Journal Report 4
9/23/19-9/30/19
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Daily Log

Monday September 23

Looked into Mathematica's graph features and started implementing weighted graphs.

Tuesday September 24

Finished my implementation of weighted graphs and plugged it into Mathematica. It didn't work for FindMaximumIndependentVertexSet. Looked into more specfic methods for FindMaximumIndependentVertexSet.

Thursday September 26

Found a solution by specifying the exact number of vertices that are needed in Mathematica's function. Finalizes a proof for .316 for symetric cases on -1,0,1

Timeline

Date	Goal	Met
9/16	Find a lower bound for {-1,0,1}^{3} with varying amounts of 0s	Yes, I found that of the $6n^2 + 12n + 8$ terms (n being the number of 0s), I can always make $2n^2 + 4n + 2$
9/23	Find a lower bound for {-1,0,1}^{3} with varying amounts of 1s and -1s as well	Sorta. I found a conjecture for a lower bound which seems to be correct, however the dataset is too big for Mathematica to verify.
9/30	Find a way to make Mathematica work with weighted vertices in order to finalize the {-1,0,1}^{3} case with varying amounts of 1s and -1s	Yes, by specifying the exact number of vertices required by Mathematica. This shows 100/316 to be a minimum for symmetric cases.
10/7	Find an answer for asymmetric amounts of 1s and -1s.	
10/14	Find a proof showing that symmetry is optimal, or find a more optimal construction,	

Reflection

This week, I worked on finishing my proof from last week. This involved getting Mathematica to show that the MIS of $\{-1, -1, 0, 0, 0, 1, 1\}^3$ was 100. I originally tried using weighted graphs. I was able to create the weighted graphs, but Mathematica's MIS method did not take into account the weighted vertices.

After studying more of Wolfram's doccumentation, I tried looking for specific values and seeing if they could find the set. This allowed me to show that the MIS was 100. This proves that with symmetric amounts of 1s and -1s, which is intuitively optimal, the lower bound we create is 0.316. This is very close to the literature.

Next week, I want to formally look at the case with asymmetric amounts of 1s and -1s to finalize my study with -1s, 0s and 1s. After that, I want to move on and analyze the situation when I add in 2s and -2s as well.