

LAMPIRAN

Lampiran 1 Biaya Bahan Bakar

Januari 2021	Truk Dobel N 8963 NB		
Tanggal	Tujuan	Total Liter	Biaya
1			
2	Kota	22.33	115000
3			
4	Lumajang	13.59	70000
5	Lumajang	22.9	118000
6	Lumajang	25.2	130000
7	Lumajang	19.4	100000
8	Pasuruan	20.3	105000
9	Lumajang	29.1	150000
10			
11	Kota	19.4	100000
12	Pasuruan		
13	Lumajang	40.7	210000
14	Pasuruan	19.4	100000
15	Kota	19.4	100000
16	Lumajang	9.7	50000
17			
18	Pasuruan	19.4	100000
19	Kota	26.2	135000
20	Kota	5.8	30000
21	Lumajang	21.3	110000
22	Surabaya	19.4	100000
23	Lumajang	56.3	290000
24			
25	Lumajang	31	160000
26	Paiton	19.4	100000
27	Situbondo	25.2	130000
28	Besuki	29.1	150000
29	Pasuruan	23.3	120000
30			
31	Lumajang	14.56	75000
TOTAL		550.78	2845000

Januari 2021	Truk Dobel N 8678 NZ		
Tanggal	Tujuan	Total Liter	Biaya
1			
2	Lumajang	24.95	128500
3			
4	Lumajang	32.6	178500
5	Lumajang	18.55	95500
6	Lumajang	23.1	119000
7	Lumajang	25.24	130000
8	Lumajang	25.14	129500
9	Lumajang	19.12	98500
10			
11	Lumajang	25.24	130000
12	Lumajang	17.96	92500
13	Lumajang	24.95	128500
14	Lumajang	25.14	129500
15	Lumajang	25.14	129500
16	Lumajang	28.2	145500
17			
18			
19	Lumajang	26.11	134500
20	Lumajang	25.83	133000
21	Lumajang	32	166000
22	Kota	27.76	143000
23	Lumajang	19.8	102000
24	Surabaya	27.7	143000
25	Kota	42.33	218000
26	Lumajang	25.24	130000
27	Lumajang	25.24	130000
28	Lumajang	22.91	118000
29	Lumajang	25.82	133000
30			
31	Lumajang	20.38	105000
TOTAL		644.19	3333000

Januari 2021	Truk Engkel N 8380 NK		
Tanggal	Tujuan	Total Liter	Biaya
1			
2	Lumajang	5.82	30000

3			
4	Kota	14.56	75000
5	Kota	4.17	21500
6	Kota		
7	Kota	9.7	50000
8	Kota	5.82	30000
9	Kota		
10	Lumajang		
11	Kota	25.24	130000
12	Kota	6.79	35000
13	Kota		
14	Kota	13.59	70000
15	Besuki	5.82	30000
16	Kota	20.7	107000
17			
18	Kota	7.79	40000
19	Paiton	22.33	115000
20	Kota	14.56	75000
21	Kota	9.7	50000
22	Kota	5.82	30000
23	Kota	3.8	20000
24			
25	Kota	3.88	20000
26	Kota	2.91	15000
27	Kota	58.2	30000
28	Kota	4.85	25000
29	Kota	3.88	20000
30			
31			
TOTAL		255.46	1047000

Januari 2021	Truk Engkel N 8360 NW		
Tanggal	Tujuan	Total Liter	Biaya
1	Lumajang		
2			
3			
4	Kota	21.35	110000
5	Besuki	12.41	64000
6	Kota	17.47	90000

7	Paiton	42.71	220000
8	Besuki	19.41	100000
9			
10			
11	Paiton	26.21	135000
12	Lumajang	19.41	100000
13	Besuki	38.8	200000
14	Lumajang		
15	Lumajang	17.47	90000
16			
17			
18	Lumajang	36.83	200000
19	Besuki	31.06	160000
20	Lumajang	25.24	130000
21	Paiton	19.41	100000
22			
23	Besuki	38.8	200000
24			
25			
26			
27			
28			
29	Paiton	38.8	200000
30			
31			
TOTAL		406.56	2105000

Februari 2021	Truk Dobel N 8963 NB		
Tanggal	Tujuan	Total Liter	Biaya
1	Lumajang	19.4	100000
2	Lumajang	19.4	100000
3	Lumajang	28.1	145000
4	Lumajang	25.2	130000
5	Lumajang	27.17	140000
6	Lumajang	25.22	130000
7	Lumajang	25.2	130000
8			

9	Lumajang	19.4	100000
10	Lumajang	29.1	150000
11	Lumajang	25.2	130000
12	Kota	29.1	150000
13			
14			
15	Lumajang	5.8	30000
16	Lumajang	25.2	130000
17	Lumajang	29.1	150000
18	Lumajang	23.3	120000
19	Lumajang	25.2	130000
20	Lumajang	29.1	150000
21			
22	Lumajang	20.3	105000
23	Besuki	21.5	111000
24	Lumajang	24.2	125000
25	Besuki	31	160000
26	Lumajang	21.3	110000
27	Lumajang	28.1	145000
28			
TOTAL		564.19	2,910,000

Februari 2021	Truk Dobel N 8678 NZ		
Tanggal	Tujuan	Total Liter	Biaya
1	Besuki	25.82	133000
2	Lumajang	17.76	91500
3	Lumajang	18.05	93000
4	Situbondo	19.41	100000
5	Paiton	29.12	150000
6	Kota	19.41	100000
7			
8			
9	Lumajang	26.99	139000
10	Lumajang	19.41	100000
11	Lumajang	19	98000
12	Lumajang	20	203000
13			
14			
15	Kota	17.47	90000

16	Paiton	5.24	27000
17	Pasuruan	17.8	88000
18	Besuki	29.51	152000
19	Lumajang	20	103000
20	Kota	17.86	92000
21			
22	Besuki	22.52	116000
23	Pasuruan	16.1	82500
24			
25	Paiton	22.32	115000
26	Grati	18.83	97000
27			
28			
TOTAL		415.45	2,236,500

Februari 2021		Truk Engkel N 8380 NK	
Tanggal	Tujuan	Total Liter	Biaya
1	Kota	27.18	140000
2	Kota	5.82	30000
3	Kota		
4	Kota	8.73	45000
5	Kota		
6	Kota		
7	Kota	14.56	75000
8			
9	Kota		
10	Kota	11.65	60000
11	Kota		
12			
13	Kota		
14			
15	Kota	11.65	60000
16	Kota		
17	Kota	14.56	75000
18	Kota		
19	Kota	7.7	40000
20	Kota		
21			
22	Kota		

23	Kota	10.67	55000
24	Paiton	9.7	50000
25	Kota		
26	Kota	21.35	110000
27	Kota		
28			
TOTAL		150.37	775,000

Februari 2021	Truk Engkel N 8360 NW		
Tanggal	Tujuan	Total Liter	Biaya
1			
2	Besuki	17.47	90000
3	Besuki	17.47	90000
4			
5			
6			
7			
8			
9	Besuki	19.41	100000
10	Grati		
11	Besuki	33.1	170000
12			
13	Besuki	19.111	100000
14			
15			
16	Besuki	21.25	110000
17			
18			
19	Pasuruan	17.17	90000
20	Pasuruan		
21			
22	Lumajang	46.6	240000
23	Lumajang	16.1	83000
24			
25	Lumajang	21.35	110000
26	Lumajang	17.47	90000
27			
28			
TOTAL		249.811	1290000

Lampiran 2 Data Customer PT. XY

No	Customer	Alamat	Jarak
1	RSUD Dr. Mohamad Saleh	Mayangan, Probolinggo	6,5 km
2	RSUD Pasirian	Pasirian, Lumajang	62 km
3	RSU Muhammadiyah Lumajang	Labruk Lor, Lumajang	46 km
4	RS Bhayangkara Lumajang	Tompokersan, Lumajang	44 km
5	RSUD Besuki	Besuki, Kab. Situbondo	53,5 km
6	RS Dharma Husada	Mayangan, Probolinggo	5,7 km
7	RSUD Grati	Grati, Kab. Pasuruan	31 km
8	RSUD Dr. Haryato	Tompokersan, Lumajang	42,3 km
9	Rumah Sakit Sinergi Medika (RSIA Siti Fatimah)	Kraksan, Kab. Probolinggo	19,6 km
10	RS Wijaya Kusuma	Kepuharjo, Lumajang	40,8 km
11	Puskesmas Paiton	Paiton, Kab. Probolinggo	32 km
12	Puskesmas Klakah	Klakah, Lumajang	27 km
13	Puskesmas Pasirian	Pasirian, Lumajang	62 km
14	Puskesmas Ranuyoso	Ranuyoso, Probolinggo	22 km
15	Puskesmas Ranugedang	Tiris, Kab. Probolinggo	21 km
16	Puskesmas Kedungjajang	Kedungjajang, Lumajang	34 km
17	PT Nusantara Sebelas Medika (RS Wonolangan)	Dringu, Probolinggo	0,9 km
18	PT Harigo Wood Indonesia	Tongas, Kab. Probolinggo	20 km
19	PT Indopherin Jaya	Kademangan, Probolinggo	8,5 km
20	PT Bromo Falcata Indonesia	Kademangan, Probolinggo	8,2 km
21	PT Mustika Buana Sejahtera	Tempeh, Lumajang	51,2 km
22	CV Mustika Karyajaya Sakti	Tempeh, Lumajang	52,3 km
23	PT Karya Setya Mustika Tama	Tempeh, Lumajang	52 km
24	PT Feva Indonesia	Banyuglugur, Kab. Situbondo	43 km
25	PT Mustika Bahana Jaya	Tempeh, Lumajang	51 km
26	PT Kutai Timber Indonesia	Mayangan, Probolinggo	6,7 km
27	PT Indah Makmur Sukses	Kademangan, Probolinggo	9,1 km

