Your Order has Arrived: How to Deliver Food Efficiently

1. Introduction

1.1 Background and context

Due to the Covid-19 pandemic outbreak, strict social distancing restrictions have been imposed around the globe. As a result, the use of food delivery services is growing increasingly prevalent in our society.

Different food delivery companies have adopted different methods to design routes for delivering orders. Selecting the right route is essential as it directly influences a company's cost and profit. In order to design the optimal route, one must take into account many factors such as distance, the sequence of orders, the number of orders and customer experience, etc.

In our project, we are going to develop a mathematical model to determine the optimal route for a rider to deliver food orders. We will start with basic assumptions and continue modifying the model to accommodate different conditions. Through examining various parameters, we will weigh them in order of importance and construct a comprehensive model.

1.2 Restatement of problem

- Construct a model to design an optimal route for one rider to deliver all orders, by
  a. Minimising total distance of route
  b. Maximising customer's user experience
- Explain all assumptions and factors
- Derive an algorithm illustrated with concrete example
- Evaluate the model

5. Conclusion

In this project, we constructed a mathematical model to determine the optimal route for a rider to deliver all the orders. First, we investigated the total distance travelled by considering different factors respectively. Afterwards, we compared the average waiting time and standard deviation in different approaches and computed the effectiveness of each parameter. After ranking the factors with different proportions, we perfected it by setting up conditions for other factors. Lastly, we implemented our model on a computer program to test the accuracy and efficiency of the model.

6. Reflection

This project expanded our understanding in methods to obtain the shortest route, and enriched our knowledge on mathematical modelling. Through this insightful and meaningful opportunity, we broadened our horizons in the world of mathematics.

In the process of researching, we also touched upon interdisciplinary concepts such as Newton's Law of Cooling, which aroused our interest in other fields of knowledge. In addition, we are encouraged to stay curious as we learn that simple daily life activities such as food delivery actually involve complex calculations in order to support its operation.

Although we were unable to discuss the project in person, we still managed to schedule regular meetings and divide our work to ensure continuous progress. We gained communication skills and recognized the importance of teamwork. All in all, we are very grateful for the chance to investigate this intriguing problem, and we thoroughly enjoyed exploring this topic. We are also thankful for Mr Lee who devoted a lot of effort to guiding us towards the right direction.

8. Reference

[1] Sawano M., Masuda H., Iyota H., Shimoyamada M.. (2021). Melting Characteristics of Ice Cream. Retrieved from
https://www.cetjournal.it/cet/21/87/057.pdf

[2] Robert Floyd. (1962). Algorithm 97: Shortest path. Retrieved from
https://dl.acm.org/doi/pdf/10.1145/367766.368168

[3] U.S. Department of Agriculture. (2020). How Temperatures Affect Food. Retrieved from
https://www.fsis.usda.gov/food-safety/safe-food-handling-and-preparation/food-safety-basics/how-temperatures-affect-food

[4] climatedata. (2012). Climate Hong Kong. Retrieved from
https://en.climate-data.org/asia/china/hong-kong/hong-kong-977986/

[5] Manitoba Health. (2013). FOOD SAFETY GUIDELINES FOR THE PREPARATION OF SUSHI. Retrieved from
https://www.gov.mb.ca/health/publichealth/environmentalhealth/protection/docs/sushi.pdf

[6] Minnesota Department of Health Food. (2019). Temperature and Time Requirements for Food. Retrieved from
https://www.health.state.mn.us/communities/environment/food/docs/fs/timetempfs.pdf

[7] Janet Shiver. (2003). Boiling Water. Retrieved from
http://jwilson.coe.uga.edu/EMT668/EMAT6680.2003.fall/Shiver/assignment12/Boiling%20Water.htm

[8] Indiamart. Retrieved from
https://m.indiamart.com/proddetail/motor-cycle-delivery-box-8438123612.html

[9] Alibaba. (2022). Fast Food Paper Bags for Food Takeaway. Retrieved from o
https://m.alibaba.com/product/1600447094973/Recycled-Kraft-Paper-Bag-Custom-Logo.html?spm=a2700.7724857.topad_classic.d_image.776e1a474sp4wk&redirect=1

[10] MotorcycleHabit. (2020). What Happens When You Put Too Much Oil In A Motorcycle?. Retrieved from
https://motorcyclehabit.com/what-happens-when-you-put-too-much-oil-in-a-motorcycle/

[11] CarProUSA. (2022). CarPro Guide To Oil Changes, Synthetic Oil and Oil Consumption. Retrieved from
https://www.carprousa.com/blog/car-pro-guide-to-oil-changes-synthetic-oil-and-oil-consumption