CHAPTER IV

DATA COLLECTING AND PROCESSING

4.1 Data Collecting

4.1.1 Company Profile

PT. Aksara Solopos and Koperasi Solopos are parties of business in in the Griya Solopos. PT Aksara Solopos becomes the front company in the Griya Solopos that has main business related with the news collector to produce as printed newspaper or published in the web. There are several divisions which exist; such news editorial division, Human resource division, circulation division, radio, and advertisement division. Especially for the Circulation division where this research is taken place, there are two shifts called as morning circulation division and night circulation division. The morning shift regulates the customer request and complaints, make a billing for customer request, and distribution of newspaper in general. Night shift work as the inspector of the after production process which are ensuring the number of customer delivery to customer, informs the obstacles that happen in the night production as allowance when there is a complaint from customer (lateness of newspaper delivery). For Koperasi Solopos regulates as koperasi in general, provide a cafeteria for employee, and has special task which is regulates driver and car that used for daily operational in the Griya Solopos. Driver wages, car maintenance, insurance of car, and fuel cost are handled by Koperasi.

There are several cities of solopos printed newspaper consumer, such Surakarta, Kartasura, Solobaru, Sragen, Karanganyar, Sukoharjo, Wonogiri, Klaten, Jogja, Boyolali, Salatiga, Semarang, and Purwodadi. For Surakarta itself there are two region, which are west Solo (Kartasura and west Surakarta) and east Solo (east Surakarta and Solobaru). Vehicles that are used have several types such truck with four tires and pick up car.

Solopos newspaper divides into three parts, Soloraya, Solopos, and Sisipan. The production of Soloraya finish on 12 pm, Solopos 3 am, and Sisipan 3.30 am. The docking process done in two places, Soloraya and Sisipan is in the old machine and the Solopos in the new machine. In the normal situation, the schedules of vehicle departure are:

a. Semarang, Salatiga, Boyolali on 3.30 am serviced by kijang pickup
b. Klaten and Jogja on 3.45 am serviced by kijang pickup
c. Purwodadi on 4 am serviced by kijang pickup
d. Sragen and Karanganyar 4.15 serviced by kijang pickup
e. Sukoharjo and Wonogiri on 4.30 serviced by suzuki carry
f. East and west Solo on 4.45 serviced by truck and panther pick up.

4.1.2 Newspaper Dimension

The dimension that used to measure the newspaper are only length and width. Length (ln)= 35cm ; width (wn) = 29cm

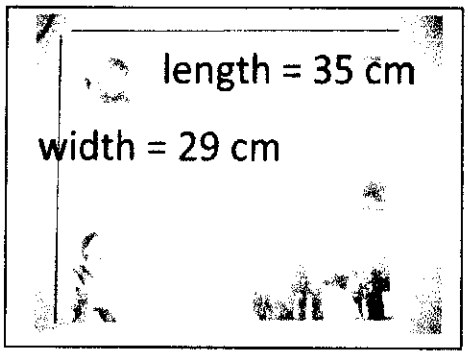

Figure 4.1 Newspaper Dimension

4.1.3 Vehicle Profile

In this research, the focus only in the Surakarta region only (east and west Surakarta), so the vehicle used are only two vehicles, which are:

a. Truck 4 tires HINO DYNA 2004, 3700 cc, fuel solar, fuel rate consumption 1litre: 8000 meters;

   Inner box dimension box length (lb_1) = 247 cm and width (wb_1) = 166 cm.

   Driver wages = IDR 1.100.000

   Maintenance cost = IDR 220.000

   Insurance = IDR 150.000

b. Panther pick up low deck with full box type 2005, 2500cc, fuel solar, fuel rate consumption 1litre: 10000 meters;

   Inner box dimension box length (lb_2) = 188 cm and width (wb_2) = 151cm.

   Driver wages = IDR 1.100.000

   Maintenance cost = IDR 140.000

Insurance = IDR 150.000

The figure of both vehicles are in the appendix.

4.1.4 Customer Profile

The customer profile includes several things; name, coordinates, and demand.

Table 4.1 Depot and Customer Profile

No	Name	Longitude	Latitude	Demand (newspaper)
0	Depot (solopos)	110.779	-7.5466	0
1	Taji Nasrudin	110.789	-7.55	2125
2	Surya	110.824	-7.5686	1080
3	Teguh	110.824	-7.5708	840
4	Matahari	110.825	-7.5694	680
5	ABC	110.826	-7.5711	295
6	Sendang Mulia	110.832	-7.5695	573
7	Muhammad dkk	110.82	-7.5822	430
8	Indomet	110.814	-7.6028	450
9	Prasasti	110.819	-7.6085	290
10	Palang kereta Hotel Agas	110.808	-7.5593	475
11	Iskak	110.82	-7.5615	660
12	Kendali	110.821	-7.5635	85
13	Hadi S	110.817	-7.5685	187
14	Agus	110.798	-7.5631	340
15	Budi Sondakan	110.787	-7.5594	126
16	Maju Mapan	110.783	-7.5562	340
17	RS Yarsis	110.771	-7.5585	70
18	Londo	110.739	-7.551	815
19	Bandara	110.749	-7.513	110

4.1.5 Current Route

The original or current route that conducted by driver to deliver the newspaper in the Surakarta is shown below.

Truck: Depot-Taji Nasrudin- Surya- Teguh- Matahari- ABC- Sendang Mulia- Muhammad- Indomet- Prasati- Depot (0-1-2-3-4-5-6-7-8-9-0). The distance traveled is 260.92 meters in a day.

Panther: Depot- Palang Kereta Api Hotel Agas- Iskak- Kendali- Hadi Sondakan- Agus- Budi Sondakan- Maju Mapan- RS Yarsis- Londo- - Bandara Adi Soemarmo- Depot (0-10-11-12-13-14-15-16-17-18-19-0). The distance traveled is 29.725 meters in a day.

The current route graph are in the appendix.

4.1.6 Fuel Prices

Both vehicles are using same type of fuel which is solar with the prices is IDR 4.500 per liter.

4.2 Mathematical Model Building of Heterogeneous Fixed Fleet Vehicle Routing Problem

To build the model of HFFVRP, there are several data need to be processed first, which are customer's demand, distance between vertex (distance matrix), vehicles

capacity, vehicle's variable cost, the maximum distance of each vehicle, and vehicle's fixed cost.

4.2.1 Demand Conversion

The demand of newspaper that shown in the Table 4.1 must be converted first to bulk measurement. Here is below the conversion of newspaper demand.

Table 4.2 Demand Conversion

No	Name	Demand (newspaper)	Converted Demand (bulk)
0	Depot (solopos)	0	0
1	Taji Nasrudin	2125	10
2	Surya	1080	5
3	Teguh	840	4
4	Matahari	680	3
5	ABC	295	1
6	Sendang Mulia	573	2
7	Muhammad dkk	430	2
8	Indomet	450	2
9	Prasasti	290	1
10	Palang kereta Hotel Agas	475	2
11	Iskak	660	3
12	Kendali	85	1
13	Hadi S	187	1
14	Agus	340	1
15	Budi Sondakan	126	1
16	Maju Mapan	340	1
17	RS Yarsis	70	1
18	Londo	815	4
19	Bandara	110	1

4.2.2 Distance Matrix

The distance between node-to-node (depot to customer, customer-to-customer, and customer to depot) are measured as real urban transport. To calculate the distance firstly must know the coordinate of every node, and then the distance measured by using a tool called as ruler from software Google Earth 5.0. The step of using Ruler to measure the distance is below:

1. Find the Ruler in the toolbar

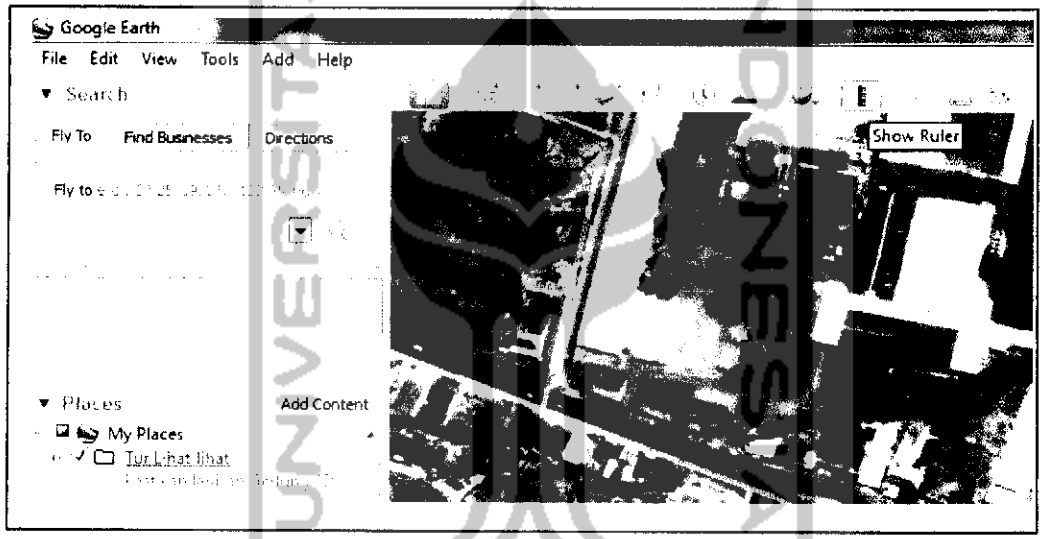

Figure 4.2 Step 1 Measuring Distance Using Google Earth

2. Choose path to measure the distance

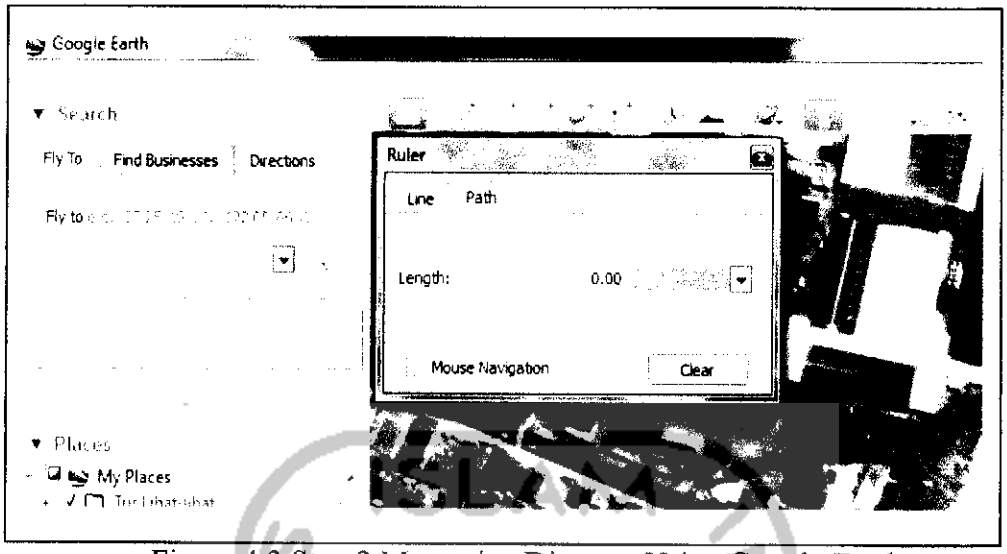

Figure 4.3 Step 2 Measuring Distance Using Google Earth

3. Measure the distance

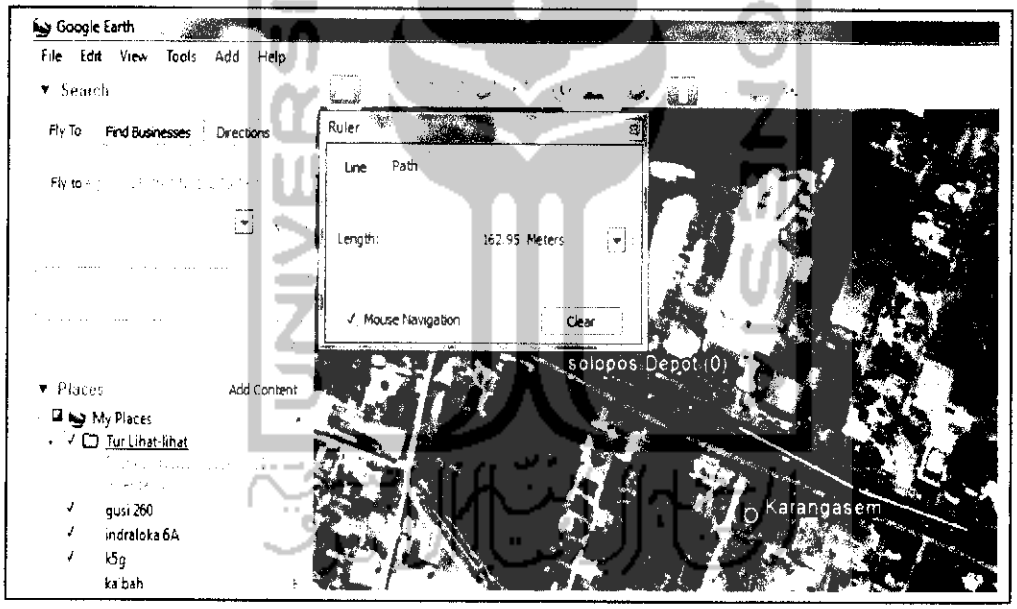

Figure 4.4 Step 3 Measuring Distance Using Google Earth

The distance matrix is shown below and the graphs are attached in the appendix.