28	PT Taihei Dengyo Indonesia	Paiton, Kab. Probolinggo	41 km
29	PT Graha Sehat Lestari Kraksaan	Kraksaan, Kab. Probolinggo	22 km
30	CV Husada Mulia	Wonorejo, Lumajang	37 km
31	PT Wira Sentosa Abadi	Mayangan, Probolinggo	7,7 km
32	CV Raja Benur	Bungaten, Situbondo	74 km
33	CV Padma Gayatri Motor	Tompokersan, Lumajang	44 km
34	PT Paiton Energy	Paiton, Kab. Probolinggo	38 km
35	CV Karya Sejati	Grati, Kab. Pasuruan	54 km
36	PT Siaga Transport Indonesia	Mayangan, Probolinggo	4,9 km
37	PT Swarga Batu Indonesia	Winongan, Kab. Pasuruan	40 km
38	PT PJB Unit Pelayanan	Paiton, Kab. Probolinggo	40 km
39	PT Hisenor Technology Indonesia	Banyuglugur, Kab. Situbondo	43 km
40	PT IOL Indonesia	Paiton, Kab. Probolinggo	39 km
41	CV Gayaza	Kraksaan, Kab. Probolinggo	19 km
42	PT Pendawa Lestari Perkasa	Winongan, Kab. Pasuruan	40,2 km
43	CV Andi Motor Probolinggo	Kanigaran, Probolinggo	3,6 km
44	PT Sari Husada Santoso	Besuki, Kab. Situbondo	53 km
45	PT Pembangkitan Jawa Bali	Paiton, Kab. Probolinggo	41 km
46	PT Babcock & Wilcox Asia	Paiton, Kab. Probolinggo	42 km
47	PT Matahari Cipta Sentosa	Banyuglugur, Kab. Situbondo	43,3 km
48	PT Truba Jaga Cita	Banyuglugur, Kab. Situbondo	44 km
49	PT Kanawood Indo Makmur	Tempeh, Lumajang	51 km
50	PT Amak Firdaus Utomo	Mayangan, Probolinggo	7,5 km
51	PT Jawa Power	Paiton, Kab. Probolinggo	40 km
52	PT Delta Windu Purnama	Banyuglugur, Kab. Situbondo	48 km
53	PT Arta Gemilang Transindo	Mangunharjo, Probolinggo	7,2 km
54	PT Farmahusada Millenia	Patrang, Kab. Jember	97 km
55	PT Astra Otoparts	Citrodiwangsan, Lumajang	44 km

56	PT Samator	Rembang, Pasuruan	56,5 km
57	PT Surya Agropratama	Tongas, Kab. Probolinggo	17,6 km
58	PT PJB UBJ OM Paiton	Paiton, Kab. Probolinggo	38,4 km
59	CV Top	Mayangan, Probolinggo	5,8 km
60	PT Sumbertaman Keramik Industri	Wonoasih, Probolinggo	6,1 km
61	Kop. Aqua Bisnis Jawa Timur	Dringu, Probolinggo	0,7 km
62	Bongso	Banyubiru Kidul, Pasuruan	38 km
63	Kisemar Mas	Besuki, Kab. Situbondo	48 km
64	Ninuk M. (Bengkel)	Kanigaran, Probolinggo	4,2 km
65	Tohet (Perorangan)	Dringu, Probolinggo	2,1 km
66	Moch Ulum (Agen)	Tempeh, Lumajang	54,8 km
67	M Wachid (Agen)	Sumbersuko, Lumajang	49,3 km
68	Hamidi (Bengkel)	Tompokersan, Lumajang	44,4 km
69	Solihin (Perorangan)	Dringu, Probolinggo	13,3 km
70	M Arifin (Perorangan)	Dringu, Probolinggo	0,55 km
71	Edi (Perorangan)	Tompokersan, Lumajang	43 km
72	Yudi (Perorangan)	Mangunharjo, Probolinggo	6,1 km
73	Sidik (Perorangan)	Kanigaran, Probolinggo	5,3 km
74	Hani (Perorangan)	Dringu, Probolinggo	1 km
75	Jamaludin (Bengkel)	Mayangan, Probolinggo	8 km
76	Ahmad Zaki (Perorangan)	Kanigaran, Probolinggo	4 km
77	Supahit (Perorangan)	Dringu, Probolinggo	1,7 km
78	Eka Saputra (Bengkel)	Pajarakan, Kab. Probolinggo	16,8 km
79	Putu Surya (Perorangan)	Kanigaran, Probolinggo	4,5 km
80	Derry (Bengkel)	Mangunharjo, Probolinggo	6,1 km
81	Sukarsiyo (Perorangan)	Dringu, Probolinggo	2,1 km
82	Gede Van. (Perorangan)	Mayangan, Probolinggo	3,5 km
83	Soegiyono (Perorangan)	Wonorejo, Lumajang	37 km
84	Brigita (Perorangan)	Dringu, Probolinggo	0,45 km
85	Endry (Perorangan)	Pasirian, Lumajang	63 km
86	Heny (Perorangan)	Mayangan, Probolinggo	3,7 km

0	Ulum																																								
5 1	Muh. Wachi d					2	18						3	26					59	26					11			19						28							
5 2	Hamid i				10	9		4				6	9					6	8		7						6	4													
5 3	Solihin												1																												
5 4	M Arifin												2																												
5 5	Edi															8																									
5 6	Yudi								2							2																									
5 7	Sidik																1						1																		
5 8	Hani															8																									
5 9	Jamalu d.																		2																						
6 0	Ahmd Zaki											2																													
6 1	Supahi t													1																								1			
6 2	Eka Saputr				1											10																									
6 3	Putu Sury							1																																	
6 4	Derry																																								
6 5	Sukars iyo						2																																		
6 6	Anton																													1							1				
6 7	Gede Van.																																						5		

No	Customer	Data Pengiriman Februari 2021																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	RSUD Dr.Saleh	60	185	120	121	113	60		124	120	111	118		124		124	91	30	40	64	62		62	53	63	63	50	61	
2	RSUD Pasiria		50		32					51		50				65			74			58		52		70			
3	RSU Muh.		30								20					30		40		33									
4	RS Bhayang.	73	50	71	32		54		41	42		65		19		41		43		60	35		61		45	24	30	40	
5	RSUD Besuki																							34					
6	RS Dharma	30					20			30	30	30		20		20			20			20		25	25				
7	RSUD Grati										15																		
8	RSUD Dr. Haryato	10		9		3	16			4		7		9		8			7		16				6	16		6	
9	RS Sinergi			20																									
10	RS Wijaya		32	35		53	36		42	45	50	34		41		45		34		28	37		33			54	40	50	
11	Pusk. Paiton													5							18								
12	Pusk. Klakah																		5										
13	Pusk. Ranuyo				3	7																							
14	Pusk. Kedung					5																							
15	PT Nusantara		10		20		20		20				20		20	20	20	20		20						20		20	
16	PT BFI										8																		
17	PT Mustika Buana Sejah.						4				6							1					2	6					
18	C V Mustika																							1					

Lampiran 4 Matrik Jarak Customer PT. XY

No	Lokasi	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	PT. XY	0	6.5	62	46	44	53	6	31	42	19.6	41	32	27	62	22	21	34	0.9	20	8.5	8.2
2	RSUD Dr. Mohamad Saleh	6.5	0	67.3	51	49	59.7	0.85	25.7	47.6	25.9	46.1	37.8	32.5	67.6	26.9	27.5	39.2	5.4	14.9	3.8	3.6
3	RSUD Pasirian	62	67.3	0	16.2	18.2	110	66.1	89.4	20.4	75.7	21.4	87.6	35.6	1.5	40.6	64.7	28.1	63.1	77.1	66.1	66
4	RSU Muhammadiyah Lumajang	46	51	16.2	0	2	93.3	49.5	72.8	4.2	59.5	5.2	71.4	19.4	16.5	24.1	48.2	11.9	46.5	60.6	49.5	49.5
5	RS Bhayangkara Lumajang	44	49	18.2	2	0	91.5	47.6	70.9	2.5	57.6	3.5	69.6	17.5	18.6	22.2	46.3	10	44.7	58.7	47.7	47.6
6	RSUD Besuki	53	59.7	110	93.3	91.5	0	59.1	83.8	89.9	34.5	88.4	22	74.8	110	69.2	54.6	81.5	54.3	73	61.9	61.6
7	RS Dharma Husada	6	0.85	66.1	49.5	47.6	59.1	0	24.8	47.4	25	45.9	37	31.6	67.4	26.1	26.6	39	4.6	14.1	3	2.7
8	RSUD Grati	31	25.7	89.4	72.8	70.9	83.8	24.8	0	70	50.3	68.4	62.3	54.9	89.9	49.3	51.9	61.6	50.3	15.4	24.5	24.3
9	RSUD Dr. Haryoto	42	47.6	20.4	4.2	2.5	89.9	47.4	70	0	56.7	2.4	68.6	16.6	20	21.3	45.4	9.1	43.8	59.3	46.8	46.7
10	Rumah Sakit Sinergi Medika (RSIA Siti Fatimah)	19.6	25.9	75.7	59.5	57.6	34.5	25	50.3	56.7	0	54.5	12.9	40.9	76	35.4	20.8	47.7	20.5	39.2	28.1	27.8
11	RS Wijaya Kusuma	41	46.1	21.4	5.2	3.5	88.4	45.9	68.4	2.4	54.5	0	66.3	14.2	21.4	18.9	43	6.7	41.4	55.4	44.4	44.3
12	Puskesmas Paiton	32	37.8	87.6	71.4	69.6	22	37	62.3	68.6	12.9	66.3	0	52.9	88	47.3	32.7	59.6	32.4	51.1	40	39.7
13	Puskesmas Klakah	27	32.5	35.6	19.4	17.5	74.8	32.3	54.9	16.6	40.9	14.2	52.9	0	35.9	5.5	29.6	7.5	28	42	31	30.9
14	Puskesmas Pasirian	62	67.6	1.5	16.5	18.6	110	67.4	89.9	20	76	21.4	88	35.9	0	40.7	64.8	29	63	79	68	67
15	Puskesmas Ranuyoso	22	26.9	40.6	24.1	22.2	69.2	26.7	49.3	21.3	35.4	18.9	47.3	5.5	40.7	0	24	12	22	37	25	25
16	Puskesmas Ranugedang	21	27.5	64.7	48.2	46.3	54.6	26.6	51.9	45.4	20.8	43	32.7	29.6	64.8	24	0	36	22	43	30	29
17	Puskesmas Kedungjajang	34	39.2	28.1	11.9	10	81.5	39	61.6	9.1	47.7	6.7	59.6	7.5	29	12	36	0	35	49	38	38
18	PT Nusantara Sebelas Medika (RS)	0.9	5.4	63.1	46.5	44.7	54.3	4.6	50.3	43.8	20.5	41.4	32.4	28	63	22	22	35	0	19	7.6	7.3

	Wonolangan)																					
19	PT Harigo Wood Indonesia	20	14.9	77.1	60.6	58.7	73	14.1	15.4	59.3	39.2	55.4	51.1	42	79	37	43	49	19	0	13	13
20	PT Indopherin Jaya	8.5	3.8	66.1	49.5	47.7	61.9	3	24.5	46.8	28.1	44.4	40	31	68	25	30	38	7.6	13	0	0.25
21	PT Bromo Falcata Indonesia	8.2	3.6	66	49.5	47.6	61.6	2.7	24.3	46.7	27.8	44.3	39.7	30.9	67	25	29	38	7.3	13	0.25	0

