FUSENA: Journal Sains and Technology
p-issn/eissn: **xxxx-cxxx/cccc-xxxx**
doi: **xxxxxxxxxxx.10**

SHORTEST ROUTE OPTIMIZATION FOR CILACAP ELECTION LOGISTICS VIA BRANCH AND BOUND

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Submit:
10 January 2026

Review:
15 January 2026

Recepted:
28 January 2026

Abstract

Planning is needed to streamline the budget. One form of planning is in the form of planning the shortest distribution route. This research aims to determine the shortest route for the distribution of election logistics in the Cilacap Regency using the Branch and Bound Algorithm. Determining the distance between sub-districts in Cilacap Regency using the help of Google Maps. Based on the results of this research, the shortest route for the distribution of election logistics in Cilacap Regency is 149.1 km for the first route and 338,3 km for the second route.

Keywords: Distribution of election logistics, graph, shortest route, Branch and Bound Algorithm

Abstrak

Perencanaan diperlukan untuk mengefisienkan anggaran. Salah satu bentuk perencanaan tersebut adalah penentuan rute distribusi terpendek. Penelitian ini bertujuan untuk menentukan rute terpendek bagi distribusi logistik pemilihan umum di Kabupaten Cilacap dengan menggunakan Algoritma Branch and Bound. Penentuan jarak antar-kecamatan di Kabupaten Cilacap dilakukan dengan bantuan Google Maps. Berdasarkan hasil penelitian ini, rute terpendek untuk distribusi logistik pemilihan umum di Kabupaten Cilacap adalah 149,1 km untuk rute pertama dan 338,3 km untuk rute kedua.

Kata kunci: Distribusi logistik pemilihan umum, graf, rute terpendek, Algoritma Branch and Bound

A. Introduction

According to UU No. 7 of 2017, Pemilihan Umum (Pemilu) is a means of popular sovereignty to elect members of the People's Representative Council, members of the People's Representative Council, President and Vice President, and members of the Regional Representative Council, which are carried out directly, publicly, freely, confidential, honest and fair in the Unitary State of the Republic of Indonesia based on Pancasila and the Undang-Undang Dasar Negara Republik Indonesia Tahun 1945. One of the election-organizing institutions is the Komisi Pemilihan Umum. The Komisi Pemilihan Umum (KPU) is an election-organizing institution that is national, permanent, and independent in carrying out elections. Meanwhile, in the district/city area, there is a Regency/City General Election Commission. One of the tasks of the KPU is to carry out all stages of implementation in the Regency/City based on the provisions of statutory regulations. Apart from that, one of the Regency KPU's authorities is to set standards and requirements for the procurement and distribution of equipment. To support the smooth running of the Regency KPU's duties and authority, a Regency KPU Secretariat was formed, one of whose duties is to assist in the preparation of election programs and budgets, and one of its authorities is to procure and distribute election administration equipment based on norms, standards, procedures and needs determined by the KPU.

Indonesia held its first Simultaneous Election on April 17, 2019. The implementation of the 2019 Simultaneous Election still has several problems, one of which is related to the distribution of Election Logistics. Even though the period for the Simultaneous Election is shorter and the use of the budget is (theoretically) more efficient, the preparation for holding the election turns out to take a long time, so technically, it becomes more complicated and election logistics must be prepared more carefully (Ardipandanto, 2019). Some examples of election logistics are ballot boxes, ballot papers, ink, voting booths, etc.

Even though the regulations and decisions on the election logistics management process are good, there are still various problems that occur during the 2019 Election implementation stages. The second highest level of vulnerability that occurs in 244 districts/cities is occupied by Election Logistics (Bawaslu, 2019). Delays in election logistics are a crucial problem not only in the implementation of the 2019 elections but also in the implementation of previous elections (Mariska et al., 2021). Delays in the distribution of election logistics can result in delays in the election process. Apart from that, problems with the distribution of election logistics can result in increased costs for distributing election logistics. This is related to the distribution distance (distribution route) which is not optimal, so the travel distance becomes long and takes a long time. Thus distribution costs increase.

Therefore, it is necessary to plan election logistics distribution routes so that the routes used in distributing election logistics are optimal. In this way, distribution costs and time become efficient. This can reduce the risk of increasing costs and reduce the risk of delays in the distribution of election logistics. There are several algorithms for determining the optimal route, one of which is the Branch and Bound Algorithm. The Branch and Bound algorithm is an algorithm method that is commonly used to determine the optimal solution to optimization problems, especially in discrete and combinatorial optimization (Prasetyo, 2017). Research related to the application of the Branch and Bound Algorithm can be seen (Margiyani & Mussafi, 2014; Melina Sari et al., 2020; Prasetyo, 2017; Rosa et al., 2012; Simarmata et al., 2020; Wulansari et al., 2020).