Table 4.3 Distance Matrix

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0	-	1093	5991	6303	6160	6452	7130	7630	10031	11091	3520	5027	5207	5434	3543	2238	1646	2771	6409	7372
1	1103	-	5015	5220	5188	5374	6160	6548	8952	10014	2433	3925	4118	4348	2493	1195	1658	2798	6546	8438
2	5815	4722	-	333	221	490	1211	1673	4072	5145	2322	1195	902	954	3083	4400	5140	6283	10026	13150
3	6144	5065	358	-	167	159	1248	1347	3747	4818	2672	1537	1221	885	3011	4330	5065	6206	9957	13483
4	5978	4895	208	172	-	316	1086	1511	3914	4977	2496	1365	1048	1067	3194	4510	5252	6396	10140	13314
5	6277	5194	502	169	337	-	1090	1475	3876	4945	2791	1659	1345	1050	3173	4492	5237	6376	10124	13614
6	6859	5776	1092	1151	983	987	-	2490	4891	5959	3373	2252	1936	2049	4173	5493	6232	7374	11121	14197
7	7485	6403	1683	1357	1521	1485	2566	-	2405	3470	3999	2861	2543	2203	4326	5640	6387	7530	11273	14815
8	10340	9253	4535	4209	4376	4343	5436	2865	-	1521	6852	5731	5412	5069	7193	8512	9256	10397	14183	17675
9	11662	10578	5865	5535	5702	5670	6762	4193	1858	-	8175	7060	6741	6397	8521	9840	10580	11721	15509	18993
10	3490	2403	2476	2816	2645	2936	3622	4157	6561	7624	-	1502	1696	1924	1580	2897	3645	4783	8566	10827
11	5001	3914	1094	1431	1261	1553	2239	2763	5162	6228	1515	-	309	901	3026	4345	5090	6234	9973	12332
12	5181	4098	785	1124	954	1246	1926	2462	4857	5926	1686	317	-	1062	3188	4507	5256	6390	10134	12514
13	5423	4338	944	875	1049	1031	2132	2193	4611	5674	1935	891	1052	-	2140	3459	4201	5345	9087	12753
14	3533	2503	3093	3021	3184	3163	4264	4344	6750	7816	1570	3036	3198	2150	-	1319	2058	3203	6945	10872
15	2248	1210	4390	4320	4491	4473	5568	5650	8052	9119	2879	4331	4498	3446	1309	-	773	1910	5652	9576
16	1656	1643	5150	5075	5241	5224	6323	6399	8802	9865	3626	5081	5246	4197	2068	763	-	1613	5362	8593
17	2788	2764	6260	6189	6358	6341	7432	7512	9920	10980	4745	6198	6363	5314	3182	1882	1585	-	3913	8541
18	6399	6536	10036	9964	10130	10114	11208	11291	13692	14757	8520	9969	10144	9092	6957	5663	5352	3923	-	6170
19	7404	8480	12372	13710	13541	13837	14531	15051	17456	18516	10906	12399	12591	12822	10925	9627	8641	8567	6227	

= ((188 cm/ 35 cm) * (151 cm/ 29 cm)) + 2

= ((5,3) * (5,2)) + 2

= (5 * 5) + 2 = 27 bulks

The second version of capacity calculation will be used for this research.

4.2.4 Vehicle Variable Cost

Variable cost calculated based on the fuel price and fuel rate consumption of vehicle in a month. The calculation based on the formula number 3.11.

Truck variable cost cv_1 (IDR/ meter/ month) = fuel rate consumption of truck (liter/ meters)* 30 (days) * fuel price (IDR)

= 1liter/8000 meters * 30days * 4500

= IDR 16,875/ meter / month

Panther variable cost cv_2 (IDR/ meter / month) = fuel rate consumption of truck (liter/ meters)* 30 (days) * fuel price (IDR)

= 1liter/10000 meters * 30 days * IDR 4500

= IDR 13,5 /meters / month

The maximum distance of each vehicle stated at 30.000 meters.

4.2.5 Vehicle Fixed Cost

The calculation of fixed cost of every vehicle will use formula number 3.12.

Truck fixed cost (cc_1) (IDR/ month) = driver wages (IDR) + maintenance in a month (IDR) + insurance (IDR)

= IDR 1.100.000 + IDR 220.000 + IDR 150.000

= IDR 1.470.000 / month

Panther fixed cost (cc_2) (IDR/ month) = driver wages (IDR) + maintenance in a month (IDR) + insurance (IDR)

= IDR 1.100.000 + IDR 140.000 + IDR 150.000

= IDR 1.390.000 / month

4.2.6 Mathematical Formulation of Heterogeneous Fixed Fleet Vehicle Routing Problem

Objective function from equation 3.1

Minimize Total Cost =

$$\sum_{k=1}^{2} \left[(cv_k \left(\sum_{i=0}^{19} \sum_{j=0, j \neq i}^{19} d_{ij} . \alpha_{ijk} \right)) + (cc_t . \sum_{t=1}^{2} \beta_{kt}) \right]$$

Subject to:

Constraint 3.2

$x_{1,1} + x_{1,2} = 1$; $x_{2,1} + x_{2,2} = 1$; $x_{3,1} + x_{3,2} = 1$; $x_{4,1} + x_{4,2} = 1$; $x_{5,1} + x_{5,2} = 1$; $x_{6,1} + x_{6,2} = 1$; $x_{7,1} + x_{7,2} = 1$; $x_{8,1} + x_{8,2} = 1$; $x_{9,1} + x_{9,2} = 1$; $x_{10,1} + x_{10,2} = 1$; $x_{11,1} + x_{11,2} = 1$; $x_{12,1} + x_{12,2} = 1$; $x_{13,1} + x_{13,2} = 1$; $x_{14,1} + x_{14,2} = 1$; $x_{15,1} + x_{15,2} = 1$; $x_{16,1} + x_{16,2} = 1$; $x_{17,1} + x_{17,2} = 1$; $x_{18,1} + x_{18,2} = 1$; $x_{19,1} + x_{19,2} = 1$

Constraint 3.3

$$\sum_{i=1}^{19} \alpha_{i0k} = 1 \quad k = 1$$

$$\sum_{i=1}^{19} \alpha_{i0k} = 1 \quad k = 2$$

Constraint 3.4

$$\sum_{j=1}^{19} \alpha_{0jk} = 1 \quad k = 1$$

$$\sum_{j=1}^{19} \alpha_{0jk} = 1 \quad k = 2$$

Constraint 3.5

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (1), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (2), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (3), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (4), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (5), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (6), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (7), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (8), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (9), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (10), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (11), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (12), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (13), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \quad i = (14), \quad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \qquad i = (15), \qquad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \qquad i = (16), \qquad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \qquad i = (17), \qquad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \qquad i = (18), \qquad k = (1,2)$$

$$\sum_{j=0,j\neq i}^{19} \alpha_{ijk} - \sum_{j=0,j\neq i}^{19} \alpha_{jik} = 0 \qquad i = (19), \qquad k = (1,2)$$

Constraint 3.6

$$\sum_{i=1}^{19} x_{ik} \cdot c_i \leq \sum_{t=1}^{2} \beta_{kt} \cdot C_t \qquad k = 1$$

$$\sum_{i=1}^{19} x_{ik} \cdot c_i \leq \sum_{t=1}^{2} \beta_{kt} \cdot C_t \qquad k = 2$$

Constraint 3.7

$\beta_{11} \leq 1$; $\beta_{22} \leq 1$

Constraint 3.8

$$\sum_{j=1,j\neq i}^{19}\sum_{i=1}^{19}\alpha_{ijk} \leq |S|-1 \qquad \forall S \subseteq V=(1,2,3,\dots,19),|S|\geq 2, k=(1)$$

$$\sum_{j=1,j\neq i}^{19}\sum_{i=1}^{19}\alpha_{ijk} \leq |S|-1 \qquad \forall S \subseteq V=(1,2,3,\dots,19),|S|\geq 2, k=(2)$$

Constraint 3.9

$$cv_k\left(\sum_{i=0}^{19}\sum_{j=0,j\neq i}^{19} d_{ij}.\alpha_{ijk}\right) \leq (cv_k.30.000) \qquad k=1$$

$$cv_k\left(\sum_{i=0}^{19}\sum_{j=0,j\neq i}^{19} d_{ij}.\alpha_{ijk}\right) \leq (cv_k.30.000) \qquad k=2$$

4.2.7 Current Route Cost

To know the money spent by the company in implementing current vehicle routes, here below is the calculation.

Total cost = (16,875 ($1093\alpha_{0,1,1}$ + $5015\alpha_{1,2,1}$ + $333\alpha_{2,3,1}$ + $167\alpha_{3,4,1}$ + $316\alpha_{4,5,1}$ + $1090\alpha_{5,6,1}$ + $2490\alpha_{6,7,1}$ + $2405\alpha_{7,8,1}$ + $1521\alpha_{8,9,1}$ + $11662\alpha_{9,0,1}$) + 1.470.000 β_{11}) + (13,5 ($3520\alpha_{0,10,2}$ + $1502\alpha_{10,11,2}$ + $309\alpha_{11,12,2}$ + $1062\alpha_{12,13,2}$ + $2140\alpha_{13,14,2}$ + $1319\alpha_{14,15,2}$ + $773\alpha_{15,16,2}$ + $1613\alpha_{16,17,2}$ + $3913\alpha_{17,18,2}$ + $6170\alpha_{18,19,2}$ + $7404\alpha_{19,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1 + 5015 . 1 + 333 . 1 + 167 . 1 + 316 . 1 + 1090 . 1 + 2490 . 1 + 2405 . 1 + 1521 . 1 + 11662 . 1) + 1.470.000 . 1)+ (13,5 (3520 . 1 + 1502 . 1 + 309 . 1 + 1062 . 1 + 2140 . 1 + 1319 . 1 + 773 . 1 + 1613 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1) + 1.390.000 . 1) = IDR 3.701.590 per month

4.3 Total Cost Minimization of Heterogeneous Fixed Fleet Vehicle Routing Problem Using Holmes and Parker Algorithm

To analyze the data, this research applies the Holmes and Parker algorithm. Below are the steps of the algorithm.

4.3.1 Initialization

Before beginning the iteration, the initialization is required to ease the iteration process. The initialization steps are below:

Step 1

This step already finished in the sub chapter 4.2.1 and 4.2.2.

Step 2

2.1 In this step, to calculate the saving of each pair, the formula 2.1 is used. The calculations are:

$s_{1,2} = d_{1,0} + d_{0,2} - d_{1,2} = 5815 + 6303 - 333 = 11785$

There are several savings that have negative value $s_{i,j} < 0$. Then the value is changed to 0 which are $s_{19,3}$, $s_{19,7}$, $s_{19,8}$, and $s_{19,9} = 0$

The other saving calculations are recorded in the saving matrix below.

2.2 This step the value of pairs; $s_{0,1}$, $s_{0,2}$, $s_{0,3}$, $s_{0,4}$, $s_{0,5}$, $s_{0,6}$, $s_{0,7}$, $s_{0,8}$, $s_{0,9}$, $s_{0,10}$, $s_{0,11}$, $s_{0,12}$, $s_{0,13}$, $s_{0,14}$, $s_{0,15}$, $s_{0,16}$, $s_{0,17}$, $s_{0,18}$, $s_{0,19}$, $s_{1,0}$, $s_{2,0}$, $s_{3,0}$, $s_{4,0}$, $s_{5,0}$, $s_{6,0}$, $s_{7,0}$, $s_{8,0}$, $s_{9,0}$, $s_{10,0}$, $s_{11,0}$, $s_{12,0}$, $s_{13,0}$, $s_{14,0}$, $s_{15,0}$, $s_{16,0}$, $s_{17,0}$, $s_{18,0}$, and $s_{19,0}$ are changed to -1.