Lampiran 5 Matrik Waktu Tempuh Customer PT. XY

No	Lokasi	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	PT. XY	0	9.75	62	46	44	53	9	31	42	19.6	41	32	27	62	22	21	34	1.35	20	12.75	12.3
2	RSUD Dr. Mohamad Saleh	9.75	0	67.3	51	49	59.7	1.275	25.7	47.6	25.9	46.1	37.8	32.5	67.6	26.9	27.5	39.2	8.1	14.9	5.7	5.4
3	RSUD Pasirian	62	67.3	0	16.2	18.2	110	66.1	89.4	20.4	75.7	21.4	87.6	35.6	1.5	40.6	64.7	28.1	63.1	77.1	66.1	66
4	RSU Muhammadiyah Lumajang	46	51	16.2	0	2	93.3	49.5	72.8	4.2	59.5	5.2	71.4	19.4	16.5	24.1	48.2	11.9	46.5	60.6	49.5	49.5
5	RS Bhayangkara Lumajang	44	49	18.2	2	0	91.5	47.6	70.9	2.5	57.6	3.5	69.6	17.5	18.6	22.2	46.3	10	44.7	58.7	47.7	47.6
6	RSUD Besuki	53	59.7	110	93.3	91.5	0	59.1	83.8	89.9	34.5	88.4	22	74.8	110	69.2	54.6	81.5	54.3	73	61.9	61.6
7	RS Dharma Husada	9	1.275	66.1	49.5	47.6	59.1	0	24.8	47.4	25	45.9	37	31.6	67.4	26.1	26.6	39	6.9	14.1	4.5	4.05
8	RSUD Grati	31	25.7	89.4	72.8	70.9	83.8	24.8	0	70	50.3	68.4	62.3	54.9	89.9	49.3	51.9	61.6	50.3	15.4	24.5	24.3
9	RSUD Dr. Haryoto	42	47.6	20.4	4.2	2.5	89.9	47.4	70	0	56.7	2.4	68.6	16.6	20	21.3	45.4	9.1	43.8	59.3	46.8	46.7
10	Rumah Sakit Sinergi Medika (RSIA Siti Fatimah)	19.6	25.9	75.7	59.5	57.6	34.5	25	50.3	56.7	0	54.5	12.9	40.9	76	35.4	20.8	47.7	20.5	39.2	28.1	27.8
11	RS Wijaya Kusuma	41	46.1	21.4	5.2	3.5	88.4	45.9	68.4	2.4	54.5	0	66.3	14.2	21.4	18.9	43	6.7	41.4	55.4	44.4	44.3
12	Puskesmas Paiton	32	37.8	87.6	71.4	69.6	22	37	62.3	68.6	12.9	66.3	0	52.9	88	47.3	32.7	59.6	32.4	51.1	40	39.7

13	Puskesmas Klakah	27	32.5	35.6	19.4	17.5	74.8	32.3	54.9	16.6	40.9	14.2	52.9	0	35.9	5.5	29.6	7.5	28	42	31	30.9
14	Puskesmas Pasirian	62	67.6	1.5	16.5	18.6	110	67.4	89.9	20	76	21.4	88	35.9	0	40.7	64.8	29	63	79	68	67
15	Puskesmas Ranuyoso	22	26.9	40.6	24.1	22.2	69.2	26.7	49.3	21.3	35.4	18.9	47.3	5.5	40.7	0	24	12	22	37	25	25
16	Puskesmas Ranugedang	21	27.5	64.7	48.2	46.3	54.6	26.6	51.9	45.4	20.8	43	32.7	29.6	64.8	24	0	36	22	43	30	29
17	Puskesmas Kedungjajang	34	39.2	28.1	11.9	10	81.5	39	61.6	9.1	47.7	6.7	59.6	7.5	29	12	36	0	35	49	38	38
18	PT Nusantara Sebelas Medika (RS Wonolangan)	1.35	8.1	63.1	46.5	44.7	54.3	6.9	50.3	43.8	20.5	41.4	32.4	28	63	22	22	35	0	19	11.4	10.95
19	PT Harigo Wood Indonesia	20	14.9	77.1	60.6	58.7	73	14.1	15.4	59.3	39.2	55.4	51.1	42	79	37	43	49	19	0	13	13
20	PT Indopherin Jaya	12.75	5.7	66.1	49.5	47.7	61.9	4.5	24.5	46.8	28.1	44.4	40	31	68	25	30	38	11.4	13	0	0.375
21	PT Bromo Falcata Indonesia	12.3	5.4	66	49.5	47.6	61.6	4.05	24.3	46.7	27.8	44.3	39.7	30.9	67	25	29	38	10.95	13	0.375	0

Lampiran 6 Produk Tabung Gas di PT. XYOksigen 1,5m³

Nitrogen



Karbondioksida

Oksigen 1m³Oksigen 7m³Oksigen 6m³

Asetilin



Argon

Oksigen 6m³ medis

LPG 40kg

Lampiran 7 (Penentuan Rute / *Running Model* menggunakan *Software Lingo* pada Rute tanggal 05 Januari 2021)

Hasil dari *solution report* pada *cluster 1* :

Global optimal solution found.

Objective value:	86.50000
Objective bound:	86.50000
Infeasibilities:	0.000000
Extended solver steps:	0
Total solver iterations:	12
Elapsed runtime seconds:	0.05

Rute yang paling optimal adalah:

rute pengiriman dari customer 1 ke customer 4 sebesar 43 km
 rute pengiriman dari customer 2 ke customer 3 sebesar 3 km
 rute pengiriman dari customer 3 ke customer 1 sebesar 16.8 km
 rute pengiriman dari customer 4 ke customer 5 sebesar 11.1 km
 rute pengiriman dari customer 5 ke customer 2 sebesar 12.6 km

Model Class: MILP

Total variables:	30
Nonlinear variables:	0
Integer variables:	25
Total constraints:	33
Nonlinear constraints:	0
Total nonzeros:	139
Nonlinear nonzeros:	0

Variable	Value	Reduced Cost
R	0.1000000E+08	0.000000
BONGKAR (1)	15.00000	0.000000
BONGKAR (2)	15.00000	0.000000
BONGKAR (3)	15.00000	0.000000
BONGKAR (4)	15.00000	0.000000
BONGKAR (5)	15.00000	0.000000
T (1)	103.5000	0.000000
T (2)	53.70000	0.000000
T (3)	71.70000	0.000000
T (4)	0.000000	0.000000
T (5)	26.10000	0.000000
X (1, 1)	0.000000	0.000000

X(1, 2)	0.000000	19.60000
X(1, 3)	0.000000	16.80000
X(1, 4)	1.000000	43.00000
X(1, 5)	0.000000	32.00000
X(2, 1)	0.000000	19.70000
X(2, 2)	0.000000	0.000000
X(2, 3)	1.000000	3.000000
X(2, 4)	0.000000	23.90000
X(2, 5)	0.000000	12.90000
X(3, 1)	1.000000	16.80000
X(3, 2)	0.000000	3.000000
X(3, 3)	0.000000	0.000000
X(3, 4)	0.000000	25.90000
X(3, 5)	0.000000	14.90000
X(4, 1)	0.000000	43.00000
X(4, 2)	0.000000	23.60000
X(4, 3)	0.000000	25.90000
X(4, 4)	0.000000	0.000000
X(4, 5)	1.000000	11.10000
X(5, 1)	0.000000	32.00000
X(5, 2)	1.000000	12.60000
X(5, 3)	0.000000	14.90000
X(5, 4)	0.000000	11.10000
X(5, 5)	0.000000	0.000000
D(1, 1)	0.000000	0.000000
D(1, 2)	19.60000	0.000000
D(1, 3)	16.80000	0.000000
D(1, 4)	43.00000	0.000000
D(1, 5)	32.00000	0.000000
D(2, 1)	19.70000	0.000000
D(2, 2)	0.000000	0.000000
D(2, 3)	3.000000	0.000000
D(2, 4)	23.90000	0.000000
D(2, 5)	12.90000	0.000000
D(3, 1)	16.80000	0.000000
D(3, 2)	3.000000	0.000000
D(3, 3)	0.000000	0.000000
D(3, 4)	25.90000	0.000000
D(3, 5)	14.90000	0.000000
D(4, 1)	43.00000	0.000000
D(4, 2)	23.60000	0.000000
D(4, 3)	25.90000	0.000000
D(4, 4)	0.000000	0.000000
D(4, 5)	11.10000	0.000000
D(5, 1)	32.00000	0.000000
D(5, 2)	12.60000	0.000000
D(5, 3)	14.90000	0.000000
D(5, 4)	11.10000	0.000000
D(5, 5)	0.000000	0.000000

DURASI (1, 1)	0.000000	0.000000
DURASI (1, 2)	19.60000	0.000000
DURASI (1, 3)	16.80000	0.000000
DURASI (1, 4)	43.00000	0.000000
DURASI (1, 5)	32.00000	0.000000
DURASI (2, 1)	19.70000	0.000000
DURASI (2, 2)	0.000000	0.000000
DURASI (2, 3)	3.000000	0.000000
DURASI (2, 4)	23.90000	0.000000
DURASI (2, 5)	12.90000	0.000000
DURASI (3, 1)	16.80000	0.000000
DURASI (3, 2)	3.000000	0.000000
DURASI (3, 3)	0.000000	0.000000
DURASI (3, 4)	25.90000	0.000000
DURASI (3, 5)	14.90000	0.000000
DURASI (4, 1)	43.00000	0.000000
DURASI (4, 2)	23.60000	0.000000
DURASI (4, 3)	25.90000	0.000000
DURASI (4, 4)	0.000000	0.000000
DURASI (4, 5)	11.10000	0.000000
DURASI (5, 1)	32.00000	0.000000
DURASI (5, 2)	12.60000	0.000000
DURASI (5, 3)	14.90000	0.000000
DURASI (5, 4)	11.10000	0.000000
DURASI (5, 5)	0.000000	0.000000

Pemrograman Lingo untuk *cluster 2*

model:

```
!parameter model:
    Bongkar      = waktu loading/unloading di customer
    D            = jarak antar customer
    T            = waktu memulai pelayanan pada customer
    Durasi       = Durasi pengiriman
    R            = bilangan rill yang bernilai besar
;
!variabel keputusan:
    x(i, j) = 1 jika kendaraan k beroperasi dari i ke j
;
```

sets:

```
customer/1..3/: Bongkar, T;
route(customer, customer) : x, D, Durasi;
endsets
```


data:

D =

0	5.7	4.2
5.5	0	3.3
4.2	3.5	0

;

Durasi =

0	8.55	6.3
8.25	0	4.95
6.3	5.25	0

;