Based on the description above, researchers are interested in examining the optimal route for distributing election logistics in the Cilacap Regency using the Branch and Bound Algorithm. It is hoped that determining the optimal route can increase efficiency in the distribution of election logistics.

B. Research Methodology

The type of research in this research is quantitative research conducted in Cilacap Regency. Data related to the location of sub-district offices in Cilacap Regency was obtained with the help of Google Maps. Then, the data was analyzed using the Branch and Bound Algorithm to determine the optimal route for the distribution of election logistics in the Cilacap Regency.

C. Results and Discussion

The following is data regarding the location of the Cilacap Regency KPU and District Offices in Cilacap Regency.

Table 1 Location of vertex coordinates

No	Code	District	Latitude	Longitude
1	A	KPU Kabupaten Cilacap	7°42'45.99"S	109° 0'19.58"E
2	B	Cipari	7°26'20.91"S	108°45'36.49"E

3	C	Jeruklegi	7°37'28.35"S	109° 1'10.64"E
4	D	Kampung Laut	7°41'5.73"S	108°49'35.83"E
5	E	Karangpucung	7°24'44.94"S	108°54'10.15"E
6	F	Kawunganten	7°35'11.63"S	108°54'35.93"E
7	G	Kedungreja	7°30'5.53"S	108°47'13.09"E
8	H	Kroya	7°37'57.10"S	109°14'41.04"E
9	I	Majenang	7°17'53.82"S	108°45'45.72"E
10	J	Nusawungu	7°38'52.01"S	109°20'33.05"E
11	K	Sampang	7°34'6.11"S	109°11'1.74"E
12	L	Sidareja	7°29'1.31"S	108°47'30.58"E
13	M	Gandrungmangu	7°31'21.75"S	108°51'19.96"E
14	N	Wanareja	7°20'2.55"S	108°41'11.59"E
15	O	Cimanggu	7°21'18.15"S	108°50'24.55"E
16	P	Cilacap Utara	7°41'3.33"S	109° 2'19.76"E
17	Q	Cilacap Tengah	7°42'19.48"S	109° 1'50.42"E
18	R	Cilacap Selatan	7°43'15.57"S	109° 0'58.90"E
19	S	Binangun	7°40'5.21"S	109°16'0.50"E
20	T	Maos	7°37'22.59"S	109° 8'52.15"E
21	U	Kesugihan	7°38'34.94"S	109° 6'50.30"E
22	V	Bantarsari	7°32'22.33"S	108°52'12.64"E
23	W	Adipala	7°39'33.66"S	109° 8'59.48"E
24	X	Patimuan	7°35'52.33"S	108°45'20.87"E
25	Y	Dayeuhluhur	7°15'34.42"S	108°36'35.58"E

The following is a map of the location of the District Office in Cilacap Regency using Google Maps.

Figure 1 Vertex location map

Figure 1 shows the location of the Cilacap Regency KPU Office and each District Office in Cilacap Regency. In this way, the distance between sub-district offices and the distance between the Cilacap Regency KPU office and the sub-district office can be determined.The following is a table of distance between sub-district offices and the distance between the Cilacap Regency KPU office and the sub-district office obtained from the Google Maps.