Table 4.4 Saving Matrix

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0	-	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
1	-1	-	2079	2186	2075	2181	2073	2185	2182	2180	2190	2205	2192	2189	2153	2146	1091	1076	966	37
2	-1	2186	-	11785	11754	11777	11734	11772	11774	11761	7013	9647	10120	10295	6275	3653	2321	2303	2198	37
3	-1	2172	11777	-	12137	12437	12026	12427	12428	12417	6992	9634	10130	10693	6676	4052	2725	2709	2596	33
4	-1	2176	11761	12109	-	12114	12022	12097	12095	12092	7002	9640	10137	10345	6327	3706	2372	2353	2247	36
5	-1	2176	11766	12411	12100	-	12317	12432	12432	12423	7006	9645	10139	10661	6647	4023	2686	2672	2562	35
6	-1	2176	11758	12011	12036	12324	-	11999	11999	11991	7006	9634	10130	10244	6229	3604	2273	2256	2147	34
7	-1	2175	11793	12431	12124	12452	12049	-	15111	15106	7006	9651	10149	10716	6702	4083	2744	2726	2621	42
8	-1	2180	11796	12434	12124	12449	12034	15105	-	19910	7008	9636	10135	10705	6690	4066	2730	2714	2566	37
9	-1	2177	11788	12430	12120	12444	12030	15099	19835	-	7007	9629	10128	10699	6684	4060	2728	2712	2562	41
10	-1	2180	7005	6977	7005	7006	6998	6963	6960	6957	-	7015	7001	7000	5453	2831	1491	1478	1333	35
11	-1	2180	9898	9873	9900	9900	9892	9868	9870	9864	7006	-	9899	9534	5518	2894	1557	1538	1437	41
12	-1	2176	10387	10360	10387	10387	10385	10349	10355	10346	7015	9891	-	9553	5536	2912	1571	1562	1456	39
13	-1	2178	10470	10851	10534	10844	10421	10860	10843	10840	7008	9559	9578	-	6826	4202	2868	2849	2745	42
14	-1	2123	6431	6815	6509	6822	6399	6819	6814	6808	5483	5524	5542	6817	-	4452	3121	3101	2997	33
15	-1	2131	3849	4231	3917	4227	3810	4228	4227	4220	2889	2944	2957	4236	4482	-	3121	3109	3005	44
16	-1	1106	2497	2884	2575	2884	2463	2887	2885	2882	1550	1602	1617	2893	3131	3131	-	2814	2703	435
17	-1	1117	2519	2902	2590	2899	2486	2906	2899	2899	1563	1617	1632	2908	3149	3144	2849	-	5284	1619
18	-1	956	2354	2738	2429	2737	2321	2738	2738	2733	1399	1457	1462	2741	2985	2974	2693	5247	-	7601
19	-1	17	1023	0	23	19	3	0	0	0	18	32	20	16	22	15	409	1608	7586	-

4.3.2 Iteration

The iteration begun with creates initial solution without any suppression or solved in the parallel version of Clarke and Wright algorithm. The suppression schemas start after initial solution found.

A. Initial Solution

The initial solution created without any suppression schemas.

Table 4.5 Iteration of Initial Solution

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	yes	13	1	6	37	0,13,4,3,7,8,9,5,6,2,0	
14	2.13	10295	no			6	37		
15	2.12	10120	yes	12	1	5	37	0,13,4,3,7,8,9,5,6,2,12,0	
16	12.11	9891	yes	11	3	2	37	0,13,4,3,7,8,9,5,6,2,12,11,0	

Table 4.5 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	11.13	9534	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	11.10	7006	yes	10	2	0	32	0,13,4,3,7,8,9,5,6,2,12,11,10,0	
20	10.13	7000	no			0	32		
21	14.13	6817	no			0	32		
22	10.14	5453	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
25	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
26	14.16	3121	no			0	28		
27	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
28	1.13	2189	no			0	28		
29	10.01	2180	no			0	28		
30	10.16	1491	no			0	28		
31	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
32	19.01	17	no			0	18		
33	19.13	16	no			0	18		

There are several savings that feasible selected, but infeasible to be merged. The reason is because the saving violating the principle in the step 4.4. The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{2,13}$, $s_{11,13}$, $s_{10,13}$, $s_{14,16}$, $s_{19,1}$,

Violating step 4.4.2 = $s_{14,13}$, $s_{10,14}$, $s_{1,13}$, $s_{10,1}$, $s_{10,16}$, $s_{19,13}$

Total cost = (16,875 ($1093\alpha_{0,1,1} + 1658\alpha_{1,16,1} + 763\alpha_{16,15,1} + 1309\alpha_{15,14,1} + 3203\alpha_{14,17,1}$ $+ 3913\alpha_{17,18,1} + 6170\alpha_{18,19,1} + 7404\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 ($5434\alpha_{0,13,2}$ + $1049\alpha_{13,4,2} + 172\alpha_{4,3,2} + 1347\alpha_{3,7,2} + 2405\alpha_{7,8,2} + 1521\alpha_{8,9,2} + 5670\alpha_{9,5,2} + 1090\alpha_{5,6,2}$ $+ 1092\alpha_{6,2,2} + 902\alpha_{2,12,2} + 317\alpha_{12,11,2} + 1515\alpha_{11,10,2} + 3490\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1+ 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1) + (13,5 (5434 . 1 + 1049 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 902 . 1 + 317 . 1 + 1515 . 1 + 3490 . 1) + 1.390.000. 1) = IDR 3.641.586 per month

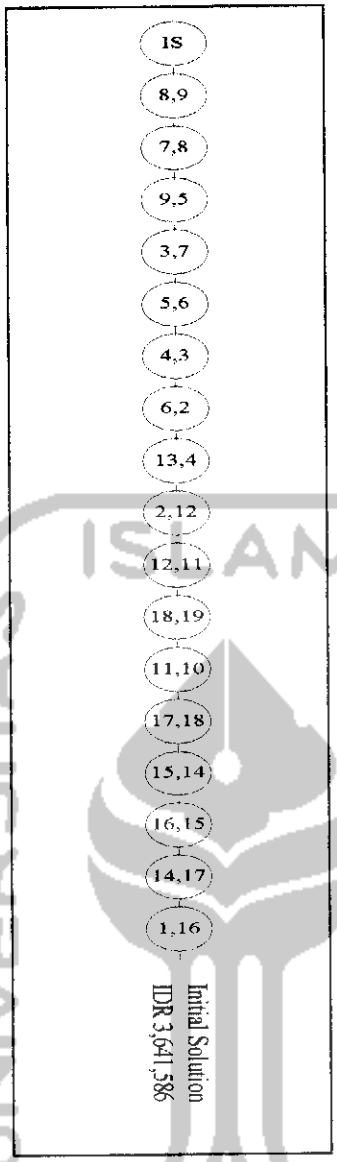

Figure 4.5 Initial Solution's Tree Diagram

B. First Suppression

The first suppression saving is taken from the current best solution (initial solution) which is $s_{8,9}$ and set $s_{8,9} = 0$ in the current saving matrix.

Table 4.6 Iteration of First Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	Temporary suppress						
2	9.08	19835	yes	9	1	-1	37	0,9,8,0	
				8	2	-3	37		
3	7.09	15106	yes	7	2	-5	37	0,7,9,8,0	
4	8.07	15105	no			-5	37		
5	8.05	12449	yes	5	1	-6	37	0,7,9,8,5,0	
6	5.07	12432	no			-6	37		
7	3.07	12427	yes	3	4	-10	37	0,3,7,9,8,5,0	
8	5.03	12411	no			-10	37		
9	5.06	12317	yes	6	2	-12	37	0,3,7,9,8,5,6,0	
10	4.03	12109	yes	4	3	-15	37	0,4,3,7,9,8,5,6,0	
11	6.04	12036	no			-15	37		
12	6.02	11758	yes	2	5	-20	37	0,4,3,7,9,8,5,6,2,0	
13	2.04	11754	no			-20	37		
14	13.04	10534	yes	13	1	-21	37	0,13,4,3,7,9,8,5,6,2,0	
15	2.13	10295	no			-21	37		
16	2.12	10120	yes	12	1	-22	37	0,13,4,3,7,9,8,5,6,2,12,0	

Table 4.6 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	12.11	9891	yes	11	3	-25	37	0,13,4,3,7,9,8,5,6,2,12,11,0	
18	11.13	9534	no			-25	37		
19	18.19	7601	yes	18	4		33		0,18,19,0
				19	1		32		
20	11.10	7006	yes	10	2	0	32	0,13,4,3,7,9,8,5,6,2,12,11,10,0	
21	10.13	7000	no			0	32		
22	14.13	6817	no			0	32		
23	10.14	5453	no			0	32		
24	17.18	5284	yes	17	1	0	31		0,17,18,19,0
25	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
26	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
27	14.16	3121	no			0	28		
28	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
29	1.13	2189	no			0	28		
30	10.01	2180	no			0	28		
31	10.16	1491	no			0	28		
32	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
33	19.01	17	no			0	18		
34	19.13	16	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{8,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{2,13}$, $s_{11,13}$, $s_{10,13}$, $s_{14,16}$, $s_{19,1}$,

Violating step 4.4.2 = $s_{14,13}$, $s_{10,14}$, $s_{1,13}$, $s_{10,1}$, $s_{10,16}$, $s_{19,13}$

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$) + 1.470.000 β_{11})+ (13,5 (5434$\alpha_{0,13,2}$ + 1049$\alpha_{13,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 3470$\alpha_{7,9,2}$ + 1858$\alpha_{9,8,2}$ + 4343$\alpha_{8,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 902$\alpha_{2,12,2}$ + 317$\alpha_{12,11,2}$ + 1515$\alpha_{11,10,2}$ + 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

(16,875 (1093 . 1 + 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1) + 1.470.000 . 1)+ (13,5 (5434 . 1 + 1049 . 1 + 172 . 1 + 1347 . 1 + 3470 . 1 + 1858 . 1 + 4343 . 1 + 1090 . 1 + 1092 . 1 + 902 . 1 + 317 . 1 + 1515 . 1 + 3490 . 1) + 1.390.000 . 1) = IDR 3.642.598 per month

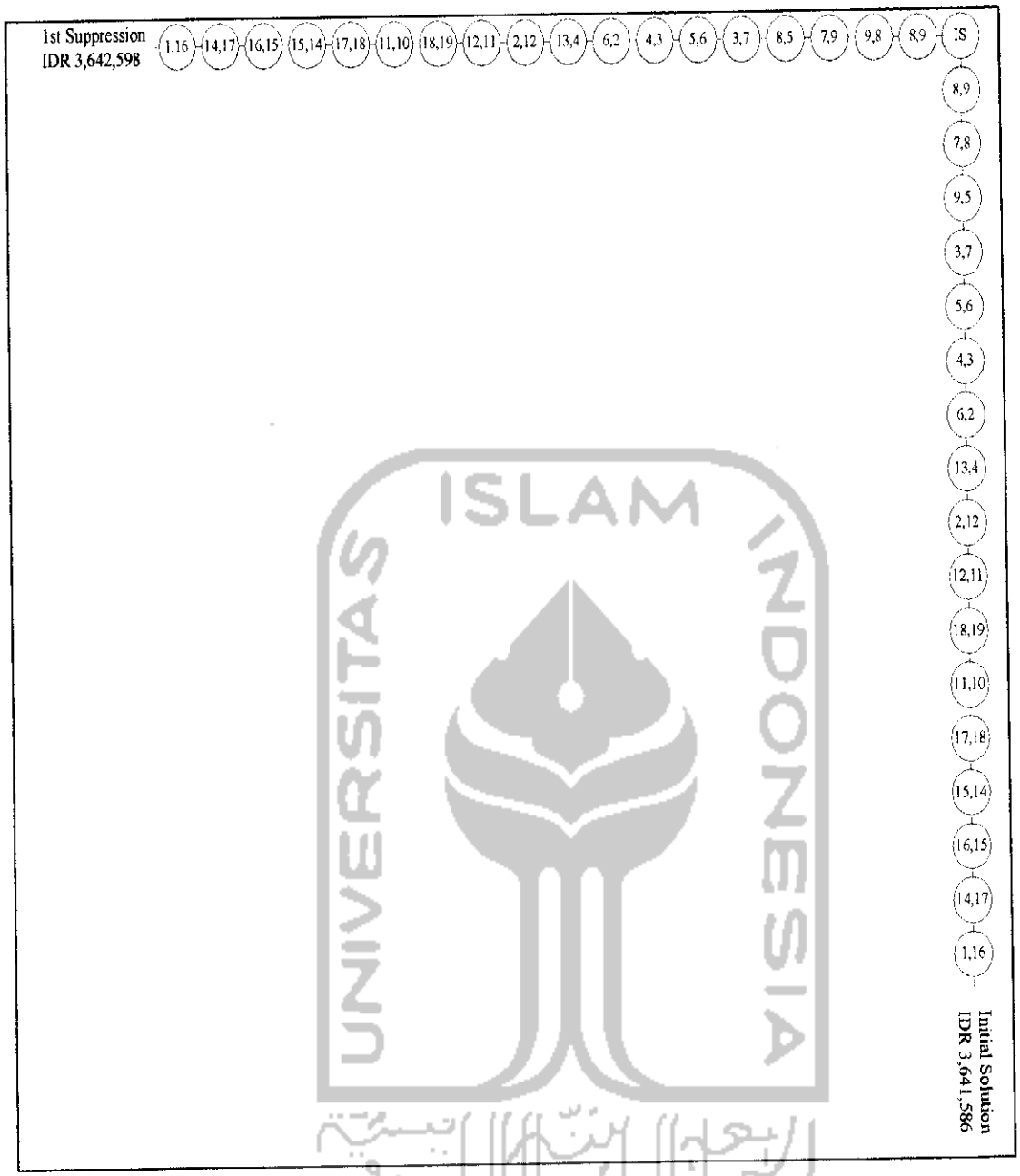

Figure 4.6 First Suppression's Tree Diagram

C. Second Suppression

The current best solution still initial solution and the first suppression pair are returned to its value in the current saving matrix. The second suppression pair is saving $s_{7,8}$ and set $s_{7,8} = 0$ in the current saving matrix.

