Implementation of the Greedy Algorithm to determine the nearest route Search in distributing food production

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Abstract. Distribution is the activity of allocating goods from producers to customers within allocated time. Managing product distribution is very important for the survival of a company, yet improper planning and management will cause the production is stacked in the warehouse thus this will cause unhealthy financial cycles and turnover to the company itself. Nowadays many companies produce foodstuffs but one of the major problems faced by the companies are the delays in distributing food production. It is found that the common difficulty faced by the food production companies in distributing the product due to long travelling distance, traffic congestion, natural disasters, ambiguous routes as well as unstructured routes. To overcome the problems, greedy algorithm is implemented. The algorithm able to identify the optimal pathway and time consumption by finding the closest distance, followed by the utmost distance. Therefore this will reduce the cost of distribution and other company resources. The results of this study show that the algorithm identifies Route 5 as the best route. This is because it will go through 5 cities, namely A-B-C-F-G-H with distance of 648KM. Although it is considered as long travelling distance, on the other hand the algorithm suggests that 648KM is the optimum distance to travelling to city H.

1. Introduction

In order to achieve the objectives and objectives of the company in the field of marketing, each company conducts distribution activities of raw goods and also finished goods. Channelling is an activity to manufacture goods production to the hands of consumers at the right time. Some understanding of distribution channels relating to distribution channels by experts in their field as follows: Early research suggests that "distribution channels are a series of organizational participants that perform all the functions needed to deliver products/services from sellers to end buyers". Thus, the conclusion can be taken distribution is the flow of goods from the manufacturer to the consumer (Sorensen, Hinds, & Kiesler, 2006).

Distribution is a support for every company because when the distribution of Lancer then production can continue to run and no build-up of production goods in the warehouse that cause harm to the company(Lakhani & Panetta, 2007). Nowadays, there are very many companies engaged in production of food as well as beverages.

The results of observations that have been done in one of the companies apparently there is a route that is unclear, causing a delay in delivery and stacking of production goods are used so that it will cause a very significant loss to the company. Nowadays almost in every company both engaged in the production of food and beverages in distributing products with less clear and irregular routes (Touretzky & Hinton, 1988). So this is what triggers interest for researchers to apply the algorithm greedy where this algorithm can help the problems that occur in the company so that it can minimize the distribution costs incurred by looking for Closest distance first then the farthest distance.

In previous research conducted by Sulistiorini and Mahmudy about “application of Evolution Strategies algorithm for the optimization of two stage goods distribution”. The genetic algorithm is applied in the case of two-stage goods distribution to optimize the distribution route of goods,
to perform the technique of optimizing route distribution used genetic algorithms by using
crossover techniques with one cut point crossover, Mutations with Exchange mutation and
selection using elitism selection by assuming 2 factories with 5 distributors and 10 agents
represented using a permutation representation. The final result is the optimum distribution path
with the right capacity. However, it is not able to provide a solution to determine the fastest route
with minimum cost (Sulistiorini & Mahmudy, 2015).

2. Methodology

2.1 Greedy Algorithm

In the previous research conducted by greedy algorithm is a type of algorithm that uses a problem
solving approach by finding the maximum value while at each step. The maximum value of
temporary is known as the local maximum. In most cases, the greedy algorithm will not produce
the optimal solution, and the greedy algorithm usually provides a solution that approaches the
optimum value in a fast enough time (Soltys, 2012).

The principle of the Greedy algorithm is to take every opportunity that exists at the moment,
without regard to the future consequences. The Greedy algorithm forms a solution from step by
step, and at every step should be made the best decision in determining the choice (Caruana &
Freitag, 2014). At each step of the algorithm Greedy take the best option that can be gained at that
moment without regard to future consequences (Bird, 1992). Figure 1 describes the concept of A
directional graph from point A to B

Figure 1 Directional Graph from point A to B

In previous research conducted by J. Webster & M. Moshkov to find the shortest distance from
A to B, a greedy algorithm will execute steps like the following (Webster & Moshkov, 2015):
1. Visit one point on the graph, and grab the whole point that can be visited from the present
point.
2. Find the local maximum to the next point.
3. Mark the graph now as the graph you have visited, and move to a predefined local
maximum.
4. Go back to step 1 until the destination point is obtained.
If you have to communicate the above steps in graph A to B earlier then we will get a move as
follows:
1. Start from the starting point (A). Take the whole point that can be visited.