Table 2 Distance between vertices (kilometer)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
A	0	40,6	9,9	20,0	35,1	17,5	33,6	27,9	53,1	37,9	25	34,6	54,7	26,7	43,6	4,9	2,9	1,5	29,3	18,6	14,2	24,3	17,0	30,3	66,5
B	40,6	0	35,2	28,2	16,0	23,3	7,5	57,6	15,6	68,3	48,9	6,1	14,0	14,2	12,8	41,0	41,9	42,1	61,4	47,4	45,1	16,5	49,4	17,6	25,9
C	9,9	35,2	0	22,3	26,8	12,8	29,0	24,9	45,9	35,7	19,2	29,6	48,8	48,8	35,8	6,9	9,0	10,7	27,7	14,1	10,6	19,0	14,9	29,3	60,6
D	20,0	28,2	22,3	0	31,3	14,2	20,7	46,6	43,3	57,0	41,5	22,6	18,2	41,8	36,5	23,4	22,6	21,3	48,6	36,1	32,1	16,8	35,8	12,4	52,8
E	35,1	16,0	26,8	31,3	0	19,3	16,1	44,9	20,0	55,0	35,5	14,6	13,3	25,4	9,4	33,6	35,3	36,4	49,1	35,7	34,6	14,5	38,6	26,2	36,5
F	17,5	23,3	12,8	14,2	19,3	0	16,5	37,3	35,8	48,2	30,3	17,3	9,3	37,3	26,7	17,9	18,7	18,9	40,4	26,6	23,4	6,8	27,7	17,1	49,0
G	33,6	7,5	29,0	20,7	16,1	16,5	0	52,6	22,6	63,4	44,4	2,0	7,9	21,6	17,2	34,4	35,0	35,1	56,1	42,0	39,3	10,1	43,7	11,2	33,1
H	27,9	57,6	24,9	46,6	44,9	37,3	52,6	0	35,8	10,9	9,8	52,6	44,6	69,9	54,2	23,4	25,0	27,0	4,6	10,8	14,5	42,6	10,9	54,1	81,3
I	53,1	15,6	45,9	43,3	20,0	35,8	22,6	35,8	0	74,8	55,3	20,8	26,9	9,3	10,6	52,4	53,9	54,5	69,1	55,6	54,4	29,2	58,5	33,2	17,4
J	37,9	68,3	35,7	57,0	55,0	48,2	63,4	10,9	74,8	0	19,6	63,4	55,5	80,3	64,4	33,7	35,0	36,9	8,6	21,7	25,2	53,5	21,3	65,0	91,6
K	25	48,9	19,2	41,5	35,5	30,3	44,4	9,8	55,3	19,6	0	44,3	36,6	60,7	22,7	20,5	22,7	25,0	14,4	7,2	11,3	34,8	10,7	47,4	72,0
L	34,6	6,1	29,6	22,6	14,6	17,3	2,0	52,6	20,8	63,4	44,3	0	8,3	20,2	15,2	35,1	36,0	36,1	56,3	42,2	39,7	10,6	44,0	13,2	31,9
M	54,7	14,0	48,8	22,6	13,3	9,3	7,9	44,6	26,9	55,5	36,6	8,3	0	28,0	18,6	27,0	28,0	28,2	48,2	34,1	31,5	2,5	35,8	13,8	39,8
N	26,7	14,2	48,8	41,8	25,4	37,3	21,6	69,9	9,3	80,3	60,7	20,2	28,0	0	17,1	55,9	55,9	56,2	73,9	60,1	58,3	30,5	62,5	30,2	11,8
O	43,6	12,8	35,8	36,5	9,4	26,7	17,2	54,2	10,6	64,4	22,7	15,2	18,6	17,1	0	42,5	44,0	44,9	58,5	45,1	43,9	20,7	48,0	28,4	27,5
P	4,9	41,0	6,9	23,4	33,6	17,9	34,4	23,4	52,4	33,7	20,5	35,1	27,0	55,9	42,5	0	2,5	4,8	25,2	13,8	9,5	24,6	12,6	32,7	66,7
Q	2,9	41,9	9,0	22,6	35,3	18,7	35,0	25,0	53,9	35,0	22,7	36,0	27,0	55,9	44,0	2,5	0	2,3	26,4	15,8	11,5	20,7	14,1	32,6	67,7
R	1,5	42,1	10,7	21,3	36,4	18,9	35,1	27,0	54,5	36,9	25,0	36,1	28,2	56,2	44,9	4,8	2,3	0	28,3	18,1	13,8	25,8	16,2	31,8	68,0
S	29,3	61,4	27,7	48,6	49,1	40,4	56,1	4,6	69,1	8,6	14,4	56,3	48,2	73,9	58,5	25,2	26,4	28,3	0	14,1	17,1	46,0	12,9	56,9	85,4
T	18,6	47,4	14,1	36,1	35,7	26,6	42,0	10,8	55,6	21,7	7,2	42,2	34,1	60,1	45,1	13,8	15,8	18,1	14,1	0	4,3	32,0	4,0	43,3	71,7
U	14,2	45,1	10,6	32,1	34,6	23,4	39,3	14,5	54,4	25,2	11,3	39,7	31,5	58,3	43,9	9,5	11,5	13,8	17,1	4,3	0	29,2	4,3	39,8	70,0
V	24,3	16,5	19,0	16,8	14,5	6,8	10,1	42,6	29,2	53,5	34,8	10,6	2,5	30,5	20,7	24,6	20,7	25,8	46,0	32,0	29,2	0	33,6	14,2	42,2
W	17,0	49,4	14,9	35,8	38,6	27,7	43,7	10,9	58,5	21,3	10,7	44,0	35,8	62,5	48,0	12,6	14,1	16,2	12,9	4,0	4,3	33,6	0	44,0	74,2
X	30,3	17,6	29,3	12,4	26,2	17,1	11,2	54,1	33,2	65,0	47,4	13,2	13,8	30,2	28,4	32,7	32,6	31,8	56,9	43,3	39,8	14,2	44,0	0	40,7
Y	66,5	25,9	60,6	52,8	36,5	49,0	33,1	81,3	17,4	91,6	72,0	31,9	39,8	11,8	27,5	66,7	67,7	68,0	85,4	71,7	70,0	42,2	74,2	40,7	0

By considering the large area of Cilacap Regency, this research is divided into two regions, namely the north-west region (1) and the south-east (2) with the following divisions

Table 3 The divided area in Cilacap Regency

Region	***Vertex***													
1	A	C	H	J	K	P	Q	R	S	T	U	W		
2	A	B	D	E	F	G	I	L	M	N	O	V	X	Y