Bongkar = 15 15 15;

R = 10000000;

```
@text() = @write("Rute yang paling optimal adalah: ",
@newline(1));
```

```
@text() = @writefor(rute(i, j) | x(i, j) #NE# 0 : "rute
pengiriman dari customer ", i, " ke customer ", j, " sebesar
", D(i, j), " km ",
@newline(1));
```

enddata

!fungsi objektif;

MIN =

```
@SUM (customer(i) :
@SUM(customer (j) | i#NE# j: D (i, j) * x(i, j))
);
```

!Fungsi batasan;

!setiap customer dikunjungi satu kali;

```
@FOR(customer (j) | j #GT# 1 :
@SUM(customer (i) | i #NE# j: x(i, j)) = 1
);
```

!perjalanan diawali dari depot;

```
@FOR (customer (i) | i #EQ# 1 :
@SUM (customer (J) | j #GT# 1 :x(i, j)) = 1
);
```

```

!perjalanan diawali dari depot menuju customer;
@FOR (customer (i) | i #EQ# 1 :
    @SUM (customer (j) | j #GT# 1 : x(i, j)) = x(1, 2)
);

!perjalanan akan berakhir di depot;
@FOR (customer (j) | j #EQ# 1 :
    @SUM (customer (i) | i #GT# 1 : x(i, j)) = 1
);

!pelaksanaan;
@FOR (customer (i) | i #NE# 1 :
    @FOR (customer (j) : T(j) >= T(i) + Bongkar(i) +
durasi(i, j) - R * (1 - x(i, j)))
);

!rute;
@FOR (customer (z) :
    @SUM(customer (i) | i #NE# z : x(i, z)) - @SUM(customer
(j) | j #NE# z : x(z, j)) = 0
);

! Variabel keputusan yang memiliki variabel biner;
@FOR (rute (i, j):
    @BIN(x(i, j)));

End

```

Hasil dari *solution report* pada *cluster 2* :

```

Global optimal solution found.
Objective value:                13.20000
Objective bound:                13.20000
Infeasibilities:                0.000000
Extended solver steps:         0
Total solver iterations:        0
Elapsed runtime seconds:       0.47

```

Rute yang paling optimal adalah:
 rute pengiriman dari customer 1 ke customer 2 sebesar 5.7 km
 rute pengiriman dari customer 2 ke customer 3 sebesar 3.3 km
 rute pengiriman dari customer 3 ke customer 1 sebesar 4.2 km
 Model Class: MILP

```

Total variables:                12
Nonlinear variables:            0

```

Integer variables:	9
Total constraints:	15
Nonlinear constraints:	0
Total nonzeros:	41
Nonlinear nonzeros:	0

Variable	Value	Reduced Cost
R	0.1000000E+08	0.000000
BONGKAR(1)	15.00000	0.000000
BONGKAR(2)	15.00000	0.000000
BONGKAR(3)	15.00000	0.000000
T(1)	41.25000	0.000000
T(2)	0.000000	0.000000
T(3)	19.95000	0.000000
X(1, 1)	0.000000	0.000000
X(1, 2)	1.000000	5.700000
X(1, 3)	0.000000	4.200000
X(2, 1)	0.000000	5.500000
X(2, 2)	0.000000	0.000000
X(2, 3)	1.000000	3.300000
X(3, 1)	1.000000	4.200000
X(3, 2)	0.000000	3.500000
X(3, 3)	0.000000	0.000000
D(1, 1)	0.000000	0.000000
D(1, 2)	5.700000	0.000000
D(1, 3)	4.200000	0.000000
D(2, 1)	5.500000	0.000000
D(2, 2)	0.000000	0.000000
D(2, 3)	3.300000	0.000000
D(3, 1)	4.200000	0.000000
D(3, 2)	3.500000	0.000000
D(3, 3)	0.000000	0.000000
DURASI(1, 1)	0.000000	0.000000
DURASI(1, 2)	8.550000	0.000000
DURASI(1, 3)	6.300000	0.000000
DURASI(2, 1)	8.250000	0.000000
DURASI(2, 2)	0.000000	0.000000
DURASI(2, 3)	4.950000	0.000000
DURASI(3, 1)	6.300000	0.000000
DURASI(3, 2)	5.250000	0.000000
DURASI(3, 3)	0.000000	0.000000

Pemrograman Lingo untuk *cluster 3*

model:

```
!parameter model:
    Bongkar      = waktu loading/unloading di customer
    D            = jarak antar customer
    T            = waktu memulai pelayanan pada customer
    Durasi       = Durasi pengiriman
    R            = bilangan rill yang bernilai besar
;
!variabel keputusan:
    x(i, j) = 1 jika kendaraan k beroperasi dari i ke j
;
```

sets:

```
customer/1..9/: Bongkar, T;
route(customer, customer) : x, D, Durasi;
endsets
```

data:

D =

0	54.8	51	51.2	52	52.3	46	44.5	42.3
54.8	0	5.1	4.6	5.2	5.3	9.4	11	13.5
51	5.1	0	0.18	0.27	0.5	5.3	7.1	9.5
51.2	4.6	0.18	0	0.45	0.7	5.4	7.4	9.5
52	5.2	0.27	0.45	0	0.25	6.3	8.2	10.5
52.3	5.3	0.5	0.7	0.25	0	6.5	8.5	10.7
46	9.4	5.3	5.4	6.3	6.5	0	1.9	4
44.8	11	7.1	7.4	8.2	8.5	1.9	0	3.4
43	12.9	8.7	8.9	9.7	10	3.4	2.4	0

;

Durasi =

0	54.8	51	51.2	52	52.3	46	44.5	42.3
54.8	0	5.1	4.6	5.2	5.3	9.4	11	13.5
51	5.1	0	0.18	0.27	0.5	5.3	7.1	9.5
51.2	4.6	0.18	0	0.45	0.7	5.4	7.4	9.5
52	5.2	0.27	0.45	0	0.25	6.3	8.2	10.5
52.3	5.3	0.5	0.7	0.25	0	6.5	8.5	10.7
46	9.4	5.3	5.4	6.3	6.5	0	1.9	4

44.8	11	7.1	7.4	8.2	8.5	1.9	0	3.4
43	12.9	8.7	8.9	9.7	10	3.4	2.4	0

```
;
```

```
Bongkar = 15 15 15 15 15 15 15 15 15;
R = 10000000;
```

```
@text() = @write("Rute yang paling optimal adalah: ",
@newline(1));
```

```
@text() = @writefor(rute(i, j) | x(i, j) #NE# 0 : "rute
pengiriman dari customer ", i, " ke customer ", j, " sebesar
", D(i, j), " km ",
@newline(1));
```

```
enddata
```

```
!fungsi objektif;
```

```
MIN =
```

```
@SUM (customer(i) :
@SUM(customer (j) | i#NE# j: D (i, j) * x(i, j))
);
```

```
!Fungsi batasan;
```

```
!setiap customer dikunjungi satu kali;
```

```
@FOR(customer (j) | j #GT# 1 :
@SUM(customer (i) | i #NE# j: x(i, j)) = 1
);
```

```
!perjalanan diawali dari depot;
```

```
@FOR (customer (i) | i #EQ# 1 :
@SUM (customer (J) | j #GT# 1 :x(i, j)) = 1
);
```

```
!perjalanan akan berakhir di depot;
```

```
@FOR (customer (j) | j #EQ# 1 :
@SUM (customer (i) | i #GT# 1 : x(i, j)) = 1
);
```

```
!pelaksanaan;
```

```
@FOR (customer (i)| i #NE# 1 :
@FOR (customer (j) : T(j) >= T(i) + Bongkar(i) +
durasi(i, j) - R * (1 - x(i, j)))
);
```

```
!rute;
```

```

@FOR (customer (z) :
    @SUM(customer (i) | i #NE# z : x(i, z)) - @SUM(customer
(j) | j #NE# z : x(z, j)) = 0
);

! Variabel keputusan yang memiliki variabel biner;
@FOR (rute (i, j):
    @BIN(x(i, j)));

End

```

Hasil dari *solution report* pada *cluster 3* :

Global optimal solution found.

Objective value:	112.6200
Objective bound:	112.6200
Infeasibilities:	0.000000
Extended solver steps:	2706
Total solver iterations:	143195
Elapsed runtime seconds:	4.78

Rute yang paling optimal adalah:

rute pengiriman dari customer 1 ke customer 9 sebesar 42.3 km
 rute pengiriman dari customer 2 ke customer 8 sebesar 11 km
 rute pengiriman dari customer 3 ke customer 5 sebesar 0.27 km
 rute pengiriman dari customer 4 ke customer 2 sebesar 4.6 km
 rute pengiriman dari customer 5 ke customer 6 sebesar 0.25 km
 rute pengiriman dari customer 6 ke customer 4 sebesar 0.7 km
 rute pengiriman dari customer 7 ke customer 3 sebesar 5.3 km
 rute pengiriman dari customer 8 ke customer 1 sebesar 44.8 km
 rute pengiriman dari customer 9 ke customer 7 sebesar 3.4 km

Model Class: MILP

Total variables:	90
Nonlinear variables:	0
Integer variables:	81
Total constraints:	92
Nonlinear constraints:	0
Total nonzeros:	496
Nonlinear nonzeros:	0

Variable	Value	Reduced Cost
R	0.1000000E+08	0.000000

BONGKAR (1)	15.00000	0.000000
BONGKAR (2)	15.00000	0.000000
BONGKAR (3)	15.00000	0.000000
BONGKAR (4)	15.00000	0.000000
BONGKAR (5)	15.00000	0.000000
BONGKAR (6)	15.00000	0.000000
BONGKAR (7)	15.00000	0.000000
BONGKAR (8)	15.00000	0.000000
BONGKAR (9)	15.00000	0.000000
T (1)	190.3200	0.000000
T (2)	104.5200	0.000000
T (3)	38.70000	0.000000
T (4)	84.92000	0.000000
T (5)	53.97000	0.000000
T (6)	69.22000	0.000000
T (7)	18.40000	0.000000
T (8)	130.5200	0.000000
T (9)	0.000000	0.000000
X (1, 1)	0.000000	0.000000
X (1, 2)	0.000000	54.80000
X (1, 3)	0.000000	51.00000
X (1, 4)	0.000000	51.20000
X (1, 5)	0.000000	52.00000
X (1, 6)	0.000000	52.30000
X (1, 7)	0.000000	46.00000
X (1, 8)	0.000000	44.50000
X (1, 9)	1.000000	42.30000
X (2, 1)	0.000000	54.80000
X (2, 2)	0.000000	0.000000
X (2, 3)	0.000000	5.100000
X (2, 4)	0.000000	4.600000
X (2, 5)	0.000000	5.200000
X (2, 6)	0.000000	5.300000
X (2, 7)	0.000000	9.400000
X (2, 8)	1.000000	11.00000
X (2, 9)	0.000000	13.50000
X (3, 1)	0.000000	51.00000
X (3, 2)	0.000000	5.100000
X (3, 3)	0.000000	0.000000
X (3, 4)	0.000000	0.1800000
X (3, 5)	1.000000	0.2700000
X (3, 6)	0.000000	0.5000000
X (3, 7)	0.000000	5.300000
X (3, 8)	0.000000	7.100000
X (3, 9)	0.000000	9.500000
X (4, 1)	0.000000	51.20000
X (4, 2)	1.000000	4.600000
X (4, 3)	0.000000	0.1800000
X (4, 4)	0.000000	0.000000

