Graph Theory: Assignment 5

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1. 1. Give details – two paragraphs will suffice – about your choice for the end-of-semester project.

   If you are doing a graph theorist's sketchpad, provide details about the language and/or environment you're doing your coding in. Also, how are you implementing vertices, edges, adjacency, and other structural data? For instance, I used the Processing environment for the sketchpad I use in class and I implemented vertices and edges as an array structure. I would then expand on this information in the writeup.

   If you are doing a narrative paper, provide information about your potential topic of choice. If you have not yet narrowed down to a specific topic, discuss broader themes that you're considering ("Algorithms that use tree-like structures"; "Graph coloring problems"; etc.) Provide details about how you'll structure the narrative (an outline, for instance) and provide some details about suitable references (going beyond Wikipedia) about your topic.

   If you're being adventuresome and considering the linear algebra project, give a brief description of how you'll implement vertices, edges, adjacency, centering on matrix, and vector data. Also, how do you anticipate dealing with eigenvalues and eigenvectors?

   (a) Solving Sudoku's puzzles using Graph coloring algorithm:

   Sudoku is a famous puzzle that should be loaded up with numbers. A couple of numbers are provided as need might have arisen to be filled keep a basic guideline: they cannot be repeated in the same row, column or region. This puzzle, regardless of utilizing numbers, is certainly not a numerical puzzle, but a combinational puzzle that can be solved with the help of graph coloring.

   We can convert the puzzle to a graph. Here, each position on the grid is represented by a vertex. The vertices are associated in the event that they share a similar row, column or region. As the connection between vertices goes the two different ways, this graph is an undirected graph. A significant component of the graph is the assignment of a name to every vertex. The name relates to the number utilized there. In graph theory, the labels of vertices are called colors.

   To solve the puzzle, one needs to assign a color to all vertices. The principal decide of Sudoku is that each row, column, or region can't have two of similar numbers, in this manner two vertices that are associated can't have a similar color. This problem is called graph coloring and, as with other graph theory problems, there are a wide range of calculations that can be utilized to tackle this issue for instance: Greedy coloring or DSatur algorithm.

   The coloring problem is utilized for very fundamental problems. However, there are more real-life problems that can be translated to a coloring problem, such as scheduling tasks. For instance, planning tests in rooms. Every test is a vertex and there is an edge interfacing them on the off chance that it requires place at a similar investment. The diagram made is called a stretch chart, and by tackling the base shading issue of the chart, you get the base number of rooms required for every one of the tests. This can be summed up with errands that utilization similar assets, like compilers of programming dialects or transfer speed designation to radio broadcasts.

References

1. http://www.ams.org/notices/200904/tx090400460p.pdf
2. http://www.conceptispuzzles.com/index.aspx?uri=puzzle/sudoku/techniques
3. http://norvig.com/sudoku.html.

2. 2. In the current era, media beyond written sources have been effective in communicating complex mathematical ideas to a broad audience. Shining examples of this include YouTube videos such as the 3Blue1Brown videos produced by Grant Sanderson. Find and provide a short synopsis of two YouTube videos each effectively explaining a problem that involves graph theory. A "short synopsis" includes the URL along with at least two paragraphs of explanation and/or narrative.

   (a) 1. https://youtu.be/Tnu_Ws7Llo4 : A Breakthrough in Graph Theory – Numberphile

   Showing that a Sudoku can be converted into a graph coloring problem shows that it is either NP-Complete or NP-Hard (not entirely sure which one. One way it shows the one the other way it shows the other. 9-COL then can be converted into a SAT problem. And I don't know where I'm doing with this but it's just great I found something that touches on my knowledge of theoretical informatics.

   video is about Hedetniemi's conjecture which is named after the mathematician who first came up with it. Video talks about graph coloring. It shows conjecture that states: the minimum coloring on one of your original graphs is the minimum for your mega graph later on your tensor graph. This conjecture stuck around more than 50 years. And recently mathematician named Yaroslav Shitov came up with counter example. He showed that if you choose your original graph in just the right way and choose just the right number of colors for building your exponential graph; then if you take those two graphs and tensor them together in the way,you're gonna end up with a tensor product that needs fewer colors than either of those two graphs.The graphs that he ended up describing are absolutely humongous. The graph G, first graph had 4^{100} vertices and the exponential graph had 4^{10000} vertices. That is infinity number but that proves conjecture false.

   2. https://youtu.be/CDMQR422LGM : Miracles of Algebraic Graph Theory

   Video talks about how graph algorithms can help you predict real-world behavior and why an averages approach fails to describe group dynamics. It shows algorithms to apply for various types of optimal paths, influence in a network, and community detection. It also shows use cases that span across industries including recommendations, resiliency planning, fraud prevention, and traffic engineering/routing (such as IP and call).

   In live demo, it shows the kinds of information we can retrieve and decisions we can make based on results from different algorithms and sets of data. It states visualization done on graph data of example given which was done in viz.js which is open source library. Based on the size of the node that's betweenness centrality so the larger the node the higher the betweenness centrality the thicker the relationship the higher the PageRank and the colors represent the different communities that are represented in the graph data.