Region 1

The following is *cost matrix* C_{ij}

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$$\begin{array}{cc} \mathit{vertex} & \begin{array}{cccccccccccc} A & C & H & J & K & P & Q & R & S & T & U & W \end{array} \\ \begin{array}{c} A \\ C \\ H \\ J \\ K \\ P \\ Q \\ R \\ S \\ T \\ U \\ W \end{array} & \begin{bmatrix} \infty & 14{,}1 & 31{,}9 & 42{,}9 & 31{,}4 & 6{,}6 & 5{,}1 & 2{,}3 & 36{,}5 & 23{,}8 & 17{,}6 & 20{,}4 \\ 14{,}1 & \infty & 28{,}2 & 39{,}2 & 23{,}6 & 9{,}1 & 12{,}5 & 14{,}8 & 35 & 16 & 14{,}2 & 19{,}1 \\ 31{,}9 & 28{,}2 & \infty & 11 & 13{,}8 & 25{,}9 & 28{,}4 & 31{,}5 & 6{,}7 & 12{,}2 & 16{,}5 & 11{,}5 \\ 42{,}9 & 39{,}2 & 11 & \infty & 24{,}4 & 36{,}8 & 40{,}6 & 41{,}5 & 11{,}7 & 23{,}2 & 27{,}5 & 22{,}5 \\ 31{,}4 & 23{,}6 & 13{,}8 & 24{,}4 & \infty & 25{,}4 & 29{,}1 & 30{,}1 & 20{,}2 & 8{,}2 & 13{,}8 & 12{,}4 \\ 6{,}6 & 9{,}1 & 25{,}9 & 36{,}8 & 25{,}4 & \infty & 3{,}8 & 6 & 30{,}4 & 17{,}8 & 11{,}6 & 14{,}3 \\ 5{,}1 & 12{,}5 & 28{,}4 & 40{,}6 & 29{,}1 & 3{,}8 & \infty & 2{,}8 & 32{,}8 & 20{,}5 & 14{,}1 & 18 \\ 2{,}3 & 14{,}8 & 31{,}5 & 41{,}5 & 30{,}1 & 6 & 2{,}8 & \infty & 35{,}5 & 22{,}5 & 16{,}3 & 19{,}1 \\ 36{,}5 & 35 & 6{,}7 & 11{,}7 & 20{,}2 & 30{,}4 & 32{,}8 & 35{,}5 & \infty & 18{,}8 & 21 & 16{,}1 \\ 23{,}8 & 16 & 12{,}2 & 23{,}2 & 8{,}2 & 17{,}8 & 20{,}3 & 22{,}5 & 18{,}8 & \infty & 4{,}3 & 6{,}2 \\ 17{,}6 & 14{,}2 & 16{,}5 & 27{,}5 & 13{,}8 & 11{,}6 & 14{,}1 & 16{,}3 & 21 & 4{,}3 & \infty & 4{,}9 \\ 20{,}4 & 19{,}1 & 11{,}5 & 22{,}5 & 12{,}4 & 14{,}3 & 18 & 19{,}1 & 16{,}1 & 6{,}2 & 4{,}9 & \infty \end{bmatrix} \end{array}$$

ext, the matrix is reduced, that is, each row is reduced by the smallest value in that row and the following reduced cost matrix C_{ij} is obtained

$$\begin{array}{cc} \mathit{vertex} & \begin{array}{cccccccccccc} A & C & H & J & K & P & Q & R & S & T & U & W \end{array} \\ \begin{array}{c} A \\ C \\ H \\ J \\ K \\ P \\ Q \\ R \\ S \\ T \\ U \\ W \end{array} & \begin{bmatrix} \infty & 6{,}5 & 29{,}6 & 36{,}3 & 25{,}2 & 4{,}3 & 2{,}8 & 0 & 34{,}2 & 21{,}5 & 15{,}3 & 17{,}5 \\ 5 & \infty & 19{,}1 & 25{,}8 & 10{,}6 & 0 & 3{,}4 & 5{,}7 & 25{,}9 & 6{,}9 & 5{,}1 & 9{,}4 \\ 25{,}2 & 16{,}2 & \infty & 0 & 3{,}2 & 19{,}2 & 21{,}7 & 24{,}8 & 0 & 5{,}5 & 9{,}8 & 4{,}2 \\ 31{,}9 & 22{,}9 & 0 & \infty & 9{,}5 & 25{,}8 & 29{,}6 & 30{,}5 & 0{,}7 & 12{,}2 & 16{,}5 & 10{,}9 \\ 23{,}2 & 10{,}1 & 5{,}6 & 11{,}9 & \infty & 17{,}2 & 20{,}9 & 21{,}9 & 12 & 0 & 5{,}6 & 3{,}6 \\ 2{,}8 & 0 & 22{,}1 & 28{,}7 & 17{,}7 & \infty & 0 & 2{,}2 & 26{,}6 & 14 & 7{,}8 & 9{,}9 \\ 2{,}3 & 4{,}4 & 25{,}6 & 33{,}5 & 22{,}4 & 1 & \infty & 0 & 30 & 17{,}5 & 11{,}3 & 14{,}6 \\ 0 & 7{,}2 & 29{,}2 & 34{,}9 & 23{,}9 & 3{,}7 & 0{,}5 & \infty & 33{,}2 & 20{,}2 & 14 & 16{,}2 \\ 29{,}8 & 23 & 0 & 0{,}7 & 9{,}6 & 23{,}7 & 26{,}1 & 28{,}8 & \infty & 12{,}1 & 14{,}3 & 8{,}8 \\ 19{,}5 & 6{,}4 & 7{,}9 & 14{,}6 & 0 & 13{,}5 & 16 & 18{,}2 & 14{,}5 & \infty & 0 & 1{,}3 \\ 13{,}3 & 4{,}6 & 12{,}2 & 18{,}9 & 5{,}6 & 7{,}3 & 9{,}8 & 12 & 16{,}7 & 0 & \infty & 0 \\ 15{,}5 & 8{,}9 & 6{,}6 & 13{,}3 & 3{,}6 & 9{,}4 & 13{,}1 & 14{,}2 & 11{,}2 & 1{,}3 & 0 & \infty \end{bmatrix} \end{array}$$