X(4, 5)	0.000000	0.4500000
X(4, 6)	0.000000	0.7000000
X(4, 7)	0.000000	5.400000
X(4, 8)	0.000000	7.400000
X(4, 9)	0.000000	9.500000
X(5, 1)	0.000000	52.00000
X(5, 2)	0.000000	5.200000
X(5, 3)	0.000000	0.2700000
X(5, 4)	0.000000	0.4500000
X(5, 5)	0.000000	0.000000
X(5, 6)	1.000000	0.2500000
X(5, 7)	0.000000	6.300000
X(5, 8)	0.000000	8.200000
X(5, 9)	0.000000	10.50000
X(6, 1)	0.000000	52.30000
X(6, 2)	0.000000	5.300000
X(6, 3)	0.000000	0.5000000
X(6, 4)	1.000000	0.7000000
X(6, 5)	0.000000	0.2500000
X(6, 6)	0.000000	0.000000
X(6, 7)	0.000000	6.500000
X(6, 8)	0.000000	8.500000
X(6, 9)	0.000000	10.70000
X(7, 1)	0.000000	46.00000
X(7, 2)	0.000000	9.400000
X(7, 3)	1.000000	5.300000
X(7, 4)	0.000000	5.400000
X(7, 5)	0.000000	6.300000
X(7, 6)	0.000000	6.500000
X(7, 7)	0.000000	0.000000
X(7, 8)	0.000000	1.900000
X(7, 9)	0.000000	4.000000
X(8, 1)	1.000000	44.80000
X(8, 2)	0.000000	11.00000
X(8, 3)	0.000000	7.100000
X(8, 4)	0.000000	7.400000
X(8, 5)	0.000000	8.200000
X(8, 6)	0.000000	8.500000
X(8, 7)	0.000000	1.900000
X(8, 8)	0.000000	0.000000
X(8, 9)	0.000000	3.400000
X(9, 1)	0.000000	43.00000
X(9, 2)	0.000000	12.90000
X(9, 3)	0.000000	8.700000
X(9, 4)	0.000000	8.900000
X(9, 5)	0.000000	9.700000
X(9, 6)	0.000000	10.00000
X(9, 7)	1.000000	3.400000
X(9, 8)	0.000000	2.400000

X(9, 9)	0.000000	0.000000
D(1, 1)	0.000000	0.000000
D(1, 2)	54.80000	0.000000
D(1, 3)	51.00000	0.000000
D(1, 4)	51.20000	0.000000
D(1, 5)	52.00000	0.000000
D(1, 6)	52.30000	0.000000
D(1, 7)	46.00000	0.000000
D(1, 8)	44.50000	0.000000
D(1, 9)	42.30000	0.000000
D(2, 1)	54.80000	0.000000
D(2, 2)	0.000000	0.000000
D(2, 3)	5.100000	0.000000
D(2, 4)	4.600000	0.000000
D(2, 5)	5.200000	0.000000
D(2, 6)	5.300000	0.000000
D(2, 7)	9.400000	0.000000
D(2, 8)	11.00000	0.000000
D(2, 9)	13.50000	0.000000
D(3, 1)	51.00000	0.000000
D(3, 2)	5.100000	0.000000
D(3, 3)	0.000000	0.000000
D(3, 4)	0.1800000	0.000000
D(3, 5)	0.2700000	0.000000
D(3, 6)	0.5000000	0.000000
D(3, 7)	5.300000	0.000000
D(3, 8)	7.100000	0.000000
D(3, 9)	9.500000	0.000000
D(4, 1)	51.20000	0.000000
D(4, 2)	4.600000	0.000000
D(4, 3)	0.1800000	0.000000
D(4, 4)	0.000000	0.000000
D(4, 5)	0.4500000	0.000000
D(4, 6)	0.7000000	0.000000
D(4, 7)	5.400000	0.000000
D(4, 8)	7.400000	0.000000
D(4, 9)	9.500000	0.000000
D(5, 1)	52.00000	0.000000
D(5, 2)	5.200000	0.000000
D(5, 3)	0.2700000	0.000000
D(5, 4)	0.4500000	0.000000
D(5, 5)	0.000000	0.000000
D(5, 6)	0.2500000	0.000000
D(5, 7)	6.300000	0.000000
D(5, 8)	8.200000	0.000000
D(5, 9)	10.50000	0.000000
D(6, 1)	52.30000	0.000000
D(6, 2)	5.300000	0.000000
D(6, 3)	0.5000000	0.000000

D(6, 4)	0.7000000	0.000000
D(6, 5)	0.2500000	0.000000
D(6, 6)	0.000000	0.000000
D(6, 7)	6.500000	0.000000
D(6, 8)	8.500000	0.000000
D(6, 9)	10.70000	0.000000
D(7, 1)	46.00000	0.000000
D(7, 2)	9.400000	0.000000
D(7, 3)	5.300000	0.000000
D(7, 4)	5.400000	0.000000
D(7, 5)	6.300000	0.000000
D(7, 6)	6.500000	0.000000
D(7, 7)	0.000000	0.000000
D(7, 8)	1.900000	0.000000
D(7, 9)	4.000000	0.000000
D(8, 1)	44.80000	0.000000
D(8, 2)	11.00000	0.000000
D(8, 3)	7.100000	0.000000
D(8, 4)	7.400000	0.000000
D(8, 5)	8.200000	0.000000
D(8, 6)	8.500000	0.000000
D(8, 7)	1.900000	0.000000
D(8, 8)	0.000000	0.000000
D(8, 9)	3.400000	0.000000
D(9, 1)	43.00000	0.000000
D(9, 2)	12.90000	0.000000
D(9, 3)	8.700000	0.000000
D(9, 4)	8.900000	0.000000
D(9, 5)	9.700000	0.000000
D(9, 6)	10.00000	0.000000
D(9, 7)	3.400000	0.000000
D(9, 8)	2.400000	0.000000
D(9, 9)	0.000000	0.000000
DURASI (1, 1)	0.000000	0.000000
DURASI (1, 2)	54.80000	0.000000
DURASI (1, 3)	51.00000	0.000000
DURASI (1, 4)	51.20000	0.000000
DURASI (1, 5)	52.00000	0.000000
DURASI (1, 6)	52.30000	0.000000
DURASI (1, 7)	46.00000	0.000000
DURASI (1, 8)	44.50000	0.000000
DURASI (1, 9)	42.30000	0.000000
DURASI (2, 1)	54.80000	0.000000
DURASI (2, 2)	0.000000	0.000000
DURASI (2, 3)	5.100000	0.000000
DURASI (2, 4)	4.600000	0.000000
DURASI (2, 5)	5.200000	0.000000
DURASI (2, 6)	5.300000	0.000000
DURASI (2, 7)	9.400000	0.000000

DURASI (2, 8)	11.00000	0.000000
DURASI (2, 9)	13.50000	0.000000
DURASI (3, 1)	51.00000	0.000000
DURASI (3, 2)	5.100000	0.000000
DURASI (3, 3)	0.000000	0.000000
DURASI (3, 4)	0.1800000	0.000000
DURASI (3, 5)	0.2700000	0.000000
DURASI (3, 6)	0.5000000	0.000000
DURASI (3, 7)	5.300000	0.000000
DURASI (3, 8)	7.100000	0.000000
DURASI (3, 9)	9.500000	0.000000
DURASI (4, 1)	51.20000	0.000000
DURASI (4, 2)	4.600000	0.000000
DURASI (4, 3)	0.1800000	0.000000
DURASI (4, 4)	0.000000	0.000000
DURASI (4, 5)	0.4500000	0.000000
DURASI (4, 6)	0.7000000	0.000000
DURASI (4, 7)	5.400000	0.000000
DURASI (4, 8)	7.400000	0.000000
DURASI (4, 9)	9.500000	0.000000
DURASI (5, 1)	52.00000	0.000000
DURASI (5, 2)	5.200000	0.000000
DURASI (5, 3)	0.2700000	0.000000
DURASI (5, 4)	0.4500000	0.000000
DURASI (5, 5)	0.000000	0.000000
DURASI (5, 6)	0.2500000	0.000000
DURASI (5, 7)	6.300000	0.000000
DURASI (5, 8)	8.200000	0.000000
DURASI (5, 9)	10.50000	0.000000
DURASI (6, 1)	52.30000	0.000000
DURASI (6, 2)	5.300000	0.000000
DURASI (6, 3)	0.5000000	0.000000
DURASI (6, 4)	0.7000000	0.000000
DURASI (6, 5)	0.2500000	0.000000
DURASI (6, 6)	0.000000	0.000000
DURASI (6, 7)	6.500000	0.000000
DURASI (6, 8)	8.500000	0.000000
DURASI (6, 9)	10.70000	0.000000
DURASI (7, 1)	46.00000	0.000000
DURASI (7, 2)	9.400000	0.000000
DURASI (7, 3)	5.300000	0.000000
DURASI (7, 4)	5.400000	0.000000
DURASI (7, 5)	6.300000	0.000000
DURASI (7, 6)	6.500000	0.000000
DURASI (7, 7)	0.000000	0.000000
DURASI (7, 8)	1.900000	0.000000
DURASI (7, 9)	4.000000	0.000000
DURASI (8, 1)	44.80000	0.000000
DURASI (8, 2)	11.00000	0.000000

DURASI (8, 3)	7.100000	0.000000
DURASI (8, 4)	7.400000	0.000000
DURASI (8, 5)	8.200000	0.000000
DURASI (8, 6)	8.500000	0.000000
DURASI (8, 7)	1.900000	0.000000
DURASI (8, 8)	0.000000	0.000000
DURASI (8, 9)	3.400000	0.000000
DURASI (9, 1)	43.000000	0.000000
DURASI (9, 2)	12.900000	0.000000
DURASI (9, 3)	8.700000	0.000000
DURASI (9, 4)	8.900000	0.000000
DURASI (9, 5)	9.700000	0.000000
DURASI (9, 6)	10.000000	0.000000
DURASI (9, 7)	3.400000	0.000000
DURASI (9, 8)	2.400000	0.000000
DURASI (9, 9)	0.000000	0.000000

