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SYOP for Week 6

As I was studying the textbook I came upon a term called the "traveling salesperson problem". I had briefly heard professor from a computer science class last year mention it, but I never really looked into it. I will investigate this problem for the SYOP this week.

This problem (in terms of graphs) is as follows - given a weighted graph P, find the shortest path for the salesperson to visit every vertex (market) in the graph and return to the starting point. This problem is easy to visualize. But to put it into mathematical terms, this means the salesperson wants the minimum-length Hamiltonian cycle for the graph P.
I like to think of this as a recursive depth-first search type of math problem. Investigate the shortest path from the starting point and find all possible paths. Do this for every path until all the possibilities have been mapped and then the smallest number represents the shortest path. This is a common algorithm seen in many difficult computer science problems. I always wondered if there was a mathematical equivalent to this programming problem because computer science and math are so closely related. After studying Hamiltonian cycles in this class I feel like the problem of the traveling salesperson is a lot clearer now — the mathematical approach makes more logical sense to me than the computer science way. I even implemented a Python algorithm using concepts the professor gave in lecture to calculate the traveling salesperson algorithm because I'm so glad I understand now.

Rough pseudocode for my algorithm

```
def travelingSalesman(graph, s):
    store all the vertices besides the starting one
    for all possible paths:
        store minimum weight Hamiltonian cycle
            find another path's weight
            compute this current path's weight
        if this new path is less than the minimum, update the minimum
    return the minimum after all paths have been investigated
```

I honestly had no idea how to do this before for a project because I couldn't conceptualize it. The concept of the Hamiltonian Graph has truly helped me grasp this topic now!