We get $\boldsymbol{r} = 80{,}5$.

In the next step, let *A* be a reduced matrix for vertex *R*. Vertex *S* is a child of vertex *R* such that along the way the edge (*S, R*) in the search tree space is connected to the edge (*i, j*). If S is not a leaf vertex, then the reduced weight matrix for vertex *S* can be calculated in the following steps:

1. Change all values in row *i* and column *j* with ∞, to prevent any paths from leaving vertex *i* or entering vertex *j*.
2. Change *A (i, j)* with ∞, this is to prevent using edge *(j, i)*, and
3. Re-reduce all rows and columns in matrix *A* except for element ∞.

For the next calculation, pay attention to the following vertex paths.

Route $\boldsymbol{A \rightarrow C = 6,5}$

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$$
\begin{array}{c}
\begin{array}{cccccccccccc} vertex\ A & C & H & J & K & P & Q & R & S & T & U & W \end{array} \\
\begin{bmatrix}
\infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty & \infty \\
\infty & \infty & 19{,}1 & 25{,}8 & 10{,}6 & 0 & 3{,}4 & 5{,}7 & 25{,}9 & 6{,}9 & 5{,}1 & 9{,}4 \\
25{,}2 & \infty & \infty & 0 & 3{,}2 & 19{,}2 & 21{,}7 & 24{,}8 & 0 & 5{,}5 & 9{,}8 & 4{,}2 \\
31{,}9 & \infty & 0 & \infty & 9{,}5 & 25{,}8 & 29{,}6 & 30{,}5 & 0{,}7 & 12{,}2 & 16{,}5 & 10{,}9 \\
23{,}2 & \infty & 5{,}6 & 11{,}9 & \infty & 17{,}2 & 20{,}9 & 21{,}9 & 12 & 0 & 5{,}6 & 3{,}6 \\
2{,}8 & \infty & 22{,}1 & 28{,}7 & 17{,}7 & \infty & 0 & 2{,}2 & 26{,}6 & 14 & 7{,}8 & 9{,}9 \\
2{,}3 & \infty & 25{,}6 & 33{,}5 & 22{,}4 & 1 & \infty & 0 & 30 & 17{,}5 & 11{,}3 & 14{,}6 \\
0 & \infty & 29{,}2 & 34{,}9 & 23{,}9 & 3{,}7 & 0{,}5 & \infty & 33{,}2 & 20{,}2 & 14 & 16{,}2 \\
29{,}8 & \infty & 0 & 0{,}7 & 9{,}6 & 23{,}7 & 26{,}1 & 28{,}8 & \infty & 12{,}1 & 14{,}3 & 8{,}8 \\
19{,}5 & \infty & 7{,}9 & 14{,}6 & 0 & 13{,}5 & 16 & 18{,}2 & 14{,}5 & \infty & 0 & 1{,}3 \\
13{,}3 & \infty & 12{,}2 & 18{,}9 & 5{,}6 & 7{,}3 & 9{,}8 & 12 & 16{,}7 & 0 & \infty & 0 \\
15{,}5 & \infty & 6{,}6 & 13{,}3 & 3{,}6 & 9{,}4 & 13{,}1 & 14{,}2 & 11{,}2 & 1{,}3 & 0 & \infty
\end{bmatrix}
\end{array}
$$

All rows and columns have a value of zero (0), so no reduction (r = 0) is carried out and obtained

$$\hat{C}(S) = \hat{C}(R) + A(A, C) + r = 80{,}5 + 6{,}5 + 0 = 87.$$

By using the same calculation technique, the following results are obtained as in the image to the side

