

Optimal Rice Distribution Route using the Greedy's Algorithm

Anita Christine Sembiring, Jason Wang, Viviana, and Mariana Sibuea

Abstract— Distribution is the activity of distributing goods directly or indirectly to consumers. Rice is the main food ingredient for Indonesian people. This study aims to determine the shortest route that is effective in distribution so that the company gets the minimum cost and prevents losses. The research was conducted at one of the rice distributors in Medan, it is known that the distributor does not yet have an optimal distribution channel. The data analysis method used to solve the distribution route problem is the Greedy Algorithm. The greedy algorithm is an algorithm that solves problems step by step, and it was one of the methods in optimization problems. The calculation results show that the shortest and fastest routes to be taken based on the Dijkstra algorithm are: A-20-19-18-17-E-B-12-13-14-15-29-28-F-26-C-8-9-D with a distance of 50,21 km.

Index Terms— Greedy's algorithm, product distribution route, shortest path.

I. INTRODUCTION

DISTRIBUTION is one of the important aspects in industry, therefore, the distribution problem needs to be considered to avoid distribution problems or constraints that can mainly cause losses to companies or producers. With distribution, the production will reach consumers located quite far away. Therefore, the distribution must use the optimal route. However, not all companies have optimal distribution routes, it caused by a lack of awareness and lack of knowledge from the company. The company's decisions in determining the distribution strategy and distribution route would be determine the smooth running of the distribution process [1]. To choose the optimal route and shortest path, it is necessary to know the distance between the destinations. Then the optimal path is chosen from the starting point to the destination point.

Distribution is a process of delivering or services from producers to consumers and users, when and where the goods or services are needed. The distribution process basically creates utility (utility) of time and place [2]. A common

problem studied in distribution is determining the shortest path, and research is carried out to determine the best method to solve the problem.

The shortest path frequently arises in practice since a wide variety of real-life problems aims to send some goods between two specified nodes in a network as cheaply as possible. Traditional SP problem requires precise arc weights, which is not always the case in real-life applications [3]. The increasing of IT and system had influenced the efficiency of activities in an agency or company, which is a problem is solved with the development of technology and information system [4]. Greedy's algorithm is an algorithm that solves problems step by step and it was one of the methods in optimization problems [5]. In this case, the Greedy's algorithm used to optimize the distribution route of the rice distributor in Medan area.

The Vehicle Routing Problem (PVRP) method produces vehicle schedules and routes with minimum transportation costs. Determine the distribution route taking into account the means of transportation used with the pick-up and labor costs must also be considered because they affect the company's operating costs [6-8]. Product distribution is the delivery of products from the locations where they are produced to consumers who will use them. The optimal distribution process will deliver the product to the consumer on time [9-12]. The optimal distribution route that minimizes distribution costs in the distribution center is currently still considered high by the company, so the distribution center is proposed to be relocated. With this relocation, the company is expected to be able to can easily distribute their products and reduce distribution costs. In this study, the problem-solving method uses the djikstra algorithm to determine the proposed distribution location node, which is used to determine the facility's location that minimizes distribution costs from the warehouse to the consumer [13-17].

II. PROCEDURE FOR PAPER SUBMISSION

A. Methodology

The type of research used in this research is descriptive research, it describes a problem that exists and then provides an offer as the final result and conclusion. This study used the Dijkstra's algorithm to determine the shortest path optimally. It had procedures of a model were as follows:

--First, identification of requests obtained, mileage used, and available vehicles from the distributor

-- Graphed the initial mapping of distribution routes

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-- Dijkstra's analysis of the distribution routes.

This research uses google maps as utilities to get information. Google Maps has several facilities that can be used to find a location by entering keywords, such as city, street, and place name [6].

B. Establishment of Mathematical Model

Greedy's Algorithm provides a simple and easily applicable method that can compete with more complex metaheuristics [7]. This algorithm is based on moving edge per edge or arc per arc, and at every step taken did not prepare for future consequences, greedy's not always give a definite optimum result but can give a result that was close to optimum [8].

The procedure of Greedy Algorithm [5]:

-- Build the candidate set C. Candidate set C was a set that contains elements forming a solution.

-- Initialize the solution set as an empty set.

- Select the node to be filled with color with the node selection function. The node selection function is a function that selects which node to choose colored first. The priority of working on a node is seen from the node with the greatest degree.

- Select a color candidate by using the color selection function. The color selection function is a function that will select the color used in coloring the map.