Table 4.7 Iteration of Second Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	Temporary suppress						
3	9.07	15099	yes	7	2	22	37	0,8,9,7,0	
4	7.05	12452	yes	5	1	21	37	0,8,9,7,5,0	
5	5.08	12432	no			21	37		
6	3.08	12428	yes	3	4	17	37	0,3,8,9,7,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,8,9,7,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,8,9,7,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,8,9,7,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	yes	13	1	6	37	0,13,4,3,8,9,7,5,6,2,0	
14	2.13	10295	no			6	37		
15	2.12	10120	yes	12	1	5	37	0,13,4,3,8,9,7,5,6,2,12,0	
16	12.11	9891	yes	11	3	2	37	0,13,4,3,8,9,7,5,6,2,12,11,0	

Table 4.7 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	11.13	9534	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	11.10	7006	yes	10	2	0	32	0,13,4,3,8,9,7,5,6,2,12,11,10,0	
20	10.13	7000	no			0	32		
21	14.13	6817	no			0	32		
22	10.14	5453	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
25	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
26	14.16	3121	no			0	28		
27	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
28	1.13	2189	no			0	28		
29	10.01	2180	no			0	28		
30	10.16	1491	no			0	28		
31	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
32	19.01	17	no			0	18		
33	19.13	16	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{5,8}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{2,13}$, $s_{11,13}$, $s_{10,13}$, $s_{14,16}$, $s_{19,1}$,

Violating step 4.4.2 = $s_{14,13}$, $s_{10,14}$, $s_{1,13}$, $s_{10,1}$, $s_{10,16}$, $s_{19,13}$

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$) + 1.470.000 β_{11})+ (13,5 (5434$\alpha_{0,13,2}$ + 1049$\alpha_{13,4,2}$ + 172$\alpha_{4,3,2}$ + 3747$\alpha_{3,8,2}$ + 1521$\alpha_{8,9,2}$ + 4193$\alpha_{9,7,2}$ + 1485$\alpha_{7,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 902$\alpha_{2,12,2}$ + 317$\alpha_{12,11,2}$ + 1515$\alpha_{11,10,2}$ + 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1 + 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1) + 1.470.000. 1)+ (13,5 (5434 . 1 + 1049 . 1 + 172 . 1 + 3747 . 1 + 1521 . 1 + 4193 . 1 + 1485 . 1 + 1090 . 1 + 1092 . 1 + 902 . 1 + 317 . 1 + 1515 . 1 + 3490 . 1) + 1.390.000 . 1) = IDR 3.641.626 per month

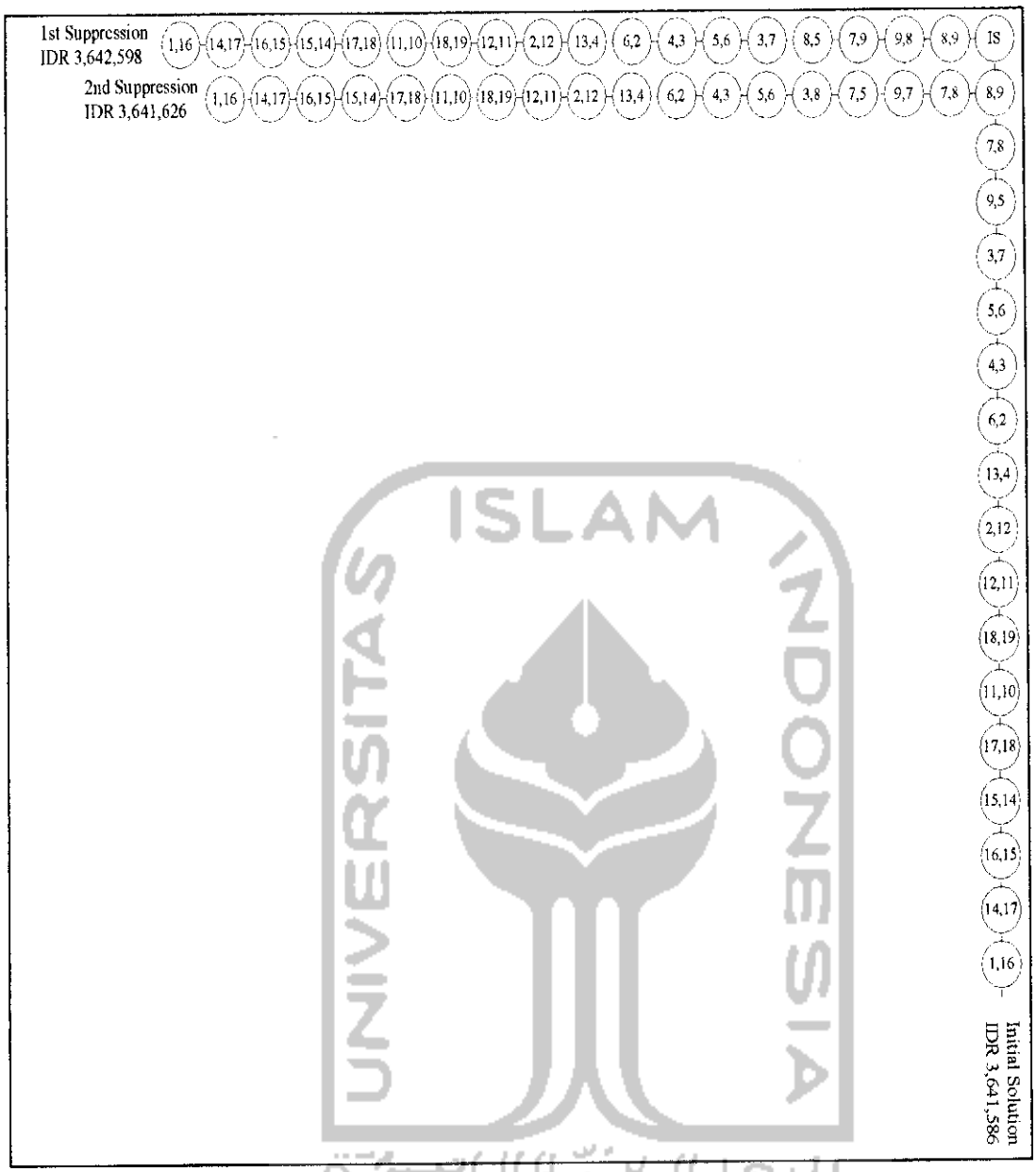

Figure 4.7 Second Suppression's Tree Diagram

D. Third Suppression

The current best solution still initial solution and the second suppression pair are returned to its value in the current saving matrix. The third suppression pair is saving $s_{9,5}$ and set $s_{9,5} = 0$ in the current saving matrix.

Table 4.8 Iteration of Third Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	Temporary suppress						
5	3.05	12437	yes	3	4	18	37	0,7,8,9,0;0,3,5,0	
				5	1	17	37		
6	5.07	12432	yes			17	37	0,3,5,7,8,9,0;	
7	9.03	12430	no			17	37		
8	9.04	12120	yes	4	3	14	37	0,3,5,7,8,9,4,0;	
9	4.03	12109	no			14	37		
10	4.06	12022	yes	6	2	12	37	0,3,5,7,8,9,4,6,0;	
11	6.03	12011	no			12	37		
12	2.03	11785	yes	2	5	7	37	0,2,3,5,7,8,9,4,6,0;	
13	6.02	11758	no			7	37		
14	13.02	10470	yes	13	1	6	37	0,13,2,3,5,7,8,9,4,6,0;	
15	6.13	10244	no			6	37		
16	6.12	10130	yes	12	1	5	37	0,13,2,3,5,7,8,9,4,6,12,0;	

Table 4.8 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	12.11	9891	yes	11	3	2	37	0,13,2,3,5,7,8,9,4,6,12,11,0;	
18	11.13	9534	no			2	37		
19	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
20	11.10	7006	yes	10	2	0	32	0,13,2,3,5,7,8,9,4,6,12,11,10,0;	
21	10.13	7000	no			0	32		
22	14.13	6817	no			0	32		
23	10.14	5453	no			0	32		
24	17.18	5284	yes	17	1	0	31		0,17,18,19,0
25	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
26	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
27	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
28	1.13	2189	no			0	28		
29	10.01	2180	no			0	28		
30	10.16	1491	no			0	28		
31	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
32	19.01	17	no			0	18		
33	19.13	16	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{9,3}$, $s_{4,3}$, $s_{6,3}$, $s_{6,2}$, $s_{6,13}$, $s_{11,13}$, $s_{10,13}$, $s_{19,1}$,

Violating step 4.4.2 = $s_{14,13}$, $s_{10,14}$, $s_{1,13}$, $s_{10,1}$, $s_{10,16}$, $s_{19,13}$

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$) + 1.470.000 β_{11})+ (13,5 (5434$\alpha_{0,13,2}$ + 944$\alpha_{13,2,2}$ + 333$\alpha_{2,3,2}$ + 159$\alpha_{3,5,2}$ + 1475$\alpha_{5,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5702$\alpha_{9,4,2}$ + 1086$\alpha_{4,6,2}$ + 1936$\alpha_{6,12,2}$ + 317$\alpha_{12,11,2}$ + 1515$\alpha_{11,10,2}$ + 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1 + 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1) + 1.470.000. 1)+ (13,5 (5434 . 1 + 944 . 1 + 333 . 1 + 159 . 1 + 1475 . 1 + 2405 . 1+ 1521 . 1+ 5702 . 1 + 1086 . 1 + 1936 . 1 + 317 . 1 + 1515 . 1 + 3490 . 1) + 1.390.000 . 1) = IDR 3.645.811 per month

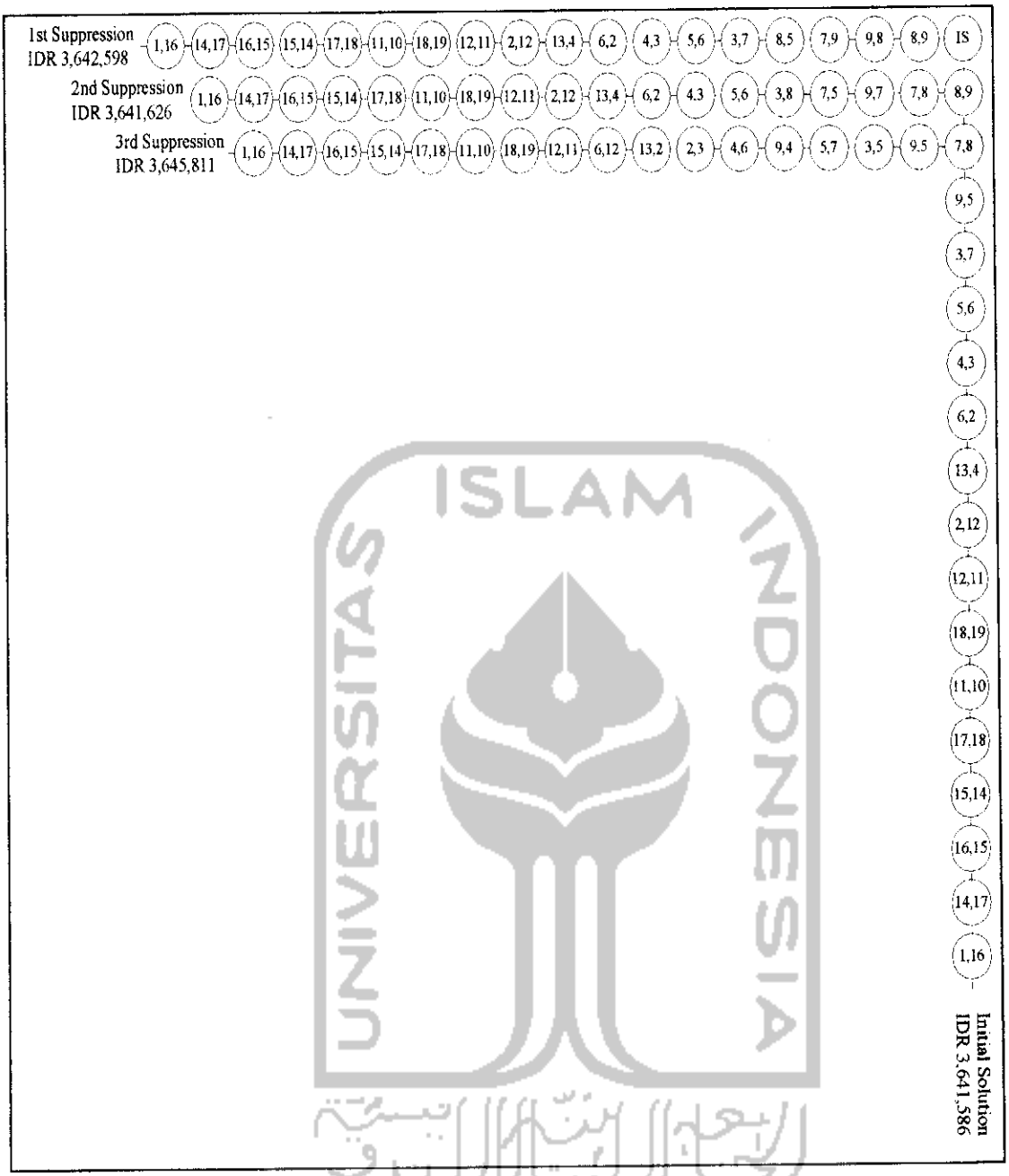

Figure 4.8 Third Suppression's Tree Diagram

E. Fourth Suppression

The current best solution still initial solution and the third suppression pair are returned to its value in the current saving matrix. The fourth suppression pair is saving $s_{3,7}$ and set $s_{3,7} = 0$ in the current saving matrix.