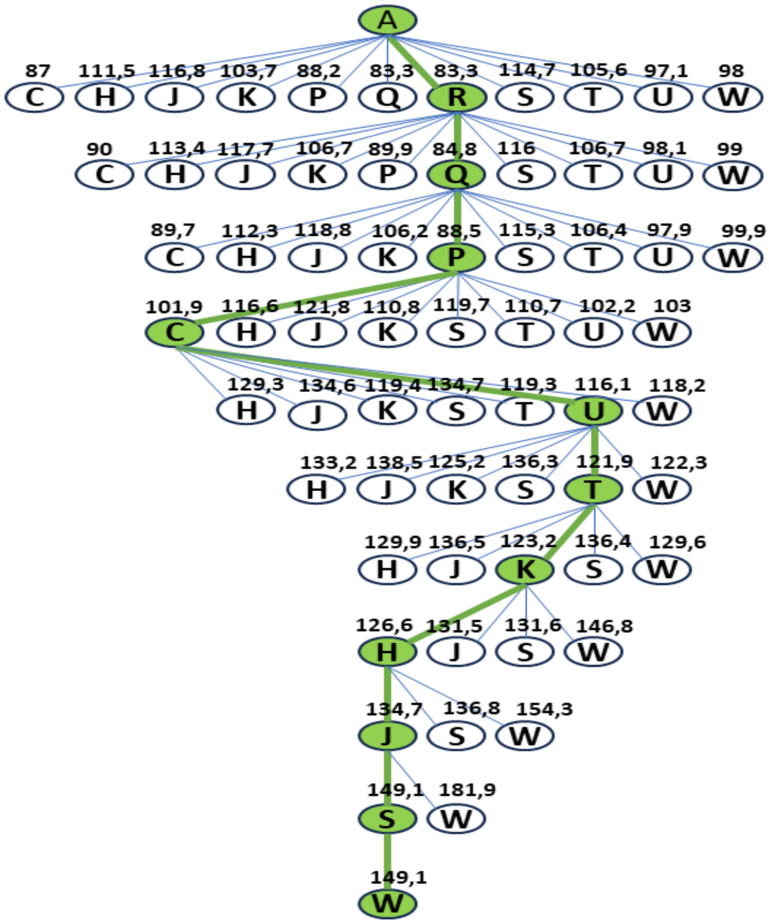

Figure 2 Branch and Bound process for region 1

Therefore, the distribution route for election logistics in Region 1 is:

$$A \to R \to Q \to P \to C \to U \to T \to K \to H \to J \to S \to W \to A$$

with a total length of 149,1 km.

