TRAVELLING SALESMAN PROBLEM ANALYSIS WITH COMPLETE ENUMERATION METHOD, BRANCH & BOUND AND GREEDY HEURISTIC

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ARTICLE INFO	ABSTRACT
	PT XYZ as the best and largest Bed Sheet Set company in Indonesia with products such as Bed Covers, Bed Sheets, Pillowcases, Bolsters and Blankets. The Traveling Salesman Problem (TSP) is a problem faced in finding the best route to visit shops that sell products from PT BIG. A visit to the shop is carried out on the condition that each city can only be visited once except the city of origin. The algorithms applied in this TSP problem include the Complete Enumeration, Branch & Bound and Greedy Heuristic methods.

INTRODUCTION

PT XYZ, a company engaged in garments, especially the largest Bed Sheet Set & Bed Cover in Indonesia with product brands A and B (Faisal, Hardianto, Dwichwanto, & Septiana, 2021). These products are widely used by every community and have been spread in several big cities such as Subang, Sukabumi, Bogor and Bandung (Firman, Herlina, Paturochman, & Sulaeman, 2018). In the process of distributing products in each city, human labor is needed, one of which is through Sales Promotion (Susanto & Sunardi, 2017). Sales Promotion offers products to stores in big cities to sell products to consumers (Larissa, Yuwono, & Mardiono, 2017). The distribution of products in each

city has obstacles in delivery with the distance from the city far enough (Chandra & RAHARDJO, 2013) so that the delivery of goods takes quite a long time (Putra, Nyoto, & Pratiwi, 2017). If product delivery takes a long time, it will result in delayed product delivery (Miradji, 2014) and product marketing cannot be done quickly (Toyib, Onsardi, & Muntahanah, 2020). For this reason, the company must be able to develop a plan to be able to create inter-city routes (Zulfikar, Mayvita, & Purboyo, 2019) that can minimize delivery time by arranging product delivery routes (Karundeng, Mandey, & Sumarauw, 2018). So that product marketing can be done effectively (Artaya & Purworusmiardi, 2019). The problem that will be discussed is that there is no optimal delivery route (Tanujaya, Dewi, & Endah, 2013) with the minimum total distance or cost and determining the best route (Muhammad, Bakhtiar, & Rahmi, 2017). Determination of delivery routes using Complete Enumeration, Branch & Bound and Greedy Heuristic methods.

RESEARCH METHODS

Data collection needed for this research, the authors use the following methods: (Pratama, Rahaningsih, Nurhadiansyah, & Purani, 2019)
1. Literature Study. The author collects materials as references from modules, journals, articles, internet on Complete Enumeration, Branch & Bound and Greedy Heuristic Methods.
2. Field Study. The author observes directly in the field based on the required data.
3. Data Collection. The data is taken based on the city that is often visited by sales and based on the distance traveled by the city.
4. Data Processing. The data is processed by analyzing problems in finding the shortest route using the Complete Enumeration, Branch & Bound and Greedy Heuristic methods.
5. Finding the Optimal Solution. Optimal solution is obtained based on the calculation of the shortest route. The shortest route deserves to be the Optimal Solution because it is more efficient.

RESULTS AND DISCUSSION

PT. XYZ will assign Sales Promotion to visit shops that sell products from PT. XYZ (Firmansyah, SE, Anita Roosmawarni, & SE, 2019). These shops are located in the cities of Subang, Sukabumi and Bogor (Taufiq, 2016). Determination of Sales Promotion travel routes in each city is obtained based on the distance of each city (Wijaya, Kristianto, Vanel, & Huwae, 2020). The data retrieval used will later be processed and determine the closest distance that will later be taken Here are the distances between cities: (Amri, Rahman, & Yuniarti, 2014)

Table 1. Distance between Cities

City	Bandung (0)	Subang (1)	Sukabumi (2)	Bogor (3)
Bandung (0)	-	57	96	124
Subang (1)	57	-	144	159
Sukabumi (2)	96	144	-	61
Bogor (3)	124	159	61	-

Based on data collection, the city of origin of the sales promotion is Bandung. Sales Promotion will travel to visit the store. The stores are located in the cities of Subang (1), Sukabumi (2) and Bogor (3). Sales Promotion requires the shortest distance in order to maximize travel and minimize costs. From these problems, the data was processed

using the Complete Enumeration, Branch & Bound and Greedy Heuristic methods. Here are the results of Data Processing:
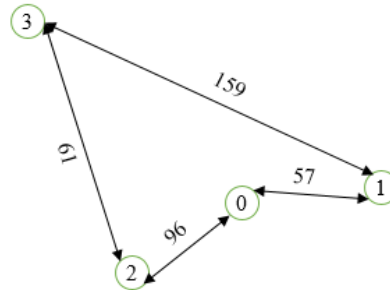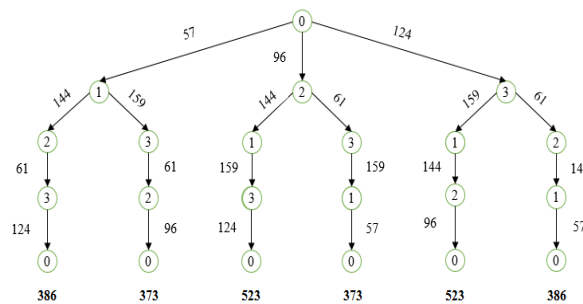
1. **Complete Enumeration Method**

Figure 1. Results of the Complete Enumeration Method

The results obtained using the Complete Enumeration method with the shortest distance of 373 km.

2. **Branch & Bound Method**

The results obtained using the Branch & Bound method with the shortest distance of 373 km.
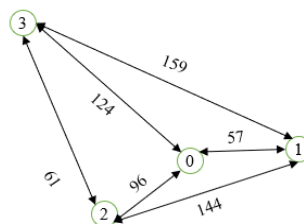
3. *Greedy Heuristic* **Method**

Figure 3. Results of Greedy Heuristic Method

The results obtained using the Branch & Bound method with the shortest distance of 386 km.

Table 2 Total Distance

Method	Closest total distance (km)
Complete Enumeration	373
Branch and Bound	373
Greedy Heuristic	386

Based on the Complete Enumeration Method, the results obtained with a distance of 373 km. The Branch & Bound method obtained results with a distance of 373 km. The Greedy Heuristic method obtained 386 km results because it is different from the Complete Enumeration Method and the Branch & Bound Method which can pass through which city first as long as it does not pass through the city of origin. In the Greedy Heuristic Method from the origin of the city the closest distance is chosen then from the city that is being occupied to the next city the closest distance is chosen.

CONCLUSION

Based on the results of the analysis and distance determination, it is found that the Complete Enumeration and Branch & Bound methods are better methods than the Greedy Heuristic method. This is because the distance traveled by determining the Complete Enumeration and Branch & Bound has the same distance of 373 km, while the Greedy Heuristic Methods method has a further distance of 386 km.

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