Table 4.9 Iteration of Fourth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	Temporary suppress						
7	5.03	12411	yes	3	4	17	37	0,7,8,9,5,3,0	
8	3.04	12137	yes	4	3	14	37	0,7,8,9,5,3,4,0	
9	4.07	12097	no			14	37		
10	4.06	12022	yes	6	2	12	37	0,7,8,9,5,3,4,6,0	
11	6.07	11999	no			12	37		
12	2.07	11772	yes	2	5	7	37	0,2,7,8,9,5,3,4,6,0	
13	6.02	11758	no			7	37		
14	13.02	10470	yes	13	1	6	37	0,13,2,7,8,9,5,3,4,6,0	
15	6.12	10130	yes	12	1	5	37	0,13,2,7,8,9,5,3,4,6,12,0	
16	12.11	9891	yes	11	3	2	37	0,13,2,7,8,9,5,3,4,6,12,11,0	

Table 4.9 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	11.13	9534	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	11.10	7006	yes	10	2	0	32	0,13,2,7,8,9,5,3,4,6,12,11,10,0	
20	10.13	7000	no			0	32		
21	14.13	6817	no			0	32		
22	10.14	5453	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
25	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
26	14.16	3121	no			0	28		
27	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
28	1.13	2189	no			0	28		
29	10.01	2180	no			0	28		
30	10.16	1491	no			0	28		
31	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
32	19.01	17	no			0	18		
33	19.13	16	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{4,7}$, $s_{6,7}$, $s_{6,2}$, $s_{11,13}$, $s_{10,13}$, $s_{14,16}$, $s_{19,1}$,

Violating step 4.4.2 = $s_{14,13}$, $s_{10,14}$, $s_{1,13}$, $s_{10,1}$, $s_{10,16}$, $s_{19,13}$

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (5434$\alpha_{0,13,2}$ + 944$\alpha_{13,2,2}$ + 1673$\alpha_{2,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 169$\alpha_{5,3,2}$ + 167$\alpha_{3,4,2}$ + 1086$\alpha_{4,6,2}$ + 1936$\alpha_{6,12,2}$ + 317$\alpha_{12,11,2}$ + 1515$\alpha_{11,10,2}$ + 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1+ 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1) + (13,5 (5434 . 1 + 944 . 1 + 1673 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 169 . 1 + 167 . 1 + 1086 . 1 + 1936 . 1 + 317 . 1 + 1515 . 1 + 3490 . 1) + 1.390.000. 1) = IDR 3.645.946 per month

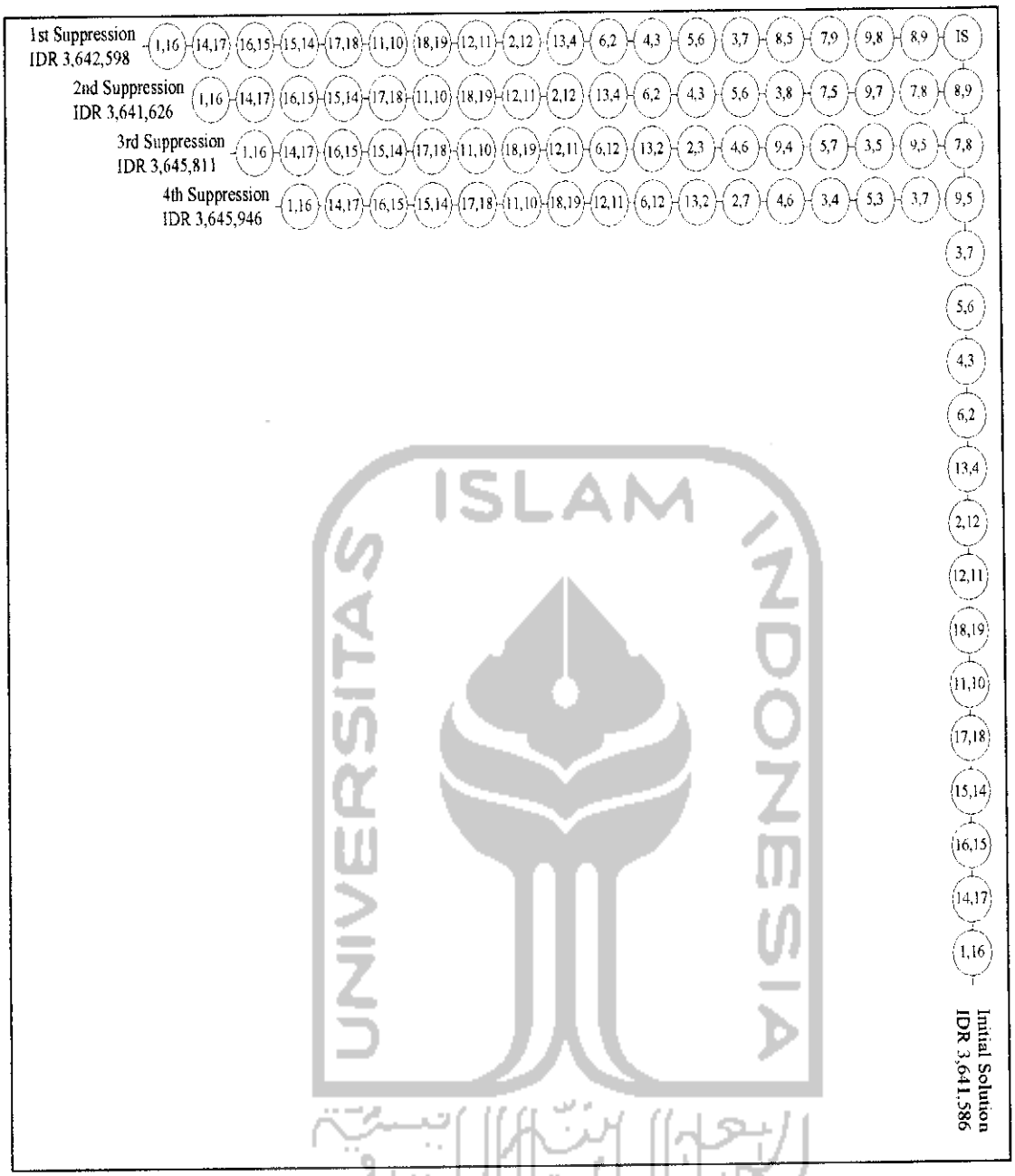

Figure 4.9 Fourth Suppression's Tree Diagram

F. Fifth Suppression

The current best solution still initial solution and the fourth suppression pair are returned to its value in the current saving matrix. The fifth suppression pair is saving $s_{5,6}$ and set $s_{5,6} = 0$ in the current saving matrix.

Table 4.10 Iteration of Fifth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	Temporary suppress						
9	4.03	12109	yes	4	3	14	37	0,4,3,7,8,9,5,0	
10	5.04	12100	no			14	37		
11	6.04	12036	yes	6	2	12	37	0,6,4,3,7,8,9,5,0	
12	5.02	11766	yes	2	5	7	37	0,6,4,3,7,8,9,5,2,0	
13	2.06	11734	no			7	37		
14	13.06	10421	yes	13	1	6	37	0,13,6,4,3,7,8,9,5,2,0	
15	2.13	10295	no			6	37		
16	2.12	10120	yes	12	1	5	37	0,13,6,4,3,7,8,9,5,2,12,0	

Table 4.10 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	12.11	9891	yes	11	3	2	37	0,13,6,4,3,7,8,9,5,2,12,11,0	
18	11.13	9534	no			2	37		
19	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
20	11.10	7006	yes	10	2	0	32	0,13,6,4,3,7,8,9,5,2,12,11,10,0	
21	10.13	7000	no			0	32		
22	14.13	6817	no			0	32		
23	10.14	5453	no			0	32		
24	17.18	5284	yes	17	1	0	31		0,17,18,19,0
25	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
26	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
27	14.16	3121	no			0	28		
28	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
29	1.13	2189	no			0	28		
30	10.01	2180	no			0	28		
31	10.16	1491	no			0	28		
32	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
33	19.01	17	no			0	18		
34	19.13	16	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{5,4}$, $s_{2,6}$, $s_{2,13}$, $s_{11,13}$, $s_{10,13}$, $s_{14,16}$, $s_{19,1}$,

Violating step 4.4.2 = $s_{14,13}$, $s_{10,14}$, $s_{1,13}$, $s_{10,1}$, $s_{10,16}$, $s_{19,13}$

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (5434$\alpha_{0,13,2}$ + 2132$\alpha_{13,6,2}$ + 983$\alpha_{6,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 502$\alpha_{5,2,2}$ + 902$\alpha_{2,12,2}$ + 317$\alpha_{12,11,2}$ + 1515$\alpha_{11,10,2}$ + 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1+ 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (543 . 1 + 2132 . 1 + 983 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 502 . 1 + 902 . 1 + 317 . 1 + 1515 . 1 + 3490 . 1) + 1.390.000. 1) = IDR 3.646.797 per month

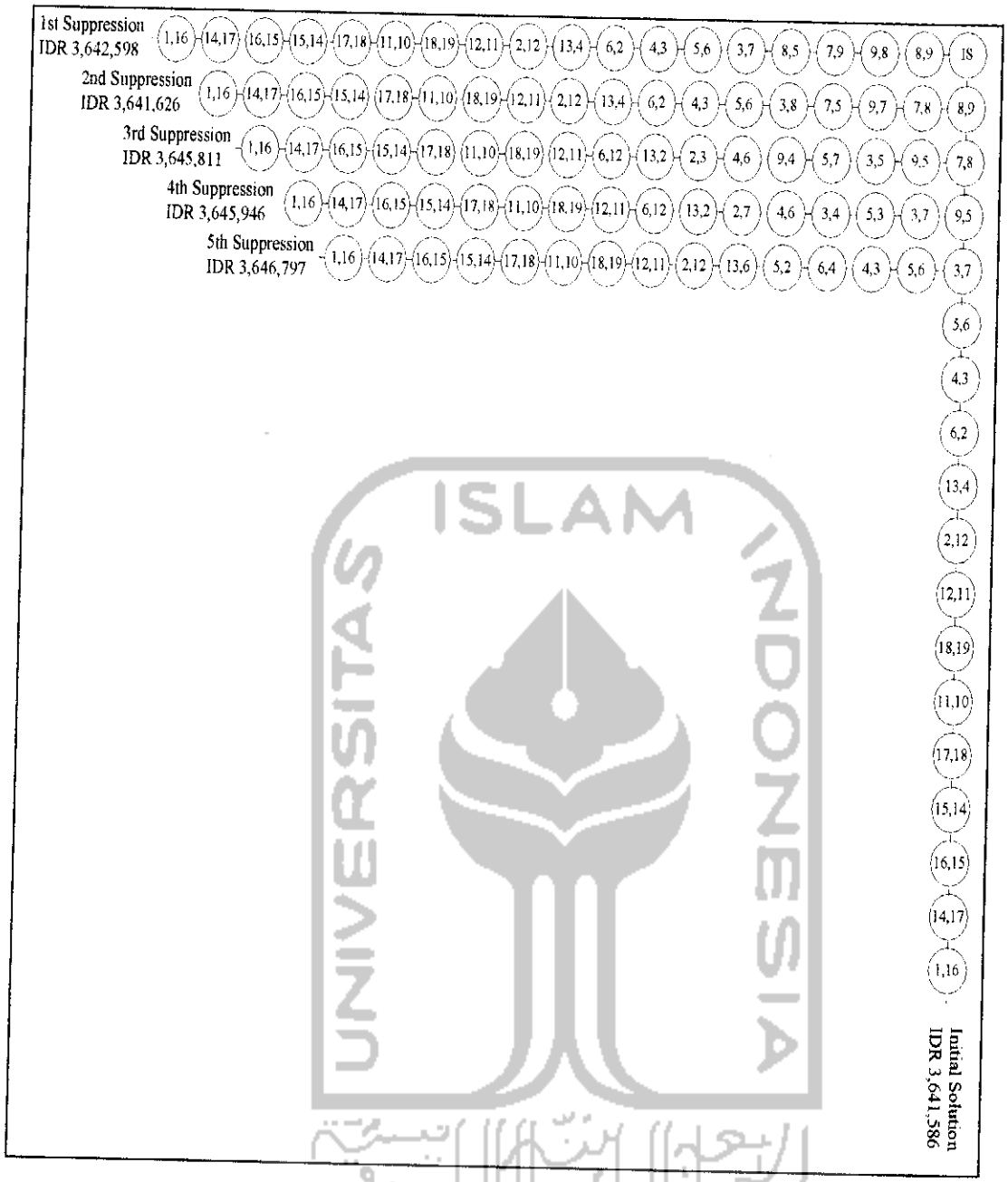

Figure 4.10 Fifth Suppression's Tree Diagram

G. Sixth Suppression

The current best solution still initial solution and the fifth suppression pair is returned to its value in the current saving matrix. The sixth suppression pair is saving $s_{4,3}$ and set $s_{4,3} = 0$ in the current saving matrix.