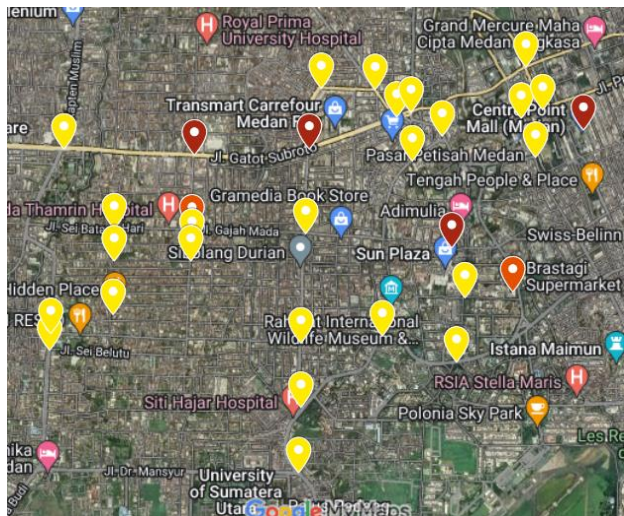


Fig. 1. Initial node of distribution area of rice distributor

Check the eligibility of the selected color using the eligibility function. The feasibility function is a function that checks whether a color is suitable for use. Eligibility check can be seen on the vertices that are adjacent to the vertex to be colored. There are 2 stages in determining the appropriateness of the color to be used on the node, that is :

- Selection of the solution set S is carried out. If the solution S is feasible, then that color is used for node coloring.
- If none of the feasible colors from the solution set S, then take a new color from the candidate set C that has never been used for the node. The appropriate color to use for the selected node will be put it in the solution set S, if the color is not feasible, then process back to step 2.

- Incorporating colors into elements of the solution set S. The solution set S was the set that contained the solution elements problem.

- Check if the solution includes coloring all vertices using an objective function. An objective function is a function that assigns a value to solution S. The coloring process is complete when all vertices have been colored.

TABLE I
NODE AND LOCATION NAME

Node	Node Location	Node	Node Location
A	Medan Rice Distributor	15	Merdeka Walk
B	Lotte Mart Centre Point	E	Brastagi Tiara Supermarket
1	Hydraulic Dorsmer	17	Pertigaan RA Kartini
2	Waunk Kitta	18	Pertigaan Jenderal Sudirman
3	J&T Express Darussalam	19	Persatuan Radio Siaran Swasta
4	Pangkas Rambut JR11	20	Bank Syariah Indonesia
5	Richeese Factory	21	Maruso Boutique
6	Domino's Pizza	22	Pertigaan Dr. Manyur
C	Brastagi Supermarket Gatot Subroto	23	Universitas Medan Area
8	Mie Ayam Jati Babar	24	Benz Ponsel
9	Baby Milano Photography	25	Perempatan Jalan Kapten Muslim Kantor
D	Transmart Carefour	26	Kecamatan Medan Petisah
11	Tugu Air Mancur	F	Lottmart Sun Plaza
12	WS Jaya Service	28	Alphamart Convenience Store
13	Perempatan HM Yamin	29	Philips Electronics
14	ATM Mandiri Graha	15	Merdeka Walk

C. Initial Optimization of Distribution Path

In determining the shortest route, the locations shown by node would make a grap [9]. The shortest path between two vertices that pass through certain vertices [10]. This rice distributor has several distribution points in of Medan. Distribution was carried out product from the Distributor's location to several supermarkets as distribution points.

Distribution had to be carried out at different locations, so a trip from one delivery location to another required.

The nodes are the locations of crossroads, small shops, places to eat, and shops that sell services. The entered nodes

are then numbered along with letters to make it easier to identify the location on the graph. As the procedure, Greedy's used coloring the to make esier to identidy the route. One of the methods in graph theory used in solving The applicable problem is graph coloring. Graph coloring is divided into three parts, namely vertex, side, and region coloring [11]. The Algorithm repeatedly picks up the nodes with the shortest route and goes at the destination node12.

The route modeling of the study was to made an algorithmic calculation from node A which is the Rice Distributor in Medan as the initial location for reading to several nodes as the destination for rice distribution, namely node B, node C, node D, node E and node F. From the results of the calculation with these results, one shortest route will be generated that will pass through node B, node C, node D, node E and node F so that rice can be distributed faster and did not take longer.

III. EXPERIMENT AND DISCUSSION

In normal conditions, this distributor has a distance of 2 km to the nearest point and 6.1 km to the farthest point. Furthermore, because the distributor does not have any route to distribute the product, this research can't determine the total mileage of the distribution process.

In this calculation, it was necessary to determine the shortest route from node A to the nearest node. There are two closest nodes from A, namely node C and node, so it was necessary to calculate the route from node A to node C and node A to node, respectively.