Lampiran 8 (Penentuan Rute / *Running Model* menggunakan *Software Lingo* pada Rute tanggal 23 Februari 2021)

Hasil dari *solution report* pada *cluster 1* :

```
Global optimal solution found.
Objective value:                107.7000
Objective bound:                107.7000
Infeasibilities:                0.000000
Extended solver steps:         0
Total solver iterations:        3
Elapsed runtime seconds:       0.11
```

Rute yang paling optimal adalah:

```
rute pengiriman dari customer 1 ke customer 4 sebesar 38.4 km
rute pengiriman dari customer 2 ke customer 1 sebesar 53.5 km
rute pengiriman dari customer 3 ke customer 2 sebesar 10.2 km
rute pengiriman dari customer 4 ke customer 3 sebesar 5.6 km
```

```
Model Class:                    MILP
```

```
Total variables:                20
Nonlinear variables:            0
Integer variables:              16
```

```
Total constraints:              23
Nonlinear constraints:          0
```

```
Total nonzeros:                83
Nonlinear nonzeros:            0
```

Variable	Value	Reduced Cost
R	0.1000000E+08	0.000000
BONGKAR(1)	15.00000	0.000000
BONGKAR(2)	15.00000	0.000000
BONGKAR(3)	15.00000	0.000000
BONGKAR(4)	15.00000	0.000000
T(1)	132.3000	0.000000
T(2)	30.80000	0.000000
T(3)	74.00000	0.000000
T(4)	0.000000	0.000000
X(1, 1)	0.000000	0.000000
X(1, 2)	0.000000	53.50000
X(1, 3)	0.000000	43.30000

X(1, 4)	1.000000	38.40000
X(2, 1)	1.000000	53.50000
X(2, 2)	0.000000	0.000000
X(2, 3)	0.000000	10.20000
X(2, 4)	0.000000	15.80000
X(3, 1)	0.000000	43.30000
X(3, 2)	1.000000	10.20000
X(3, 3)	0.000000	0.000000
X(3, 4)	0.000000	5.600000
X(4, 1)	0.000000	38.40000
X(4, 2)	0.000000	15.80000
X(4, 3)	1.000000	5.600000
X(4, 4)	0.000000	0.000000
D(1, 1)	0.000000	0.000000
D(1, 2)	53.50000	0.000000
D(1, 3)	43.30000	0.000000
D(1, 4)	38.40000	0.000000
D(2, 1)	53.50000	0.000000
D(2, 2)	0.000000	0.000000
D(2, 3)	10.20000	0.000000
D(2, 4)	15.80000	0.000000
D(3, 1)	43.30000	0.000000
D(3, 2)	10.20000	0.000000
D(3, 3)	0.000000	0.000000
D(3, 4)	5.600000	0.000000
D(4, 1)	38.40000	0.000000
D(4, 2)	15.80000	0.000000
D(4, 3)	5.600000	0.000000
D(4, 4)	0.000000	0.000000
DURASI(1, 1)	0.000000	0.000000
DURASI(1, 2)	53.50000	0.000000
DURASI(1, 3)	43.30000	0.000000
DURASI(1, 4)	38.40000	0.000000
DURASI(2, 1)	53.50000	0.000000
DURASI(2, 2)	0.000000	0.000000
DURASI(2, 3)	10.20000	0.000000
DURASI(2, 4)	15.80000	0.000000
DURASI(3, 1)	43.30000	0.000000
DURASI(3, 2)	10.20000	0.000000
DURASI(3, 3)	0.000000	0.000000
DURASI(3, 4)	5.600000	0.000000
DURASI(4, 1)	38.40000	0.000000
DURASI(4, 2)	15.80000	0.000000
DURASI(4, 3)	5.600000	0.000000
DURASI(4, 4)	0.000000	0.000000

Pemrograman Lingo untuk *cluster 2*

model:

```
!parameter model:
    Bongkar      = waktu loading/unloading di customer
    D            = jarak antar customer
    T            = waktu memulai pelayanan pada customer
    Durasi       = Durasi pengiriman
    R            = bilangan rill yang bernilai besar
;
!variabel keputusan:
    x(i, j) = 1 jika kendaraan k beroperasi dari i ke j
;
```

sets:

```
customer/1..6/: Bongkar, T;
route(customer, customer) : x, D, Durasi;
endsets
```

data:

D =

0	7.7	6.7	6.5	0.55	3.6
7.7	0	1.9	3	7.2	4.3
6.7	1.3	0	2.1	6.3	3.6
6.3	2.5	2.1	0	5.8	3.7
0.55	7.2	6.3	6	0	3
3.7	4.2	3.3	3	3.2	0

;

Durasi =

0	11.55	10.05	9.75	0.825	5.4
11.55	0	2.85	4.5	10.8	6.45
10.05	1.95	0	3.15	9.45	5.4
9.45	3.75	3.15	0	8.7	5.55
0.825	10.8	9.45	9	0	4.5
5.55	6.3	4.95	4.5	4.8	0

;

Bongkar = 15 15 15 15 15 15;

R = 10000000;

```

@text() = @write("Rute yang paling optimal adalah: ",
@newline(1));

@text() = @writefor(rute(i, j) | x(i, j) #NE# 0 : "rute
pengiriman dari customer ", i, " ke customer ", j, " sebesar
", D(i, j), " km ",
@newline(1));

enddata

!fungsi objektif;
MIN =
@SUM (customer(i) :
    @SUM(customer (j) | i#NE# j: D (i, j) * x(i, j))
);

!Fungsi batasan;

!setiap customer dikunjungi satu kali;
@FOR(customer (j) | j #GT# 1 :
    @SUM(customer (i) | i #NE# j: x(i, j)) = 1
);

!perjalanan diawali dari depot;
@FOR (customer (i) | i #EQ# 1 :
    @SUM (customer (J) | j #GT# 1 :x(i, j)) = 1
);

!perjalanan diawali dari customer menuju customer;
@FOR (customer (i) | i #EQ# 6 :
    @SUM (customer (J) | j #GT# 1 :x(i, j)) = x(6, 4)
);

!perjalanan akan berakhir di depot;
@FOR (customer (j) | j #EQ# 1 :
    @SUM (customer (i) | i #GT# 1 : x(i, j)) = 1
);

!pelaksanaan;
@FOR (customer (i)| i #NE# 1 :
    @FOR (customer (j) : T(j) >= T(i) + Bongkar(i) +
durasi(i, j) - R * (1 - x(i, j)))
);

!rute;
@FOR (customer (z) :

```



```

        @SUM(customer (i) | i #NE# z : x(i, z)) - @SUM(customer
(j) | j #NE# z : x(z, j)) = 0
    );
! Variabel keputusan yang memiliki variabel biner;
@FOR (rute (i, j):
    @BIN(x(i, j)));

End

```

Hasil dari *solution report* pada cluster 2 :

```

Global optimal solution found.
  Objective value:                17.65000
  Objective bound:                17.65000
  Infeasibilities:                0.000000
  Extended solver steps:          16
  Total solver iterations:        325
  Elapsed runtime seconds:       0.17

```

Rute yang paling optimal adalah:

```

rute pengiriman dari customer 1 ke customer 5 sebesar 0.55 km
rute pengiriman dari customer 2 ke customer 1 sebesar 7.7 km
rute pengiriman dari customer 3 ke customer 2 sebesar 1.3 km
rute pengiriman dari customer 4 ke customer 3 sebesar 2.1 km
rute pengiriman dari customer 5 ke customer 6 sebesar 3 km
rute pengiriman dari customer 6 ke customer 4 sebesar 3 km
  Model Class:                    MILP

```

```

Total variables:                  42
Nonlinear variables:              0
Integer variables:                36

Total constraints:                45
Nonlinear constraints:            0

Total nonzeros:                  209
Nonlinear nonzeros:              0

```

Variable	Value	Reduced Cost
R	0.1000000E+08	0.000000
BONGKAR(1)	15.00000	0.000000
BONGKAR(2)	15.00000	0.000000
BONGKAR(3)	15.00000	0.000000
BONGKAR(4)	15.00000	0.000000
BONGKAR(5)	15.00000	0.000000
BONGKAR(6)	15.00000	0.000000

T(1)	0.1000000E+08	0.000000
T(2)	9999974.	0.000000
T(3)	9999957.	0.000000
T(4)	9999885.	0.000000
T(5)	0.000000	0.000000
T(6)	19.50000	0.000000
X(1, 1)	0.000000	0.000000
X(1, 2)	0.000000	7.700000
X(1, 3)	0.000000	6.700000
X(1, 4)	0.000000	6.500000
X(1, 5)	1.000000	0.550000
X(1, 6)	0.000000	3.600000
X(2, 1)	1.000000	7.700000
X(2, 2)	0.000000	0.000000
X(2, 3)	0.000000	1.900000
X(2, 4)	0.000000	3.000000
X(2, 5)	0.000000	7.200000
X(2, 6)	0.000000	4.300000
X(3, 1)	0.000000	6.700000
X(3, 2)	1.000000	1.300000
X(3, 3)	0.000000	0.000000
X(3, 4)	0.000000	2.100000
X(3, 5)	0.000000	6.300000
X(3, 6)	0.000000	3.600000
X(4, 1)	0.000000	6.300000
X(4, 2)	0.000000	2.500000
X(4, 3)	1.000000	2.100000
X(4, 4)	0.000000	0.000000
X(4, 5)	0.000000	5.800000
X(4, 6)	0.000000	3.700000
X(5, 1)	0.000000	0.550000
X(5, 2)	0.000000	7.200000
X(5, 3)	0.000000	6.300000
X(5, 4)	0.000000	6.000000
X(5, 5)	0.000000	0.000000
X(5, 6)	1.000000	3.000000
X(6, 1)	0.000000	3.700000
X(6, 2)	0.000000	4.200000
X(6, 3)	0.000000	3.300000
X(6, 4)	1.000000	3.000000
X(6, 5)	0.000000	3.200000
X(6, 6)	0.000000	0.000000
D(1, 1)	0.000000	0.000000
D(1, 2)	7.700000	0.000000
D(1, 3)	6.700000	0.000000
D(1, 4)	6.500000	0.000000
D(1, 5)	0.550000	0.000000
D(1, 6)	3.600000	0.000000
D(2, 1)	7.700000	0.000000

