

MATH 2310, EXTRA HOMEWORK ASSIGNMENT

DUE TUESDAY, DECEMBER 10, 2019 AT 11:59PM

This bonus assignment is for those who want a challenge and to see an actual real-world application of all these linear algebra concepts that we learned about in class. It is long, it is difficult, but it can also be rewarding for those who have an interest in seeing how the concepts we have learned in class so far are harnessed to approach something larger than the scope of a few textbook problems.

The subject of the assignment is PageRank, which was a key development in the initial Google search engine. It has grown increasingly sophisticated since its inception, but at its core is a linear algebra solution to a natural problem: how do you determine which webpages are most relevant for your search query? While it is not PageRank alone that led to the success of Google—there were any number of other factors that were also responsible for its great success—it is difficult to point to a case as prominent as this in which a key role was played by a new mathematical development, especially one that is so comprehensible (at least, with some linear algebra under your belt).

Your assignment: Read the article “The \$25,000,000,000 Eigenvector” by Kurt Bryan and Tanya Leise:

<https://www.rose-hulman.edu/~bryan/googleFinalVersionFixed.pdf>

There are about 24 problems in this paper (e.g. Exercise 6 has 3 parts, Exercise 10 has 6 parts), and your task is to answer as many of these as you are willing and able. These problems are considerably harder than anything from the textbook. However, given enough time and effort, this is completely doable with the material we have developed so far.

You may also be interested in looking at the original paper: “The PageRank Citation Ranking: Bringing Order to the Web” by Larry Page:

<http://ilpubs.stanford.edu:8090/422/1/1999-66.pdf>

As usual on the homeworks, you are allowed to work with your classmates on this assignment, but you *must write up your solutions individually* and *state who you worked with on which problems*. If you consult sources other than your textbook, they must be cited. **Your answers must be in complete sentences.** In particular, solutions without justification, or those consisting of merely diagrams, equations, or matrices will receive little to no credit.

How to submit: Turn in *typed*—not handwritten, not scanned—problems and solutions—rewrite the problem statements and write your solutions below them—directly to my email (bwh59) in both PDF form and editable form (e.g. .pdf file and .tex files if you want to use L^AT_EX, or a .pdf and .doc file, etc.) by 11:59pm on the last day of classes: Tuesday, December 10.