

# 15-400 Report 6

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## 1 Major Changes

No big changes. These several weeks we have tried to work out a solution for cartesian product graph, since our ultimate goal is to beat such a graph. The formulation is as follows: most of current algorithms can be reduced to matrix multiplication or a linear solve, cartesian product of graphs are just kroncker sum of matrices, so is it possible that we find solution on separated graphs, then combining them by some smart ways to get a solution on the product?

## 2 Accomplishments

Random walk and local pagerank has been implemented and tested. Due to intrinsic quadratic space requirements for this algorithms, I cannot test on very large dataset on my computer.

## 3 Meeting Milestones

Last time I mentioned to finish local pagerank, and that has been achieved.

## 4 Surprises

Since these weeks we focused on solving cartesian product graphs, we kind of getting a sense of what does these whole things look like. Previously, we thought that it should be easy to derive a solution on product given solutions on smaller graphs, however, the dynamic turns out to be pretty mysterious. Since kronecker sum, which is the main operator we are working with preserve the eigenstructure, in the sense that eigenvalues are direct sums and eigenvectors are direct products, so we expect things to be easy since eigenspace is nice. However, random walk and local pagerank give rise to solution that does not look like direct product at all. CRD seems to preserve product structure, but due to its complicated nature, it's hard to clean it up and give a nice interpretation.

## 5 Look Ahead

Two parts: 1). Give a final try on product construction I mentioned above, specifically, we will look at the values on each small graphs, and decide whether we can do something to that. 2). Finish experiments using different algorithms on at least two kinds of “hard” product graphs.

## **6 Revisions**

No big revision, and no time for revisions really.

## **7 Resources**

No.