D(2, 2)	0.000000	0.000000
D(2, 3)	1.900000	0.000000
D(2, 4)	3.000000	0.000000
D(2, 5)	7.200000	0.000000
D(2, 6)	4.300000	0.000000
D(3, 1)	6.700000	0.000000
D(3, 2)	1.300000	0.000000
D(3, 3)	0.000000	0.000000
D(3, 4)	2.100000	0.000000
D(3, 5)	6.300000	0.000000
D(3, 6)	3.600000	0.000000
D(4, 1)	6.300000	0.000000
D(4, 2)	2.500000	0.000000
D(4, 3)	2.100000	0.000000
D(4, 4)	0.000000	0.000000
D(4, 5)	5.800000	0.000000
D(4, 6)	3.700000	0.000000
D(5, 1)	0.550000	0.000000
D(5, 2)	7.200000	0.000000
D(5, 3)	6.300000	0.000000
D(5, 4)	6.000000	0.000000
D(5, 5)	0.000000	0.000000
D(5, 6)	3.000000	0.000000
D(6, 1)	3.700000	0.000000
D(6, 2)	4.200000	0.000000
D(6, 3)	3.300000	0.000000
D(6, 4)	3.000000	0.000000
D(6, 5)	3.200000	0.000000
D(6, 6)	0.000000	0.000000
DURASI(1, 1)	0.000000	0.000000
DURASI(1, 2)	11.55000	0.000000
DURASI(1, 3)	10.05000	0.000000
DURASI(1, 4)	9.750000	0.000000
DURASI(1, 5)	0.825000	0.000000
DURASI(1, 6)	5.400000	0.000000
DURASI(2, 1)	11.55000	0.000000
DURASI(2, 2)	0.000000	0.000000
DURASI(2, 3)	2.850000	0.000000
DURASI(2, 4)	4.500000	0.000000
DURASI(2, 5)	10.80000	0.000000
DURASI(2, 6)	6.450000	0.000000
DURASI(3, 1)	10.05000	0.000000
DURASI(3, 2)	1.950000	0.000000
DURASI(3, 3)	0.000000	0.000000
DURASI(3, 4)	3.150000	0.000000
DURASI(3, 5)	9.450000	0.000000
DURASI(3, 6)	5.400000	0.000000
DURASI(4, 1)	9.450000	0.000000
DURASI(4, 2)	3.750000	0.000000

```

DURASI ( 4, 3)      3.150000      0.000000
DURASI ( 4, 4)      0.000000      0.000000
DURASI ( 4, 5)      8.700000      0.000000
DURASI ( 4, 6)      5.550000      0.000000
DURASI ( 5, 1)      0.8250000     0.000000
DURASI ( 5, 2)      10.80000     0.000000
DURASI ( 5, 3)      9.450000     0.000000
DURASI ( 5, 4)      9.000000     0.000000
DURASI ( 5, 5)      0.000000     0.000000
DURASI ( 5, 6)      4.500000     0.000000
DURASI ( 6, 1)      5.550000     0.000000
DURASI ( 6, 2)      6.300000     0.000000
DURASI ( 6, 3)      4.950000     0.000000
DURASI ( 6, 4)      4.500000     0.000000
DURASI ( 6, 5)      4.800000     0.000000
DURASI ( 6, 6)      0.000000     0.000000

```

Pemrograman Lingo untuk *cluster 3*

model:

```

!parameter model:
    Bongkar      = waktu loading/unloading di customer
    D            = jarak antar customer
    T            = waktu memulai pelayanan pada customer
    Durasi       = Durasi pengiriman
    R            = bilangan rill yang bernilai besar
;
!variabel keputusan:
    x(i, j) = 1 jika kendaraan k beroperasi dari i ke j
;

```

sets:

```

customer/1..3/: Bongkar, T;
route(customer, customer) : x, D, Durasi;
endsets

```

data:

D =

0	56.5	17.6
55.6	0	38.1
17.6	38.1	0

```

;
Durasi =


|      |      |      |
|------|------|------|
| 0    | 56.5 | 17.6 |
| 55.6 | 0    | 38.1 |
| 17.6 | 38.1 | 0    |


;

Bongkar = 15 15 15;
R = 10000000;

@text() = @write("Rute yang paling optimal adalah: ",
@newline(1));

@text() = @writefor(rute(i, j) | x(i, j) #NE# 0 : "rute
pengiriman dari customer ", i, " ke customer ", j, " sebesar
", D(i, j), " km ",
@newline(1));

enddata

!fungsi objektif;
MIN =
@SUM (customer(i) :
    @SUM(customer (j) | i#NE# j: D (i, j) * x(i, j))
);

!Fungsi batasan;

!setiap customer dikunjungi satu kali;
@FOR(customer (j) | j #GT# 1 :
    @SUM(customer (i) | i #NE# j: x(i, j)) = 1
);

!perjalanan diawali dari depot;
@FOR (customer (i) | i #EQ# 1 :
    @SUM (customer (J) | j #GT# 1 :x(i, j)) = 1
);

!perjalanan akan berakhir di depot;
@FOR (customer (j) | j #EQ# 1 :
    @SUM (customer (i) | i #GT# 1 : x(i, j)) = 1
);

!pelaksanaan;
@FOR (customer (i)| i #NE# 1 :

```

```

        @FOR (customer (j) : T(j) >= T(i) + Bongkar(i) +
durasi(i, j) - R * (1 - x(i, j)))
);

!rute;
@FOR (customer (z) :
        @SUM(customer (i) | i #NE# z : x(i, z)) - @SUM(customer
(j) | j #NE# z : x(z, j)) = 0
);

! Variabel keputusan yang memiliki variabel biner;
@FOR (rute (i, j):
        @BIN(x(i, j)));

End

```

Hasil dari *solution report* pada *cluster 3* :

```

Global optimal solution found.
  Objective value:                111.3000
  Objective bound:                111.3000
  Infeasibilities:                0.0000000
  Extended solver steps:          0
  Total solver iterations:        0
  Elapsed runtime seconds:       0.09

```

Rute yang paling optimal adalah:

```

rute pengiriman dari customer 1 ke customer 3 sebesar 17.6 km
rute pengiriman dari customer 2 ke customer 1 sebesar 55.6 km
rute pengiriman dari customer 3 ke customer 2 sebesar 38.1 km

```

```

Model Class:                      MILP

```

```

Total variables:                   12
Nonlinear variables:               0
Integer variables:                 9

```

```

Total constraints:                 14
Nonlinear constraints:             0

```

```

Total nonzeros:                   40
Nonlinear nonzeros:               0

```

Variable	Value	Reduced Cost
R	0.1000000E+08	0.000000
BONGKAR(1)	15.00000	0.000000

BONGKAR(2)	15.00000	0.000000
BONGKAR(3)	15.00000	0.000000
T(1)	123.7000	0.000000
T(2)	53.10000	0.000000
T(3)	0.000000	0.000000
X(1, 1)	0.000000	0.000000
X(1, 2)	0.000000	56.50000
X(1, 3)	1.000000	17.60000
X(2, 1)	1.000000	55.60000
X(2, 2)	0.000000	0.000000
X(2, 3)	0.000000	38.10000
X(3, 1)	0.000000	17.60000
X(3, 2)	1.000000	38.10000
X(3, 3)	0.000000	0.000000
D(1, 1)	0.000000	0.000000
D(1, 2)	56.50000	0.000000
D(1, 3)	17.60000	0.000000
D(2, 1)	55.60000	0.000000
D(2, 2)	0.000000	0.000000
D(2, 3)	38.10000	0.000000
D(3, 1)	17.60000	0.000000
D(3, 2)	38.10000	0.000000
D(3, 3)	0.000000	0.000000
DURASI(1, 1)	0.000000	0.000000
DURASI(1, 2)	56.50000	0.000000
DURASI(1, 3)	17.60000	0.000000
DURASI(2, 1)	55.60000	0.000000
DURASI(2, 2)	0.000000	0.000000
DURASI(2, 3)	38.10000	0.000000
DURASI(3, 1)	17.60000	0.000000
DURASI(3, 2)	38.10000	0.000000
DURASI(3, 3)	0.000000	0.000000

Pemrograman Lingo untuk *cluster 4*

model:

```
!parameter model:
    Bongkar      = waktu loading/unloading di customer
    D            = jarak antar customer
    T            = waktu memulai pelayanan pada customer
    Durasi       = Durasi pengiriman
    R            = bilangan rill yang bernilai besar
;
!variabel keputusan:
    x(i, j) = 1 jika kendaraan k beroperasi dari i ke j
```

;

sets:

```
customer/1..7/: Bongkar, T;
route(customer, customer) : x, D, Durasi;
endsets
```

data:

D =

0	6.1	54.8	51.2	52.3	44.4	0.7
6.1	0	57	53.4	54.5	46.7	5.8
54.8	57	0	4.6	5.3	11	55.7
51.2	53.4	4.6	0	0.7	7.4	51.8
52.3	54.5	5.3	0.7	0	8.5	52.8
44.4	46.7	11	7.4	8.5	0	45.3
0.7	5.8	55.7	51.8	52.8	45.3	0

;

Durasi =

0	6.1	54.8	51.2	52.3	44.4	0.7
6.1	0	57	53.4	54.5	46.7	5.8
54.8	57	0	4.6	5.3	11	55.7
51.2	53.4	4.6	0	0.7	7.4	51.8
52.3	54.5	5.3	0.7	0	8.5	52.8
44.4	46.7	11	7.4	8.5	0	45.3
0.7	5.8	55.7	51.8	52.8	45.3	0

;

Bongkar = 15 15 15 15 15 15 15;

R = 10000000;

```
@text() = @write("Rute yang paling optimal adalah: ",
@newline(1));
```

```
@text() = @writefor(route(i, j) | x(i, j) #NE# 0 : "rute
pengiriman dari customer ", i, " ke customer ", j, " sebesar
", D(i, j), " km ",
@newline(1));
```

enddata

!fungsi objektif;

MIN =


```

@SUM (customer(i) :
    @SUM(customer (j) | i#NE# j: D (i, j) * x(i, j))
);

!Fungsi batasan;

!setiap customer dikunjungi satu kali;
@FOR (customer (j) | j #GT# 1 :
    @SUM(customer (i) | i #NE# j: x(i, j)) = 1
);

!perjalanan diawali dari depot;
@FOR (customer (i) | i #EQ# 1 :
    @SUM (customer (J) | j #GT# 1 :x(i, j)) = 1
);

!perjalanan diawali dari depot menuju customer;
@FOR (customer (i) | i #EQ# 1 :
    @SUM (customer (J) | j #GT# 1 :x(i, j)) = x(1, 7)
);

!perjalanan diawali dari customer menuju customer;
@FOR (customer (i) | i #EQ# 7 :
    @SUM (customer (J) | j #GT# 1 :x(i, j)) = x(7, 4)
);

!perjalanan akan berakhir di depot;
@FOR (customer (j) | j #EQ# 1 :
    @SUM (customer (i) | i #GT# 1 : x(i, j)) = 1
);

!pelaksanaan;
@FOR (customer (i)| i #NE# 1 :
    @FOR (customer (j) : T(j) >= T(i) + Bongkar(i) +
durasi(i, j) - R * (1 - x(i, j)))
);

!rute;
@FOR (customer (z) :
    @SUM(customer (i) | i #NE# z : x(i, z)) - @SUM(customer
(j) | j #NE# z : x(z, j)) = 0
);

! Variabel keputusan yang memiliki variabel biner;
@FOR (rute (i, j):
    @BIN(x(i, j)));

End

```

Hasil dari solution report pada cluster 4 :

Global optimal solution found.