Table 4.11 Iteration of Sixth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	Temporary suppress						
10	6.04	12036	yes	4	3	12	37	0,3,7,8,9,5,6,4,0	
11	2.03	11785	yes	2	5	7	37	0,2,3,7,8,9,5,6,4,0	
12	4.02	11761	no			7	37		
13	13.02	10470	yes	13	1	6	37	0,13,2,3,7,8,9,5,6,4,0	
14	4.13	10345	no			6	37		
15	4.12	10137	yes	12	1	5	37	0,13,2,3,7,8,9,5,6,4,12,0	
16	12.11	9891	yes	11	3	2	37	0,13,2,3,7,8,9,5,6,4,12,11,0	

Table 4.11 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	11.13	9534	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	11.10	7006	yes	10	2	0	32	0,13,2,3,7,8,9,5,6,4,12,11,10,0	
20	10.13	7000	no			0	32		
21	14.13	6817	no			0	32		
22	10.14	5453	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
25	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
26	14.16	3121	no			0	28		
27	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
28	1.13	2189	no			0	28		
29	10.01	2180	no			0	28		
30	10.16	1491	no			0	28		
31	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
32	19.01	17	no			0	18		
33	19.13	16	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{4,2}$, $s_{4,13}$, $s_{11,13}$, $s_{10,13}$, $s_{14,16}$, $s_{19,1}$,

Violating step 4.4.2 = $s_{14,13}$, $s_{10,14}$, $s_{1,13}$, $s_{10,1}$, $s_{10,16}$, $s_{19,13}$

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (5434$\alpha_{0,13,2}$ + 944$\alpha_{13,2,2}$ + 333$\alpha_{2,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 983$\alpha_{6,4,2}$ + 1048$\alpha_{4,12,2}$ + 317$\alpha_{12,11,2}$ + 1515$\alpha_{11,10,2}$ + 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1+ 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (5434 . 1 + 944 . 1 + 333 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 983 . 1 + 1048 . 1 + 317 . 1 + 1515 . 1 + 3490 . 1) + 1.390.000. 1) = IDR 3.642.841 per month

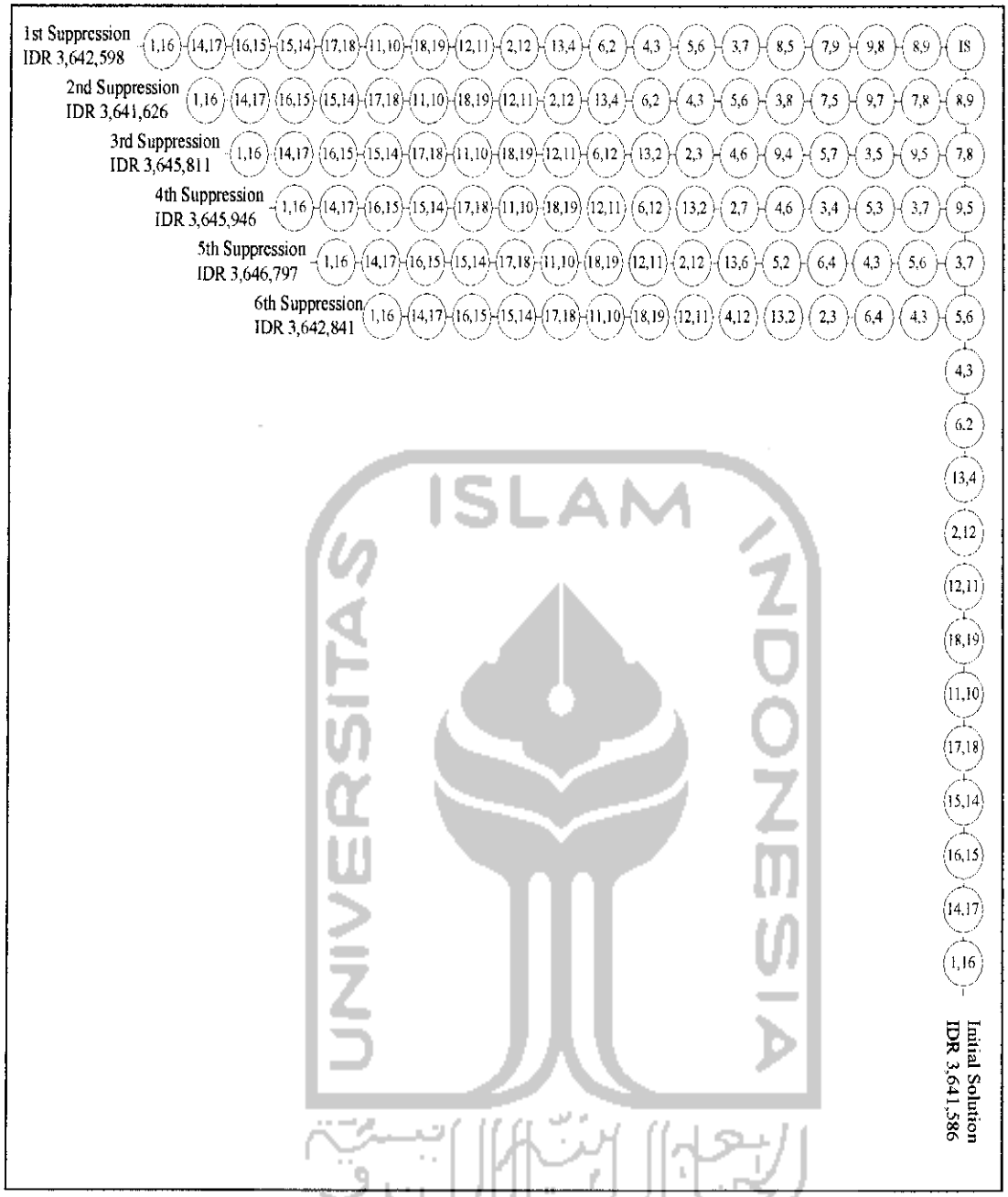

Figure 4.11 Sixth Suppression's Tree Diagram

H. Seventh Suppression

The current best solution still initial solution and the sixth suppression pair are returned to its value in the current saving matrix. The seventh suppression pair is saving $s_{6,2}$ and set $s_{6,2} = 0$ in the current saving matrix.

Table 4.12 Iteration of Seventh Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	Temporary suppress						
12	2.04	11754	yes	2	5	7	37	0,2,4,3,7,8,9,5,6,0	
13	13.02	10470	yes	13	1	6	37	0,13,2,4,3,7,8,9,5,6,0	
14	6.13	10244	no			6	37		
15	6.12	10130	yes	12	1	5	37	0,13,2,4,3,7,8,9,5,6,12,0	
16	12.11	9891	yes	11	3	2	37	0,13,2,4,3,7,8,9,5,6,12,11,0	

Table 4.12 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	11.13	9534	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	11.10	7006	yes	10	2	0	32	0,13,2,4,3,7,8,9,5,6,12,11,10,0	
20	10.13	7000	no			0	32		
21	14.13	6817	no			0	32		
22	10.14	5453	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
25	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
26	14.16	3121	no			0	28		
27	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
28	1.13	2189	no			0	28		
29	10.01	2180	no			0	28		
30	10.16	1491	no			0	28		
31	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
32	19.01	17	no			0	18		
33	19.13	16	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{6,13}$, $s_{11,13}$, $s_{10,13}$, $s_{14,16}$, $s_{19,1}$,

Violating step 4.4.2 = $s_{14,13}$, $s_{10,14}$, $s_{1,13}$, $s_{10,1}$, $s_{10,16}$, $s_{19,13}$,

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (5434$\alpha_{0,13,2}$ + 944$\alpha_{13,2,2}$ + 221$\alpha_{2,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1936$\alpha_{6,12,2}$ + 317$\alpha_{12,11,2}$ + 1515$\alpha_{11,10,2}$ + 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1+ 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (5434 . 1 + 944 . 1 + 221 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1936 . 1 + 317 . 1 + 1515 . 1 + 3490 . 1) + 1.390.000. 1) = IDR 3.642.369 per month

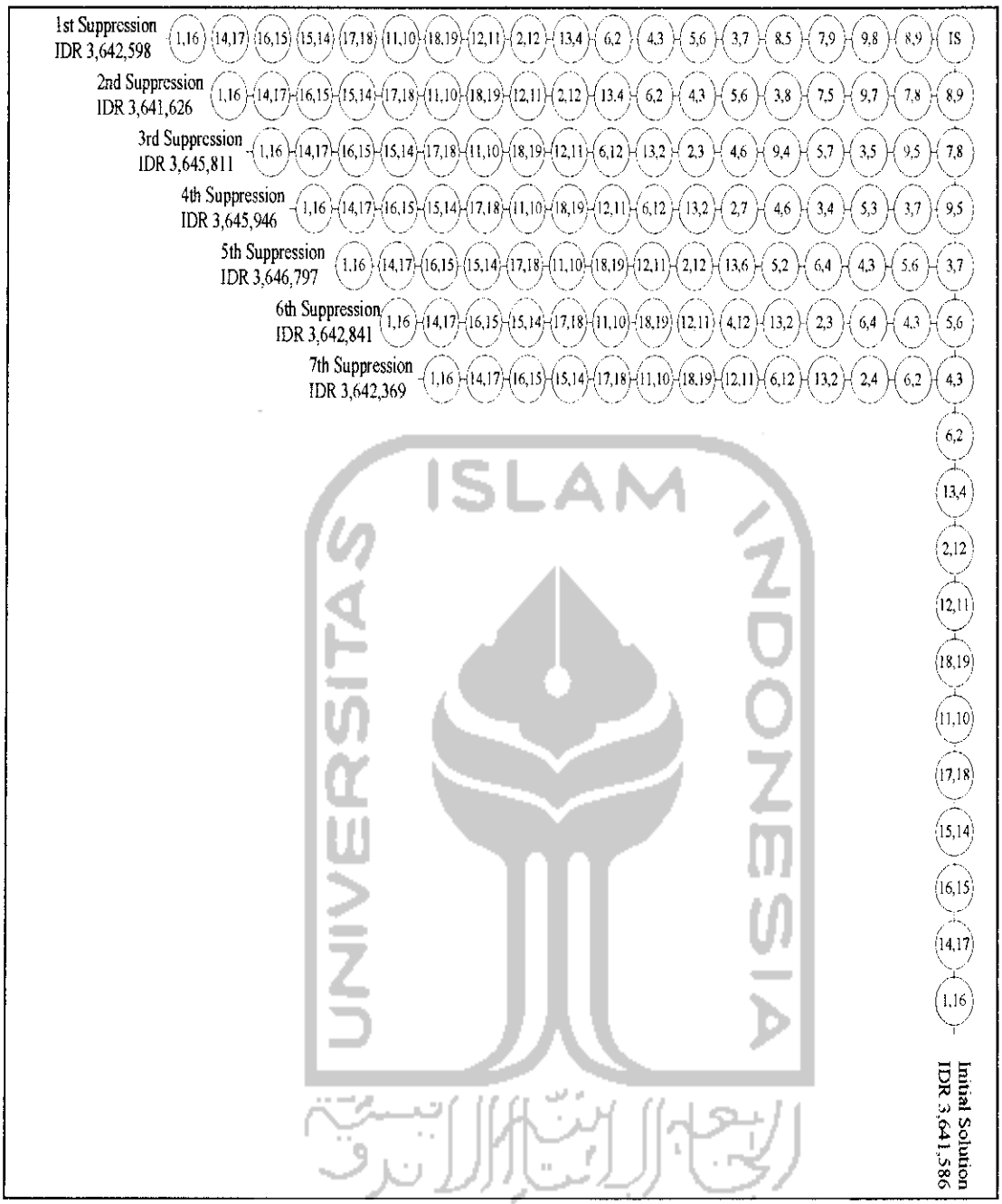

Figure 4.12 Seventh Suppression's Tree Diagram

I. Eighth Suppression

The current best solution still initial solution and the seventh suppression pair are returned to its value in the current saving matrix. The eighths suppression pair is saving $s_{13,4}$ and set $s_{13,4} = 0$ in the current saving matrix.