Figure 2 Greedy Steps

2. Local maximum is to C, because the distance to C is the closest.
3. Mark A as the point that has been visited, and move to C.
4. Take the whole point that can be visited from C.
Figure 3 The Second Step Of Greedy

5. Local maximum is to D, with a distance of 6.
6. Mark C as the point that has been visited, and move to D.

Figure 4 The Third Step Greedy

7. (Next step is handed over to the reader as exercise)

In this research will be conducted analysis on the search of product distribution route to 5 distributors and 10 agents with attention to distance and duration of inter-city travel so that distribution time can be utilized efficiently.

3. Result and Discussion

Researchers have represented distributing their products to many cities. The city that is closest to the position of the home industry we illustrate is the town of Lubuk Pakam. Then the city that often ask for our products are the high cliff, Pematangsiantar, Medan, Binjai, Kabanjahe, Sidikalang and ACEH. The distribution path is depicted with the following nodes,

Table 1 City name and code

| Num | City           | Code |
|-----|----------------|------|
| 1   | Lubuk Pakam    | A    |
| 2   | Tebing Tinggi | B    |
| 3   | Pematang Siantar | C    |
| 4   | Medan           | D    |
Table 2 Distance between cities

| Num | City code | Distance |
|-----|-----------|----------|
| 1   | A-B       | 40 km    |
| 2   | A-C       | 69 km    |
| 3   | A-D       | 23 km    |
| 4   | A-F       | 65 km    |
| 5   | B-F       | 46 km    |
| 6   | C-F       | 100 km   |
| 7   | F-G       | 76 km    |
| 8   | G-H       | 386 km   |
| 9   | D-E       | 42 km    |
| 10  | D-F       | 75 km    |
| 11  | E-H       | 399 km   |

Based on the Greedy algorithm, the route starts from the first node to the node that is expected to be optimal, thus there are several routes found. These routes are described with the following nodes:

**A. Route 1**

The first route algorithm starts from City A to H City with distribution line that passes 2 cities.

The Total distance from city A to City H is:

\[
\text{Rute1} = 23 \text{ km} + 42 \text{ km} + 399 \text{ km} \\
= 464 \text{ km}
\]

The city passed is A-D-E-H.
B. Route 2

The Total distance from city A to City H is:
Rute2 = 23 km + 75 km + 76 km + 386 km
      = 560 km
The skipped city was A-D-F-G-H.

C. Route 3
The third route begins from City A to the city of H with a distribution line that passes 2 cities.

The Total distance from city A to City H is:
Rute3 = 65 km + 76 km + 386 km
       = 527 km
The city being skipped was A-F-G-H
D. Route 4
The fourth route algorithm starts from City A to H City with distribution line that passes through 3 cities.

The Total distance from city A to City H is:
\[ \text{Rute4} = 69 \text{ km} + 100 \text{ km} + 76 \text{ km} + 386 \text{ km} \]
\[ = 631 \text{ km} \]
The skipped city was A-C-F-G-H.

E. Route 5
The fifth route algorithm starts from City A to H City with distribution line that passes 4 cities.

The Total distance from city A to City H is:
\[ \text{Rute5} = 40 \text{ km} + 46 \text{ km} + 100 \text{ km} + 76 \text{ km} + 386 \text{ km} \]
\[ = 648 \text{ km} \]
The skipped city was A-B-C-F-G-H.

From the search results of the above route, obtained 5 distribution route data such as the table below:

| Num | Route | Pathway       | Distance |
|-----|-------|---------------|----------|
| 1   | Route 1 | A-D-E-H       | 464 km   |
| 2   | Route 2 | A-D-F-G-H     | 560 km   |
| 3   | Route 3 | A-F-G-H       | 527 km   |
| 4   | Route 4 | A-C-F-G-H     | 631 km   |
| 5   | Route 5 | A-B-C-F-G-H   | 648 km   |

Based on the concept of the Greedy algorithm, the most popular pathway is Route 5 which passes through the city of A-B-C-F-G-H which is considered as the best track. With a distance of 648 km.
4. Conclusion
The use of the GREEDY algorithm in the process of distributing food production obtained very good results, where the distance to distribute foods from the city of A-H is only 648KM and passing through five cities only. There are still 2 cities that are passed by, yet greedy algorithm able to decide that the 2 cities are not worth passing.

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