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Math/CPT_S 453

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HW 6

1. I am doing the PowerPoint. I am considering the following topics:
    - Dinic's Algorithm
    - Group Theory
    - Steinitz's Theorem
    - Tutte's Algorithm
    - Ranking Network Flow problems
2. Here are the YouTube videos I found involving Graph Theory

How to Solve a Crime with Graph Theory
https://www.youtube.com/watch?v=TwHy2DuWB3k

The video goes through a type of logic problem using a graph to solve it, and then forming an algorithm. Take a node, count the number of lines going into it, then repeat it for each node. Starting from a graph with 3 nodes (or people) and then going onwards, it's able to help track down the answer to the logic problem given some criteria. It's a sort of introductory video intended to get people interested in Graph Theory.

A Breakthrough in Graph Theory – Numberphile
https://www.youtube.com/watch?v=Tnu_Ws7Llo4

This video talks about the solving of Hedetniemi's conjecture. The conjecture involves problems regarding graph coloring (color each node such that when two nodes share an edge they are different colors). The question asked at first is what's the smallest number of colors I can use in this problem? Each connection made in the graphs here revolves around incompatibility. Then upon having 2 graphs with those types of connections they are then combined as Tensor Products. As more and more colors are used, the minimum number of colors needed for the graph got more confusing. In 1966 Hedetniemi conjectured that the minimum coloring on one of y our original graphs is the minimum for the tensor graph.

Decades went by until Yaroslav Shitov came up with a counterexample to the conjecture. Shitov showed that given a graph G and an exponential graph H, if you shape G in a right way and choose the right number of colors for the exponential graphs, if you take the two graphs and tensor them in the right way, you'll end up with a tensor product that needs fewer colors than either of the two graphs.

Group Theory, Abstraction, and the 196,883 – dimensional monster
https://www.youtube.com/watch?v=mH0oCDa74tE

A group action is a collection of objects that when interacted with in specific ways they remain symmetric (A collection of actions that result in symmetry). The amount of actions in these groups are formed by permutations of organizations of them, S_n. The structure of the group actions showed the impossibility of a quintic formula (5-parentheses version of quadratic formula). By abstracting groups, it becomes easier to work with groups (in an analogous ways to how numbers represent counts). When there is a 1-1 mapping of rotations of cubes and composition of n-vertex graphs, it is called an isomorphism.

The video then asks, "What are all the groups up to isomorphism? "or "What are all the ways things can be symmetric?" The video limits this question to finite groups. It's broken down into 2 steps: Find all the simple groups, then find all the ways to combine simple groups. Mathematicians have already found all the simple groups, and have proven that they have been found, consisting of 18 infinite families and 26 groups that don't fit the families, 19 of which derive from one of those groups, the monster group.