Table 4.13 Iteration of Eighth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Temporary suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	yes	13	1	5	37	0,12,4,3,7,8,9,5,6,2,13,0	
16	11.12	9899	yes	11	3	2	37	0,11,12,4,3,7,8,9,5,6,2,13,0	

Table 4.13 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	13.11	9559	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	10.11	7015	yes	10	2	0	32	0,10,11,12,4,3,7,8,9,5,6,2,13,0	
20	13.14	6826	no			0	32		
21	17.18	5284	yes	17	1	0	31		0,17,18,19,0
22	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
23	13.15	4202	no			0	29		
24	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
25	14.16	3121	no			0	28		
26	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
27	13.16	2868	no			0	28		
28	1.10	2190	no			0	28		
29	13.01	2178	no			0	28		
30	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
31	19.10	18	no			0	18		
32	19.01	17	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,11}$, $s_{14,16}$, $s_{19,1}$

Violating step 4.4.2 = $s_{13,14}$, $s_{13,15}$, $s_{13,16}$, $s_{1,10}$, $s_{13,1}$, $s_{19,10}$,

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (3520$\alpha_{0,10,2}$ + 1502$\alpha_{10,11,2}$ + 309$\alpha_{11,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$ + 5423$\alpha_{13,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1+ 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (3520 . 1 + 1502 . 1 + 309 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 954 . 1 + 5423 . 1) + 1.390.000. 1) = IDR 3.640.978 per month

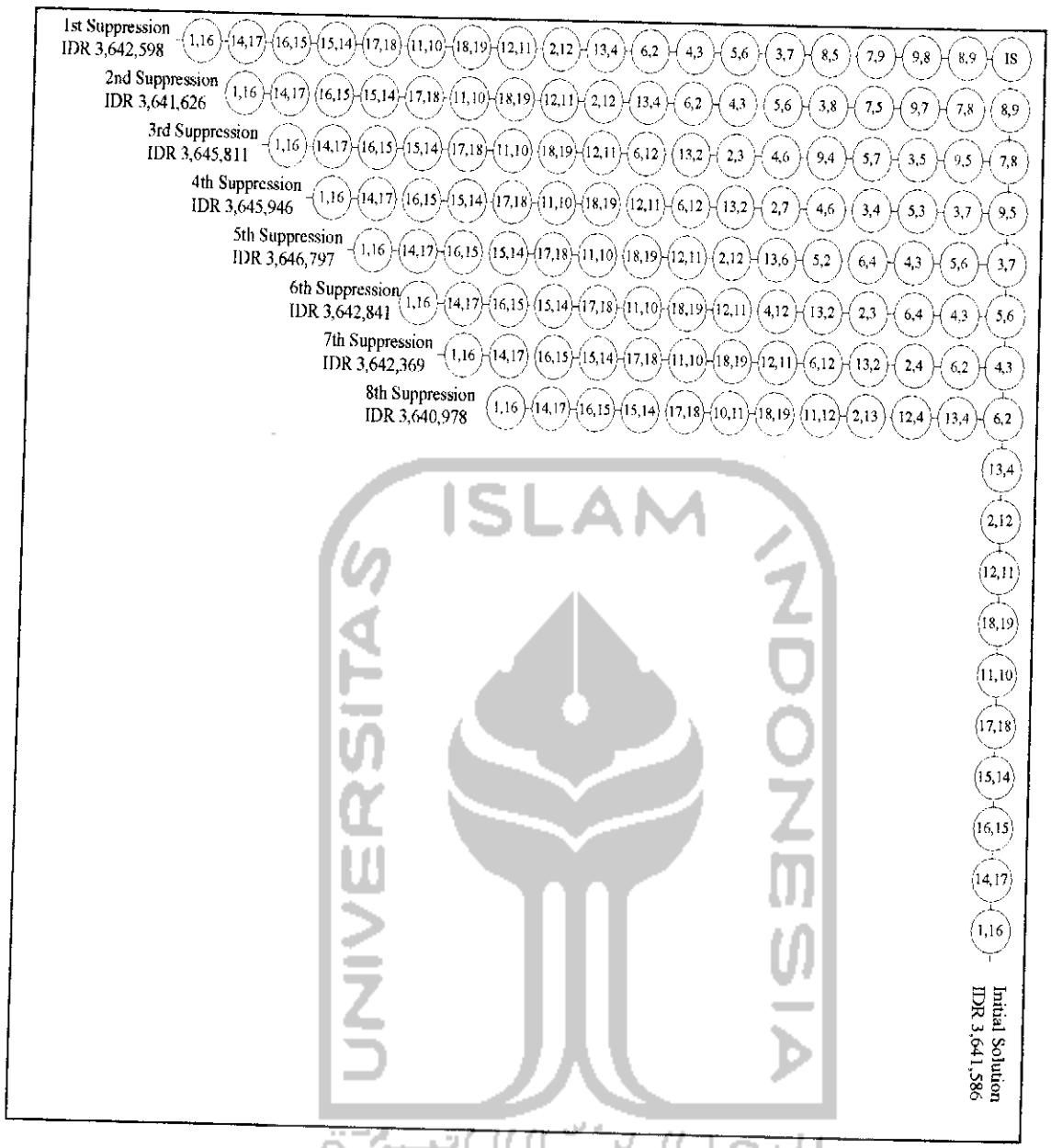

Figure 4.13 Eight Suppression's Tree Diagram

J. Ninth Suppression

The current best solution is change to the result in eighth suppression and then the eighth suppression pair is removed permanently from the current saving matrix $s_{13,4}$ and set $s_{13,4} = 0$ in the current saving matrix and remains zero in all next iterations. The ninth suppression pair is saving $s_{12,4}$ and set $s_{12,4} = 0$ in the current saving matrix.

Table 4.14 Iteration of Ninth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	Temporary suppress						
15	2.13	10295	yes	13	1	6	37	0,4,3,7,8,9,5,6,2,13,0	
16	11.04	9900	yes	11	3	3	37	0,11,4,3,7,8,9,5,6,2,13,0	

Table 4.14 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	12.11	9891	yes	12	1	2	37	0,12,11,4,3,7,8,9,5,6,2,13,0	
18	13.12	9578	no			2	37		
19	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
20	13.10	7008	yes	10	2	0	32	0,12,11,4,3,7,8,9,5,6,2,13,10,0	
21	10.12	7001	no			0	32		
22	14.12	5542	no			0	32		
23	10.14	5453	no			0	32		
24	17.18	5284	yes	17	1	0	31		0,17,18,19,0
25	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
26	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
27	14.16	3121	no			0	28		
28	14.17	3101	yes						0,16,15,14,17,18,19,0;
29	1.12	2192	no			0	28		
30	10.01	2180	no			0	28		
31	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
32	19.12	20	no			0	18		
33	19.01	17	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,12}$, $s_{10,12}$, $s_{14,16}$, $s_{19,1}$

Violating step 4.4.2 = $s_{14,12}$, $s_{10,14}$, $s_{1,12}$, $s_{10,1}$, $s_{19,12}$,

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (5207$\alpha_{0,12,2}$ + 317$\alpha_{12,11,2}$ + 1261$\alpha_{11,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$+ 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$ + 1935$\alpha_{13,10,2}$+ 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1+ 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (5207 . 1 + 317 . 1 + 1261 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 954 . 1 + 1935 . 1 + 3490 . 1) + 1.390.000. 1) = IDR 3.647.755 per month

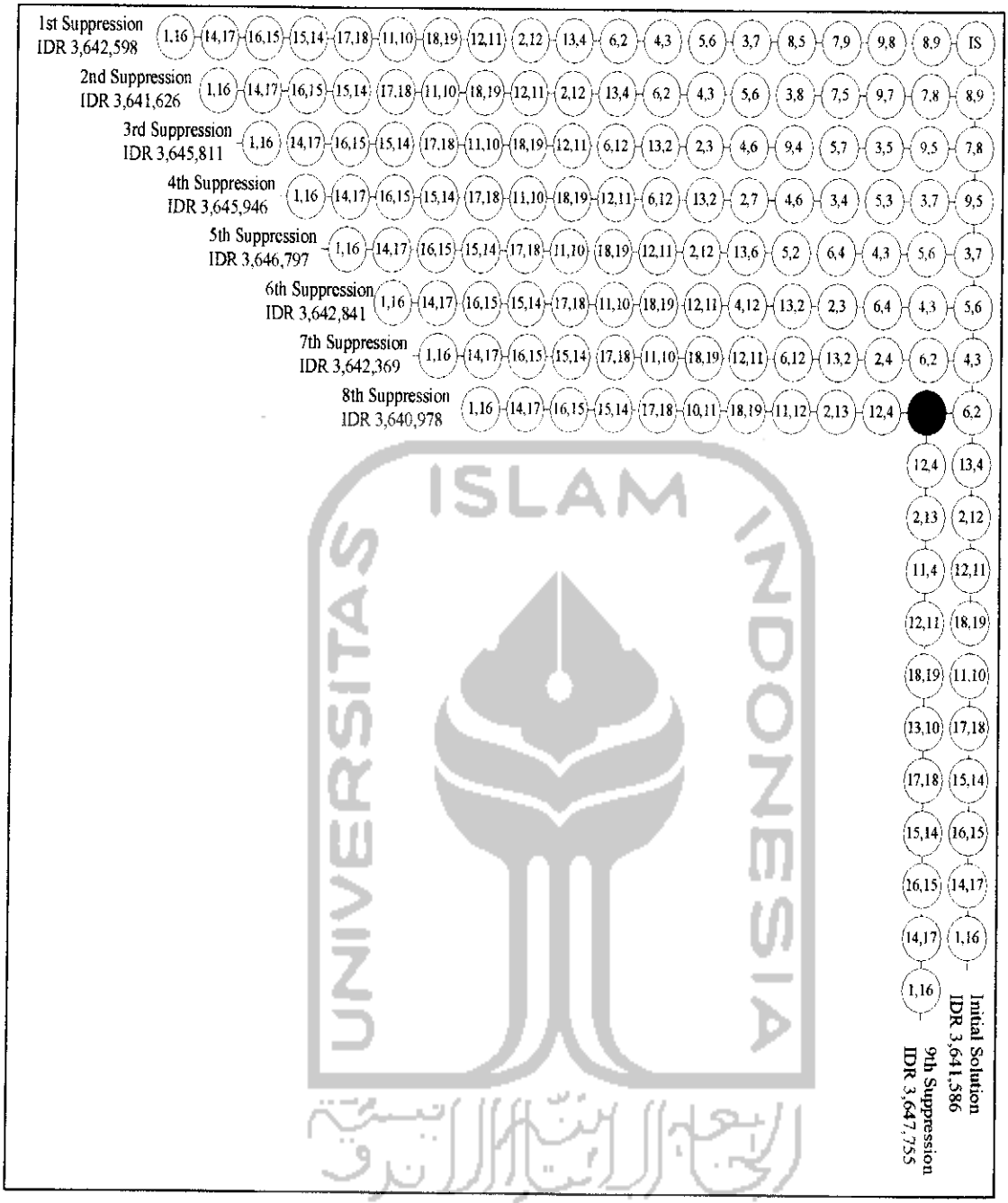

Figure 4.14 Ninth Suppression's Tree Diagram

K. Tenth Suppression

The current best solution still eighth suppression and the ninth suppression pair are returned to its value in the current saving matrix. The tenth suppression pair is saving $s_{2,13}$ and set $s_{2,13} = 0$ in the current saving matrix.