The calculation of Greedy's algorithm from point A to point F is as follows:

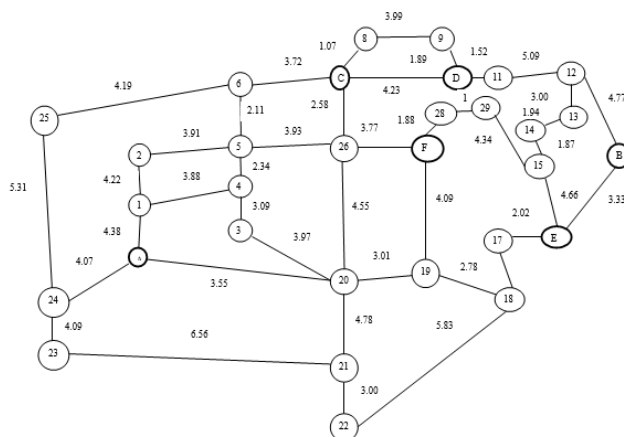


Fig 2. Pre-mapping without algorithm

Step 1:

From point A there are 3 paths that can be taken to point 24, 1 dam 20. Since the distance between point A and point 20 was the shortest, it's chosen to point A.

Step 2:

After had been going to point 20, the point 20 also had branche to points 26, 21 and 19. So point 19 chose because

it was the shortest distance of the three distances that can be traveled from point 20.

Step 3:

After point 19, then looked for the shortest distance between the 2 branches, namely to point F and point 18. The shortest distance from point 19 was point 18. So the route that has been determined was A-20-19-18.

Step 4:

After getting to point 18, then to point 17 because the only branch was at point 18.

Step 5:

From point 17, next point was E because it was the only branch from point 17.

Step 6:

From point E, next point was B because it was the only branch from point E.

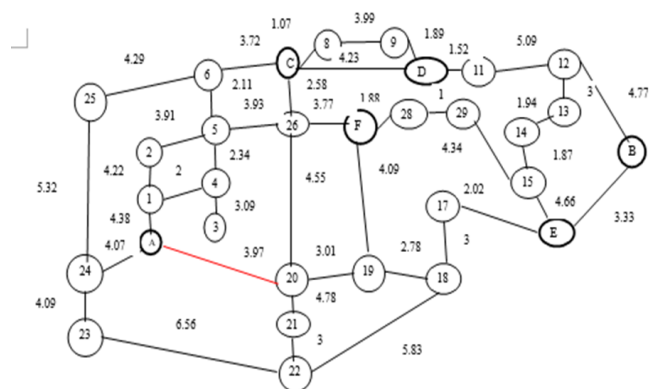


Fig. 3. Iteration of temporary shortest route. Result from step 1.

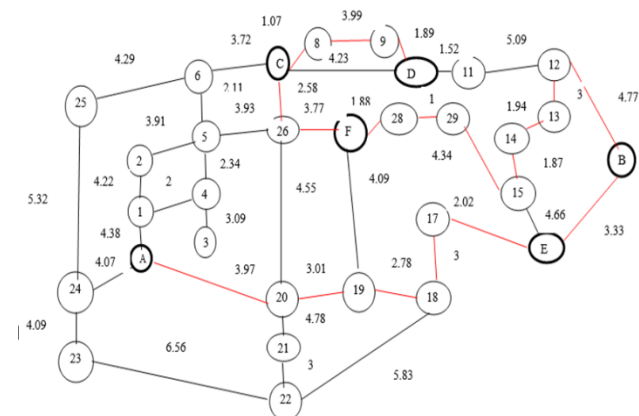


Fig. 4. The optimal shortest path of rice distribution in Medan. The last iteration/calculation in this algorithm

Step 7:

From point B, next point was 12 because it is the only branch from point B.

Step 8:

From point 12, next was point 13 because the shortest distance of 2 branches at point 12 was point 13.

Step 9:

From point 13, next point was 14 because it is the only branch from point 13.

Step 10:

From point 14, next point was 15 because it is the only branch from point 14.

Step 11:

From point 15, next point was 29 because the shortest distance from point 15 was point 29.

Step 12:

From point 29, next point was 28 because it is the only branch from point 29.

Step 13:

From point 28, next point was F because it is the only branch from point 28.

Step 14:

From point F, next point was 26 because the shortest distance from point F was point 26.

Step 15:

From point 26, next point was C because the shortest distance from point 26 was point C.

Step 16:

From point C, then to point 8 because the shortest distance from point C was point 8.

Step 17:

From point 8, next point was 9 because it is the only branch from point 8.

Step 18:

From point 9, next point was D because it is the only branch from point 9.

Finally, Form the calculation the route had graphed to the final result of the optimal shortest path on Fig. 4. Based on the steps that have been described, the routes that taken were:

A-20-19-18-17-E-B-12-13-14-15-29-28-F-26-C-8-9-D

The total distance covered was 50.21 km.

IV. CONCLUSION

This study uses the Greedy's algorithm method to determine the shortest route from the Medan City Distributor to several supermarket locations. The calculation results show that the shortest and fastest route is based on the steps described using the greedy algorithm, the point A-20-19-18-17-E-B-12-13-14-15-29-28-F-26-C-8-9-D The total distance covered is 50.21 km.

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