Objective value:	122.3000
Objective bound:	122.3000
Infeasibilities:	0.3725290E-08
Extended solver steps:	49
Total solver iterations:	2515
Elapsed runtime seconds:	0.28

Rute yang paling optimal adalah:

rute pengiriman dari customer 1 ke customer 7 sebesar 0.7 km
 rute pengiriman dari customer 2 ke customer 1 sebesar 6.1 km
 rute pengiriman dari customer 3 ke customer 6 sebesar 11 km
 rute pengiriman dari customer 4 ke customer 5 sebesar 0.7 km
 rute pengiriman dari customer 5 ke customer 3 sebesar 5.3 km
 rute pengiriman dari customer 6 ke customer 2 sebesar 46.7 km
 rute pengiriman dari customer 7 ke customer 4 sebesar 51.8 km

Model Class: MILP

Total variables:	56
Nonlinear variables:	0
Integer variables:	49

Total constraints:	60
Nonlinear constraints:	0

Total nonzeros:	298
Nonlinear nonzeros:	0

Variable	Value	Reduced Cost
R	0.1000000E+08	0.000000
BONGKAR (1)	15.00000	0.000000
BONGKAR (2)	15.00000	0.000000
BONGKAR (3)	15.00000	0.000000
BONGKAR (4)	15.00000	0.000000
BONGKAR (5)	15.00000	0.000000
BONGKAR (6)	15.00000	0.000000
BONGKAR (7)	15.00000	0.000000
T (1)	0.1000000E+08	0.000000
T (2)	9999979.	0.000000
T (3)	9999892.	0.000000
T (4)	66.80000	0.000000
T (5)	9999871.	0.000000
T (6)	9999918.	0.000000
T (7)	0.000000	0.000000
X (1, 1)	0.000000	0.000000

X(1, 2)	0.000000	6.100000
X(1, 3)	0.000000	54.80000
X(1, 4)	0.000000	51.20000
X(1, 5)	0.000000	52.30000
X(1, 6)	0.000000	44.40000
X(1, 7)	1.000000	0.7000000
X(2, 1)	1.000000	6.100000
X(2, 2)	0.000000	0.000000
X(2, 3)	0.000000	57.00000
X(2, 4)	0.000000	53.40000
X(2, 5)	0.000000	54.50000
X(2, 6)	0.000000	46.70000
X(2, 7)	0.000000	5.800000
X(3, 1)	0.000000	54.80000
X(3, 2)	0.000000	57.00000
X(3, 3)	0.000000	0.000000
X(3, 4)	0.000000	4.600000
X(3, 5)	0.000000	5.300000
X(3, 6)	1.000000	11.00000
X(3, 7)	0.000000	55.70000
X(4, 1)	0.000000	51.20000
X(4, 2)	0.000000	53.40000
X(4, 3)	0.000000	4.600000
X(4, 4)	0.000000	0.000000
X(4, 5)	1.000000	0.7000000
X(4, 6)	0.000000	7.400000
X(4, 7)	0.000000	51.80000
X(5, 1)	0.000000	52.30000
X(5, 2)	0.000000	54.50000
X(5, 3)	1.000000	5.300000
X(5, 4)	0.000000	0.7000000
X(5, 5)	0.000000	0.000000
X(5, 6)	0.000000	8.500000
X(5, 7)	0.000000	52.80000
X(6, 1)	0.000000	44.40000
X(6, 2)	1.000000	46.70000
X(6, 3)	0.000000	11.00000
X(6, 4)	0.000000	7.400000
X(6, 5)	0.000000	8.500000
X(6, 6)	0.000000	0.000000
X(6, 7)	0.000000	45.30000
X(7, 1)	0.000000	0.7000000
X(7, 2)	0.000000	5.800000
X(7, 3)	0.000000	55.70000
X(7, 4)	1.000000	51.80000
X(7, 5)	0.000000	52.80000
X(7, 6)	0.000000	45.30000
X(7, 7)	0.000000	0.000000
D(1, 1)	0.000000	0.000000

D(1, 2)	6.100000	0.000000
D(1, 3)	54.800000	0.000000
D(1, 4)	51.200000	0.000000
D(1, 5)	52.300000	0.000000
D(1, 6)	44.400000	0.000000
D(1, 7)	0.7000000	0.000000
D(2, 1)	6.100000	0.000000
D(2, 2)	0.000000	0.000000
D(2, 3)	57.000000	0.000000
D(2, 4)	53.400000	0.000000
D(2, 5)	54.500000	0.000000
D(2, 6)	46.700000	0.000000
D(2, 7)	5.800000	0.000000
D(3, 1)	54.800000	0.000000
D(3, 2)	57.000000	0.000000
D(3, 3)	0.000000	0.000000
D(3, 4)	4.600000	0.000000
D(3, 5)	5.300000	0.000000
D(3, 6)	11.000000	0.000000
D(3, 7)	55.700000	0.000000
D(4, 1)	51.200000	0.000000
D(4, 2)	53.400000	0.000000
D(4, 3)	4.600000	0.000000
D(4, 4)	0.000000	0.000000
D(4, 5)	0.7000000	0.000000
D(4, 6)	7.400000	0.000000
D(4, 7)	51.800000	0.000000
D(5, 1)	52.300000	0.000000
D(5, 2)	54.500000	0.000000
D(5, 3)	5.300000	0.000000
D(5, 4)	0.7000000	0.000000
D(5, 5)	0.000000	0.000000
D(5, 6)	8.500000	0.000000
D(5, 7)	52.800000	0.000000
D(6, 1)	44.400000	0.000000
D(6, 2)	46.700000	0.000000
D(6, 3)	11.000000	0.000000
D(6, 4)	7.400000	0.000000
D(6, 5)	8.500000	0.000000
D(6, 6)	0.000000	0.000000
D(6, 7)	45.300000	0.000000
D(7, 1)	0.7000000	0.000000
D(7, 2)	5.800000	0.000000
D(7, 3)	55.700000	0.000000
D(7, 4)	51.800000	0.000000
D(7, 5)	52.800000	0.000000
D(7, 6)	45.300000	0.000000
D(7, 7)	0.000000	0.000000
DURASI(1, 1)	0.000000	0.000000

DURASI (1, 2)	6.100000	0.000000
DURASI (1, 3)	54.80000	0.000000
DURASI (1, 4)	51.20000	0.000000
DURASI (1, 5)	52.30000	0.000000
DURASI (1, 6)	44.40000	0.000000
DURASI (1, 7)	0.7000000	0.000000
DURASI (2, 1)	6.100000	0.000000
DURASI (2, 2)	0.000000	0.000000
DURASI (2, 3)	57.00000	0.000000
DURASI (2, 4)	53.40000	0.000000
DURASI (2, 5)	54.50000	0.000000
DURASI (2, 6)	46.70000	0.000000
DURASI (2, 7)	5.800000	0.000000
DURASI (3, 1)	54.80000	0.000000
DURASI (3, 2)	57.00000	0.000000
DURASI (3, 3)	0.000000	0.000000
DURASI (3, 4)	4.600000	0.000000
DURASI (3, 5)	5.300000	0.000000
DURASI (3, 6)	11.00000	0.000000
DURASI (3, 7)	55.70000	0.000000
DURASI (4, 1)	51.20000	0.000000
DURASI (4, 2)	53.40000	0.000000
DURASI (4, 3)	4.600000	0.000000
DURASI (4, 4)	0.000000	0.000000
DURASI (4, 5)	0.7000000	0.000000
DURASI (4, 6)	7.400000	0.000000
DURASI (4, 7)	51.80000	0.000000
DURASI (5, 1)	52.30000	0.000000
DURASI (5, 2)	54.50000	0.000000
DURASI (5, 3)	5.300000	0.000000
DURASI (5, 4)	0.7000000	0.000000
DURASI (5, 5)	0.000000	0.000000
DURASI (5, 6)	8.500000	0.000000
DURASI (5, 7)	52.80000	0.000000
DURASI (6, 1)	44.40000	0.000000
DURASI (6, 2)	46.70000	0.000000
DURASI (6, 3)	11.00000	0.000000
DURASI (6, 4)	7.400000	0.000000
DURASI (6, 5)	8.500000	0.000000
DURASI (6, 6)	0.000000	0.000000
DURASI (6, 7)	45.30000	0.000000
DURASI (7, 1)	0.7000000	0.000000
DURASI (7, 2)	5.800000	0.000000
DURASI (7, 3)	55.70000	0.000000
DURASI (7, 4)	51.80000	0.000000
DURASI (7, 5)	52.80000	0.000000
DURASI (7, 6)	45.30000	0.000000
DURASI (7, 7)	0.000000	0.000000

BIOGRAFI



DICKY PRADANA FEBRIANTO, Dilahirkan di kota Probolinggo, Jawa Timur. Pada hari Sabtu tanggal 13 Februari 1999. Anak pertama dari 2 bersaudara dari pasangan Herry Noegroho dan Wenny Meirawati. Penulis menyelesaikan pendidikan sekolah dasar di SD Negeri 02 Sumbertaman Probolinggo dan tamat pada tahun 2011. Pada tahun itu juga penulis

melanjutkan pendidikan di SMP Negeri 04 Probolinggo dan tamat pada tahun 2014, disaat SMP penulis aktif mengikuti kegiatan Ekstrakurikuler yaitu Pramuka dan Badminton. Kemudian penulis melanjutkan pendidikan di SMA Negeri 02 Probolinggo pada tahun 2014 dan tamat pada tahun 2017, disaat SMA penulis aktif mengikuti kegiatan Ekstrakurikuler yaitu Pramuka dan Badminton. Pada tahun 2017 penulis melanjutkan pendidikan di perguruan tinggi swasta, tepatnya di Universitas 17 Agustus 1945 Surabaya Fakultas Teknik Program Studi Teknik Industri. Berikut ini adalah email penulis yang bisa dihubungi pradanadicky966@gmail.com