The following is a map of election logistics distribution routes in Region I

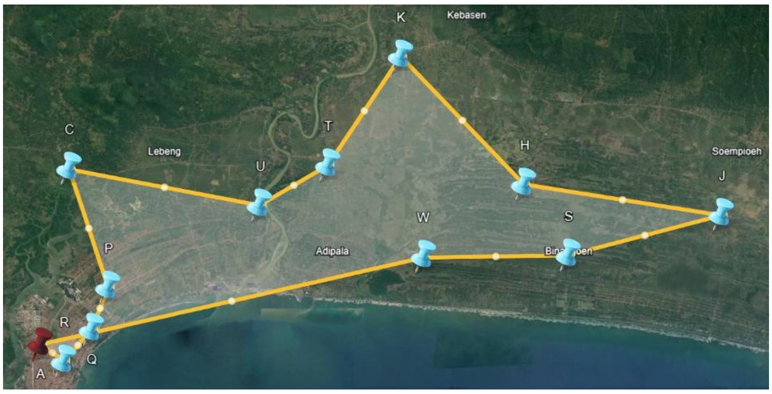

Figure 3 Distribution route map for region 1

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Region 2

The following is *cost matrix* C_{ij}

$$
\begin{array}{c}
\begin{array}{cccccccccccccc} vertex & A & B & D & E & F & G & I & L & M & N & O & V & X \end{array} \\
\begin{bmatrix}
\infty & 59{,}9 & 55 & 60{,}7 & 32{,}1 & 54{,}5 & 82{,}1 & 51{,}9 & 42{,}8 & 78{,}7 & 70{,}9 & 40{,}2 & 58{,}8 \\
59{,}9 & \infty & 38 & 26{,}2 & 27{,}9 & 10 & 26{,}2 & 8{,}3 & 17{,}4 & 18{,}8 & 36{,}4 & 19{,}7 & 23{,}4 \\
55 & 38 & \infty & 42 & 23 & 32 & 63 & 30 & 21 & 57 & 51 & 18 & 37 \\
60{,}7 & 26{,}2 & 42 & \infty & 28{,}7 & 20 & 21{,}8 & 18{,}2 & 18{,}2 & 34{,}5 & 10{,}7 & 20{,}6 & 33 \\
32{,}1 & 27{,}9 & 23 & 28{,}7 & \infty & 22{,}5 & 50{,}1 & 19{,}9 & 10{,}9 & 46{,}7 & 38{,}9 & 8{,}2 & 26{,}7 \\
54{,}5 & 10 & 32 & 20 & 22{,}5 & \infty & 36{,}3 & 2{,}1 & 11{,}3 & 28{,}9 & 30{,}2 & 14{,}4 & 13{,}4 \\
82{,}1 & 26{,}2 & 63 & 21{,}8 & 50{,}1 & 36{,}3 & \infty & 34{,}5 & 39{,}7 & 12{,}7 & 11{,}5 & 41{,}9 & 49{,}6 \\
51{,}9 & 8{,}3 & 30 & 18{,}2 & 19{,}9 & 2{,}1 & 34{,}5 & \infty & 9{,}4 & 27{,}1 & 28{,}4 & 11{,}8 & 15{,}5 \\
42{,}8 & 17{,}4 & 21 & 18{,}2 & 10{,}9 & 11{,}3 & 39{,}7 & 9{,}4 & \infty & 36{,}2 & 16{,}3 & 2{,}6 & 18{,}9 \\
78{,}7 & 18{,}8 & 57 & 34{,}5 & 46{,}7 & 28{,}9 & 12{,}7 & 27{,}1 & 36{,}2 & \infty & 24{,}1 & 38{,}6 & 42{,}3 \\
70{,}9 & 36{,}4 & 51 & 10{,}7 & 38{,}9 & 30{,}2 & 11{,}5 & 28{,}4 & 16{,}3 & 24{,}1 & \infty & 30{,}7 & 43{,}6 \\
40{,}2 & 19{,}7 & 18 & 20{,}6 & 8{,}2 & 14{,}4 & 41{,}9 & 11{,}8 & 2{,}6 & 38{,}6 & 30{,}7 & \infty & 18{,}6 \\
58{,}8 & 23{,}4 & 37 & 33 & 26{,}7 & 13{,}4 & 49{,}6 & 15{,}5 & 18{,}9 & 42{,}3 & 43{,}6 & 18{,}6 & \infty \\
99{,}4 & 39{,}5 & 78 & 55{,}1 & 67{,}4 & 49{,}6 & 33{,}4 & 47{,}8 & 56{,}9 & 21 & 44{,}7 & 59{,}2 & 62{,}9
\end{bmatrix}
\end{array}
$$

By using the same method in Region 1, the following results are obtained as in the image below

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doi: **xxxxxxxxxxx.10**

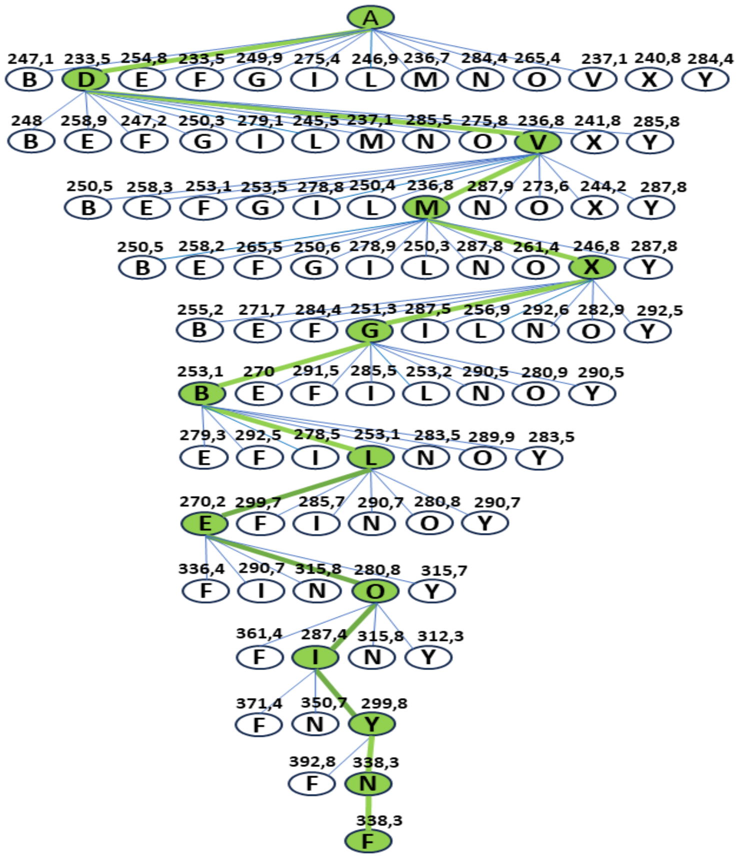

Figure 4 Branch and Bound process for region 2

Therefore, the distribution route for election logistics in Region 2 is:

$$A \to D \to V \to M \to X \to G \to B \to L \to E \to O \to I \to Y \to N \to F \to A$$

with a total length of 338,3 km.

