A Wandering Student

Question

As a team of international students, each one of us seems to be a hitchhiker in our journey through this graduate program and our exploration of this vast country. How then would a wandering student, hitchhiker if we would, plan an optimal journey on this road trip? What are the constraints that hold this individual back? Given some resources, a plan to get more resources, all the time in the world, and multiple ways of exploring, how would this individual fare against this maze?

Let's talk Context

This project is intended to help us explore the concepts of **Dikjstra's Algorithm, Prim's or Kruskal's Algorithm, Greedy Techniques, the Knapsack problem, and potentially Dynamic Programming**.
As a team, the four of us have empathized with each other on our passion to explore the state and get to know more about this country. To that end, we thought about modeling a hitchhiker who would travel across a fixed number of vertices – locations in Maine – in our simulated **Directed Graph**. This hitchhiker, let's call him Husky, starts off from a fixed vertex with a limited amount of resources. Husky would then have to find a way to visit all vertices all while trying to meet a few conditions to win some additional resources at each vertex. Moreover, each vertex represents a location in Maine and hence has an associated property which would mean Husky could spend more time at that vertex or less time. This directly affects the mode of travel or different modes of travel to that vertex.
Would Husky be able to visit all planned locations in Maine? Or would he fall short because of resources? Let's find out!

What does each one of us have to say?

Through the eyes of Hakshay Sundar:
As a student, like many others, I, too have a limited amount of resources and the hope to explore more of the world around me. Thinking of this, a hitchhiker comes to mind, exploring at random the various places around them and finding ways to maximize their resources. Doubling down on that thought, I could relate to a few more processes such as: a CPU scheduling tasks while taking into consideration a wide range of constraints and working to optimize the output; animals moving from one place to the other in the hopes of increasing their food supply, potentially staying in a warmer climate, etc... This project allows me a chance to try and understand these operations more closely to some extent all while giving me a chance to model my hope of traveling around and exploring more of this pale blue dot — Pale Blue Dot by Carl Sagan.

Through the eyes of Saanidhya Vats:
In our lives, particularly when we embark on a journey as tourists to a new destination, our expectations for exploring the city can vary significantly. Some individuals aspire to visit every renowned landmark swiftly, while others prefer a more leisurely exploration of fewer places. Some aim to navigate the city in a manner that minimizes overall travel costs. Given that everyone is unfamiliar with the new surroundings, pursuing specific objectives becomes challenging. Our project seeks to address this challenge by offering diverse routes tailored to individuals based on their available resources and specific goals. This solution is not only beneficial for tourists but also extends its utility to students, like ourselves, who are newcomers to a city. Students often wish to discover the city while managing their finances or earning some additional income. As a student, this project holds significant relevance for us.

Through the eyes of Rashaad Mirza:
As an individual deeply passionate about the intersection of technology and human experiences, I find profound personal relevance in our project, which focuses on optimizing travel routes for hitchhikers. Drawing parallels to the hitchhiker's quest to explore diverse places while minimizing costs, I see this project as a mirror to the intricate dance of balancing constraints and optimizing outcomes. This endeavor resonates with my curiosity for efficient systems and aligns with my belief that technology can significantly enhance personal experiences. It serves as an invaluable opportunity to delve into the complexities of route optimization, akin to the hitchhiker strategically navigating their path. Additionally, the implementation of concepts learned in class and understanding their real-world applications excites me, bridging the gap between theoretical knowledge and practical solutions. Moreover, I am confident that the skills and insights gained from this project will undoubtedly fortify my pursuit of another project idea, focusing on the seamless and personalized integration of daily tasks with travel experiences. Like every hitchhiker with a unique story, I am enthusiastic about contributing to the narrative of our project, weaving together the threads of exploration, efficiency, and the human element in travel.

Through the eyes of Hardik Bishnoi :
As the global landscape becomes increasingly interconnected, international students often find themselves exploring new and diverse experiences in unfamiliar territories. From my own experience, stepping into foreign lands with limited resources commanded high-level resource optimization to deal with cultural, geographical, and financial challenges. One can say that such an experience is no different from a hitchhiker trying to explore new lands with confined resources. Our final project for algorithms is to model such a scenario with a hitchhiker and understand how various variables affect optimal route planning. I have always been interested in how various algorithms can actually be put into practical path planning [**1**]. I want to utilize the knowledge I have gained about various algorithms in class by implementing this model and understanding the nuances of implementation.

Scope of our project

Whilst discussing our project we came up with the following points that we needed to focus on. Therefore, the intended scope of our project is as follows:

- Maze Structure
- Weight Costs (random or selected)
- Different kinds of weights
  - The attractiveness of a node: whether Husky wants to stay at a node for longer etc...
  - Mode of Transport available including the Time Constraint
- If Husky is aware of all the nodes or only nodes at a certain depth.
- End conditions:
  - Explore maximum nodes with minimum resources spent
  - Explore all nodes in the maze
- Graph and document results

While working on developing the maze structure, we intend to come to a consensus on the techniques and properties we will fix in order to maximize our learning given the short time span.

Sprint Planning

As of **November 15^{th}**, the team has completed formulating the project, discussed on ideas to build our maze structure, and created this proposal.

The plan for the upcoming **2 weeks** is as follows:

- Generate a Graph with $\approx$ **20** nodes
- Plan travel routes between these nodes
- Determine allocation of weights for each edge
- Determine a method to provide positive resource allocation
- Determine properties assigned to nodes that affect the mode of travel chosen by Husky

We intend to identify pain points and assign more members to work on those while fewer members work on simpler points to meet the sprint plan.

Team Data

Guide: Professor Jonathan Mwaura

- Hakshay Sundar [**NUID: 002249420**]
- Saanidhya Vats [**NUID: 002709621**]
- Rashaad Mohammed Mirza [**NUID: 002844720**]
- Hardik Bishnoi [**NUID: 002807991**]

References

[**1**]: Vehicle Routing, Google OR-Tools