting in that all the points plotted on top of each other, and the topmost one appeared yellow when it should have been close enough to the target point (which is on the plane) to be black. I fixed two errors in the subroutine and I made an option to ran-

domize the basepoints. With the original basepoints, the top point that is shown is now black as it should be. With randomized basepoints, if any other points show at all, they are always in a line, never close to the plane, and the pictures don't really offer the best or most useful information.

Next Week's Plans

In the next week I plan to start on at least one of the following goals. I plan to rewrite the sequence-generating subroutine so that it can approximate a target of general rank, dimension, and resolution. I also hope to have it easily adjustable to approach a general target point (rather than the same specific one I have already used). Also, with respect to the originally chosen basepoints and target, I hope to somehow choose new basepoints in such a way as that I can view the sequence from a different, useful angle, and still guarantee that when I run the program, there will actually be something to look at. Such is not the case with randomized basepoints.

Week of February 6, 2008

This Week's Progress

This week I wrote the subroutine that can generate a sequence of points which approaches a target point of general rank, dimension, and resolution. The only restriction on the target points, by design, is that every dimension of the target point must only have unit entries across the resolution, except for one. This follows the design of the original target point in that it was the sum of the basepoints, and each basepoint only had one dimension that had anything but ones in it.

Next Week's Plans

In the next week, I plan to explore what sort of pictures I can get with various target points, since it is now easy to approach various different targets.

I also plan to make sure that the new subroutine is actually working properly, because when approaching the original target point, the picture shows a yellow dot once more, instead of a black one (which the identity being modeled would call for). I already tested out the subroutine and it seems to return the points correctly–the formula seems intact. But somehow a yellow point shows instead of black, so I plan to explore further.

Week of February 13, 2008

This Week's Progress

This week I wrote a subroutine that randomly generates a target point of a given rank and resolution (due to the structure of all the targets we will be choosing, dimension is not needed to generate a target). It originally multiplied 100, or -100, or some other integer by a random.random() command for each nonzero coordinate. I also wrote a new looped portion of the program so that it could generate and approach multiple targets. The first few tries resulted in some nice pictures, but the randomized targets couldn't seem to escape the triangle formed by the three plotted basepoints. I then changed the random.random() to a randint(-100,100), so that I could incorporate negative values, and have a good range of random values as coordinates. This resulted in a much more varied picture, with plenty of points outside the triangle. There seems to be a pattern in the pictures where approaches to points in the triangle mostly seem to come out of the center, and approaches outside the triangle mostly seem to point towards the center. I'm unsure if this is a result of the nature of the identity, or just a result of the methods of plotting incorporated (the latter seems more likely, since the plot is based on the basepoints, which comprise the triangle).

Next Week's Plans

In the next week I plan to explore the random points a bit more, and see if there is any pattern to speak of. I may also try to think of a set of non-random targets that would cover the whole plot and give me something to look at. Finally, I plan to change the identity (which is currently a central

difference) to a right-hand and left-hand difference, and see what that is like.

Week of February 20, 2008

This Week's Progress

This past week was a busy one. First, I incorporated subroutines that model the identity using a forward difference and a backward difference version of the definition of the derivative. These yielded random plots that looked much different from the original central difference versions. Some of the sequence paths actually appeared to be curved rather than straight. Also, it is clear that the forward and backward difference sequences do not achieve their limits as quickly as the central difference sequences do. I only got black points when I used the faster of the two h-finding subroutines ($h = \frac{1}{2^i}$ rather than $h = \frac{1}{i}$). After a meeting with Dr. Mohlenkamp, I then designed a way to create a grid of specific target points in order to try to gather some more useful information than can be gathered from random plots. The idea was to decide what target should be seen on the plot, then work backwards to see what that target point in separated representation would map to that xy-plot point. Basically, I can specify an interval for x and an interval for y, and a number of x-values and a number of y-values. The program then creates a rank-3 target point for every possible combination of x and y-values. This yielded some interesting pictures, where it is easy to see where the directions of the approaches for each target change drastically. So far, I've only created central-difference plots using this new grid-target point system.

Next Week's Plans

In the next week, I plan to create more pictures using the grid system, just to see what can be seen. I also may try it with the backward and forward differences. Also, I plan to do some housecleaning in the code itself, such as making some parts subroutines that should be subroutines, and importing standardized subroutines from last quarter.

Week of February 27, 2008

This Week's Progress

This past week, I did not manage to generate grid plots using backward and forward differences, as I was more focused on cleaning up the code and creating the word 'MATH'. So, I removed any subroutines from the code that could already be found in 'settools' provided by Dr. Mohlenkamp, and then imported 'settools' and used the subroutines that way in my code. I also made the part of the code that generates grids of target points into a subroutine, since originally I had it in the main body of the code. Thus, I can now call it as many times as I want, although twice is plenty, and sort of useless (compared to just calling it once). I then created a subroutine that takes two xy-points, and generates target points that ultimately map in postscript onto the line determined by the two original xy-points. After figuring out some ideal endpoints on paper, I was able to generate the word 'MATH' by repeatedly calling the new subroutine. I then adjusted some of the endpoints, and decided to use the first h-formula, and the backward difference, just to get more color in the picture (since the backward difference is less efficient). I did not adjust the scale or anything of the actual postscript output, I simply did not understand how those numbers would relate to the xy-coordinates I was already dealing with. To deal with the basepoints that get plotted as a triangle, I simply added the option to not include them in the final list of points to be plotted.

Next Week's Plans

I suppose next week I should begin the actual write-up for the quarter. I may explore a little more, maybe using backward and forward differences with the grid style of targets.

Week of March 5, 2008

This Week's Progress

The first thing I did this week was try to improve the look of the 'MATH' picture, and I did, although I am not altogether satisfied with it yet. I also tried to write a more general version of my pointslope subroutine, that will return a list of rank = 3*rank-of-basepoints on a specified line. These points will be in the general separated representation format that the Sets group has been using all along, and not in the format that I exclusively have been using for my own portion of the project. In other words, dimension is taken into account in this version. Unfortunately, I have had problems with this subroutine, and it is not yet completed. I cannot seem to get the coefficients of each basepoint (because each new point on the line will be a linear combination of the basepoints) to multiply correctly. I found and fixed a couple of errors while trying to solve the problem, but the fixes made no difference, at least, concerning the problem of the coefficients. I have confirmed that coefficients are found, and they seem correct, it is only in implementing them that there seems to be an error.

Next Week's Plans

In the next week I plan on finalizing the 'MATH' picture, fixing the new subroutine so that it can maybe be included with Settools, and writing my report for the quarter.

Week of March 12, 2008

This past week, I mainly focused on writing my final report. It is done, unless I decide to add one more section that may or may not be necessary before turning it in. I have not had much progress in making the line-generator for settools that takes two xy-points as inputs. I know that all I have to do is convert the two xy-points into separated representation points, and then feed those to the existing linepoint subroutine, but I can't seem to make it work and I've scrapped the whole thing, possibly to start

from scratch before this week is up. The problem was probably in my looping through the ranks and dimensions of the basepoints to multiply the proper coefficients into the entries. The other problem with such a subroutine in general is that it will have to generate points that are 3 times the rank of the basepoints (because the only way to convert xy-points to separated representation points is to make a linear combination of the basepoints). Finally, I have finalized the 'MATH' picture as far as I can at this point. I don't really like the way it looks, mainly because of the pattern and directions of the colors. Krishna has been working on a subroutine that can easily relocate and rescale the postscript plots, so in the future, I hope to be able to relocate the word 'MATH' to a place where the colored sequence tails will look better.