The following is a map of election logistics distribution routes in Region 2

Figure 5 Distribution route map for region 1

The following is a route for the distribution of election logistics in Cilacap Regency

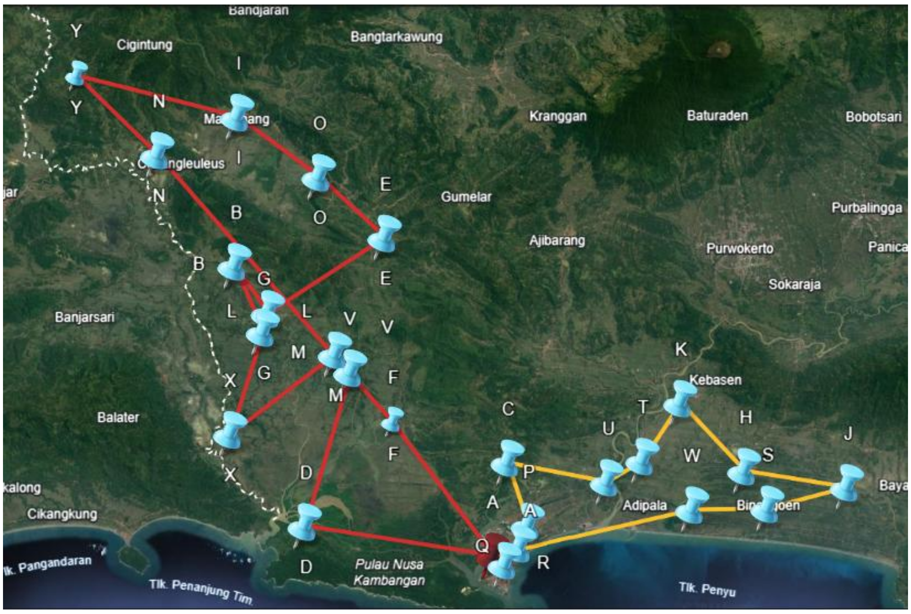

Figure 6 Distribution route map for Cilacap Regency

D. Conclusion and Suggestions

The Branch and Bound algorithm can be used to determine the shortest route for logistics distribution in the Cilacap Regency. The shortest route for the distribution of

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election logistics in Cilacap Regency is 149.1 km for the first route and 338,3 km for the second route.

References

Ardipandanto, A. (2019). Permasalahan Penyelenggaraan Pemilu Serentak Tahun 2019. *Jurnal Ilmu Pemerintahan*, *11*(11), 25–30.

Bawaslu. (2019). *Pemutakhiran Indeks Kerawanan Pemilu 2019*. Bawaslu.

Margiyani, S., & Mussafi, N. S. M. (2014). Aplikasi Algoritma Branch and Bound untuk Optimasi Jalur Pemadam Kebakaran Kota Yogyakarta. *J. Fourier*, *3*(1), 59–66. www.fourier.or.id

Mariska, R., Kusmanto, H., & Fadli, F. (2021). Analisis Distribusi Logistik pada Pemilu 2019 di Kota Medan. *PERSPEKTIF*, *10*(1), 110–119. https://doi.org/10.31289/perspektif.v10i1.4143

Melina Sari, G., Maini Heryanto, R., & Santoso, S. (2020). Penentuan Rute Distribusi Menggunakan Model Integer Linear Programming dengan Metode Branch and Bound. *Go-Integratif : Jurnal Teknik Sistem Dan Industri*, *1*(01), 69–79. https://doi.org/10.35261/gijtsi.v1i01.4265

Prasetyo, Y. D. (2017). Penyelesaian Travelling Salesman Problem dengan Algoritma Branch and Bound. *Jurnal Matematics Paedagodic*, *1*(2), 162–168. www.jurnal.una.ac.id/indeks/jmp

Purwanto, E. B. (2008). *Perancangan dan Analisis Algoritma*. Graha Ilmu.

Rosa, W. R., Suhartono, & Wibawa, H. A. (2012). Penentuan Jalur Terpendek pada Pelayanan Agen Travel Khusus Pengantaraan Wilayah Semarang Berbasis SIG dengan Algoritma Branch And Bound. *Journal of Informatics and Technology*, *1*(1), 63–71.

Simarmata, J. E., Rosmaini, E., & Napitupulu, N. (2020). Penerapan Algoritma pada Persoalan Pedagang Keliling (Travelling Salesman Problem). *Range: Jurnal Pendidikan Matematika*, *1*(2), 111–121.

Suyanto. (2010). *Algoritma Optimasi Deterministik atau Probabistik*. Graha Ilmu.

Wulansari, T., Aditya, M., & Fauzi, M. (2020). Penentuan Rute Optimal Distribusi Paving Block dengan Metode Branch and Bound. *Jurnal Teknik Industri*, *6*(2), 66–71.