Table 4.15 Iteration of Tenth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	Temporary suppress						
16	2.12	10120	no			6	37		

Table 4.15 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	11.12	9899	yes	11	3	3	37	0,11,12,4,3,7,8,9,5,6,2,0	
18	2.11	9647	no			3	37		
19	13.11	9559	yes	13	1	2	37	0,13,11,12,4,3,7,8,9,5,6,2,0	
20	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
21	2.10	7013	yes	10	2	0	32	0,13,11,12,4,3,7,8,9,5,6,2,10,0	
22	10.13	7000	no			0	32		
23	14.13	6817	no			0	32		
24	10.14	5453	no			0	32		
25	17.18	5284	yes	17	1	0	31		0,17,18,19,0
26	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
27	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
28	14.16	3121	no			0	28		
29	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
30	1.13	2189	no			0	28		
31	10.01	2180	no			0	28		
32	10.16	1491	no			0	28		
33	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
34	19.01	17	no			0	18		
35	19.13	16	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{2,12}$, $s_{2,11}$, $s_{10,13}$, $s_{14,16}$, $s_{19,1}$,

Violating step 4.4.2 = $s_{14,13}$, $s_{10,14}$, $s_{1,13}$, $s_{10,1}$, $s_{10,16}$, $s_{19,13}$

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (5434$\alpha_{0,13,2}$ + 891$\alpha_{13,11,2}$ + 309$\alpha_{11,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 2322$\alpha_{2,10,2}$ + 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1+ 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (5434 . 1 + 891 . 1 + 309 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 2322 . 1 + 3490 . 1) + 1.390.000. 1) = IDR 3.650.941 per month

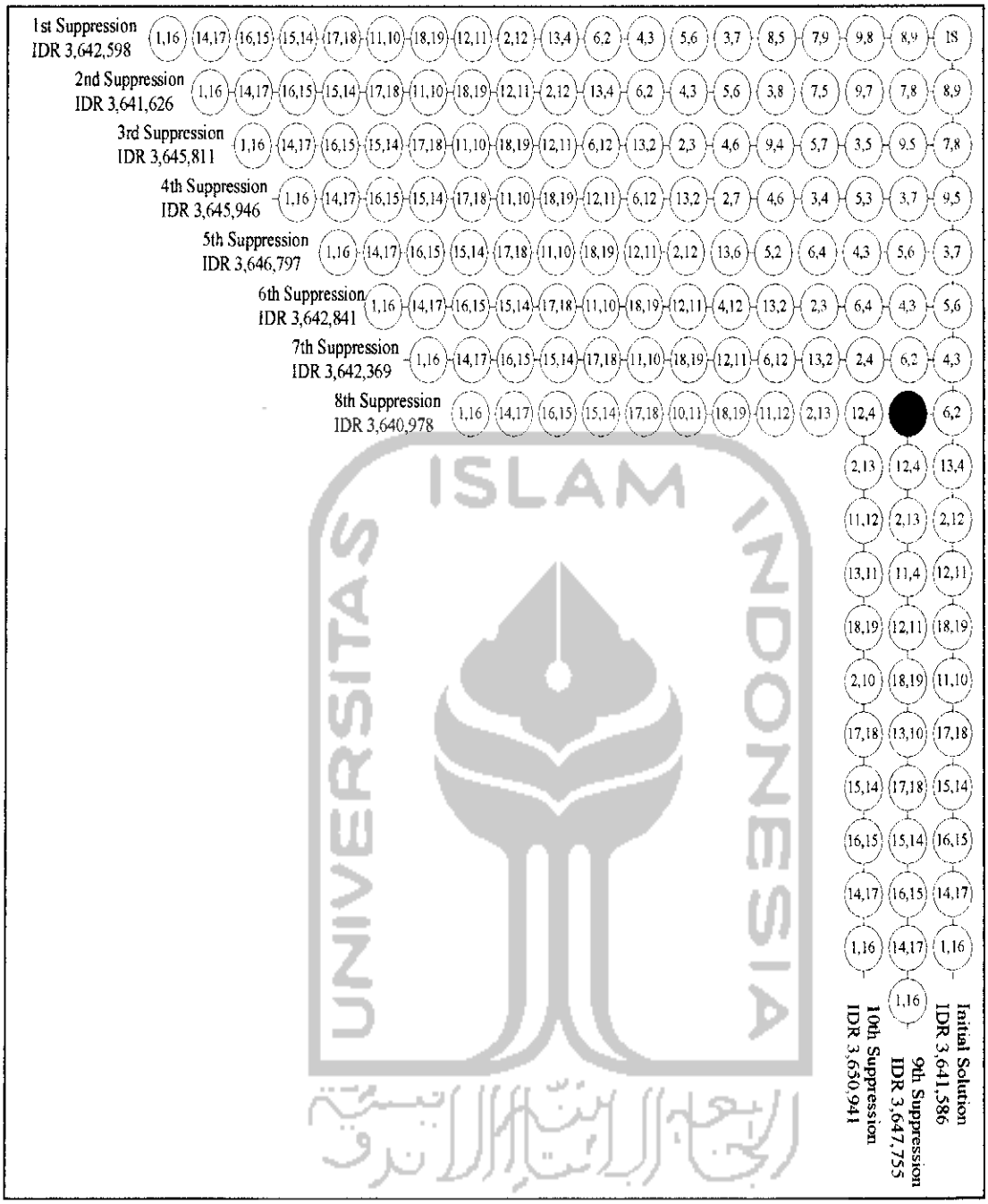

Figure 4.15 Tenth Suppression's Tree Diagram

L. Eleventh Suppression

The current best solution still eighth suppression and the tenth suppression pair are returned to its value in the current saving matrix. The eleventh suppression pair is saving $s_{11,12}$ and set $s_{11,12} = 0$ in the current saving matrix.

Table 4.16 Iteration of Eleventh Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	yes	13	1	5	37	0,12,4,3,7,8,9,5,6,2,13,0	
16	11.12	9899	Temporary suppress						

Table 4.16 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	13.12	9578	no			5	37		
18	13.11	9559	yes	11	3	2	37	0,12,4,3,7,8,9,5,6,2,13,11,0	
19	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
20	11.10	7006	yes	10	2	0	32	0,12,4,3,7,8,9,5,6,2,13,11,10,0	
21	10.12	7001	no			0	32		
22	10.14	5453	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
25	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
26	14.16	3121	no			0	28		
27	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
28	1.12	2192	no			0	28		
29	10.01	2180	no			0	28		
30	10.16	1491	no			0	28		
31	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
32	19.12	20	no			0	18		
33	19.01	17	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,12}$, $s_{10,12}$, $s_{14,16}$, $s_{19,1}$

Violating step 4.4.2 = $s_{10,14}$, $s_{1,12}$, $s_{10,1}$, $s_{10,16}$, $s_{19,12}$,

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (5207$\alpha_{0,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$+ 891$\alpha_{13,11,2}$ + 1515$\alpha_{11,10,2}$ + 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1+ 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (5207 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 954 . 1 + 891 . 1 + 1515 . 1 + 3490 . 1) + 1.390.000. 1) = IDR 3.645.690 per month

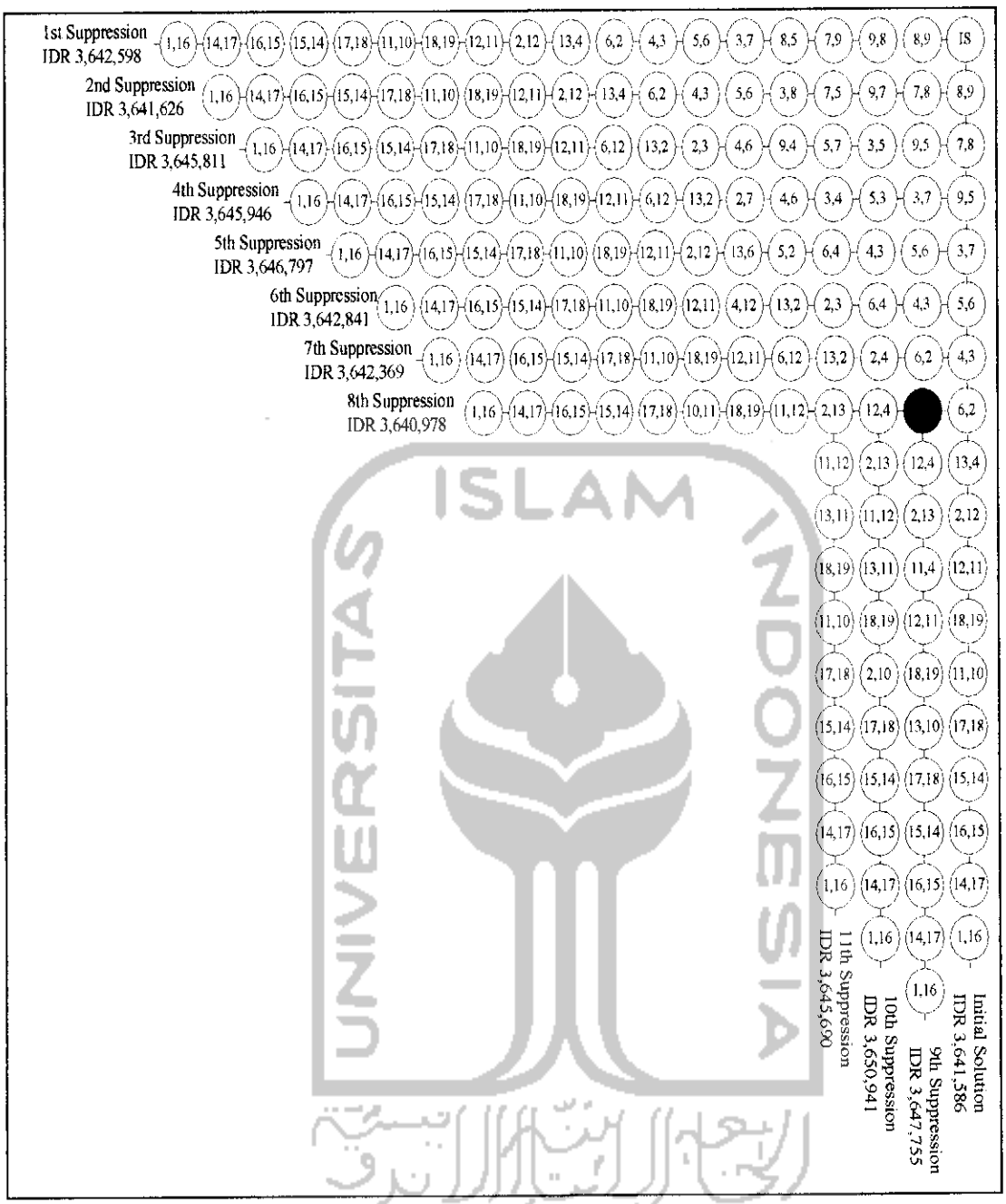

Figure 4.16 Eleventh Suppression's Tree Diagram

M. Twelfth Suppression

The current best solution still eighth suppression and the eleventh suppression pair are returned to its value in the current saving matrix. The twelfth suppression pair is saving $s_{18,19}$ and set $s_{18,19} = 0$ in the current saving matrix.

Table 4.17 Iteration of Twelfth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	yes	13	1	5	37	0,12,4,3,7,8,9,5,6,2,13,0	
16	11.12	9899	yes	11	3	2	37	0,11,12,4,3,7,8,9,5,6,2,13,0	

Table 4.17 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	13.11	9559	no			2	37		
18	18.19	7601	Temporary suppress						
19	19.18	7586	yes	19	1	2	36		0,19,18,0
				18	4	2	32		
20	10.11	7015	yes	10	2	0	32	0,10,11,12,4,3,7,8,9,5,6,2,13,0	
21	13.10	7008	no			0	32		
22	13.14	6826	no			0	32		
23	14.10	5483	no			0	32		
24	18.17	5247	yes	17	1	0	31		0,19,18,17,0
25	15.14	4482	yes	15	1	0	30		0,19,18,17,0;0,15,14,0
				14	1	0	29		
26	13.15	4202	no			0	29		
27	17.15	3144	yes			0	29		0,19,18,17,15,14,0
28	14.16	3121	yes	16	1	0	28		0,19,18,17,15,14,16,0
29	1.10	2190	no			0	28		
30	13.01	2178	no			0	28		
31	16.10	1550	no			0	28		
32	16.01	1106	yes	1	10	0	18		0,19,18,17,15,14,16,1.0
33	13.19	42	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,11}$, $s_{13,10}$,

Violating step 4.4.2 = $s_{13,14}$, $s_{14,10}$, $s_{13,15}$, $s_{1,10}$, $s_{13,1}$, $s_{16,10}$, $s_{13,19}$

Total cost = (16,875 (7372$\alpha_{0,19,1}$ + 6227$\alpha_{19,18,1}$ + 3923$\alpha_{18,17,1}$ + 1882$\alpha_{17,15,1}$ + 1309$\alpha_{15,14,1}$ + 2058$\alpha_{14,16,1}$ + 1643$\alpha_{16,1,1}$ + 1103$\alpha_{1,0,1}$)+ 1.470.000 β_{11})+ (13,5 (3520$\alpha_{0,10,2}$ + 1502$\alpha_{10,11,2}$ + 309$\alpha_{11,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$+ 5423$\alpha_{13,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (7372 . 1 + 6227 . 1 + 3923 . 1 + 1882 . 1 + 1309 . 1 + 2058 . 1 + 1643 . 1 + 1103 . 1)+ 1.470.000. 1)+ (13,5 (3520 . 1 + 1502 . 1 + 309 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 954 . 1 + 5423 . 1) + 1.390.000. 1) = IDR 3.641.046 per month

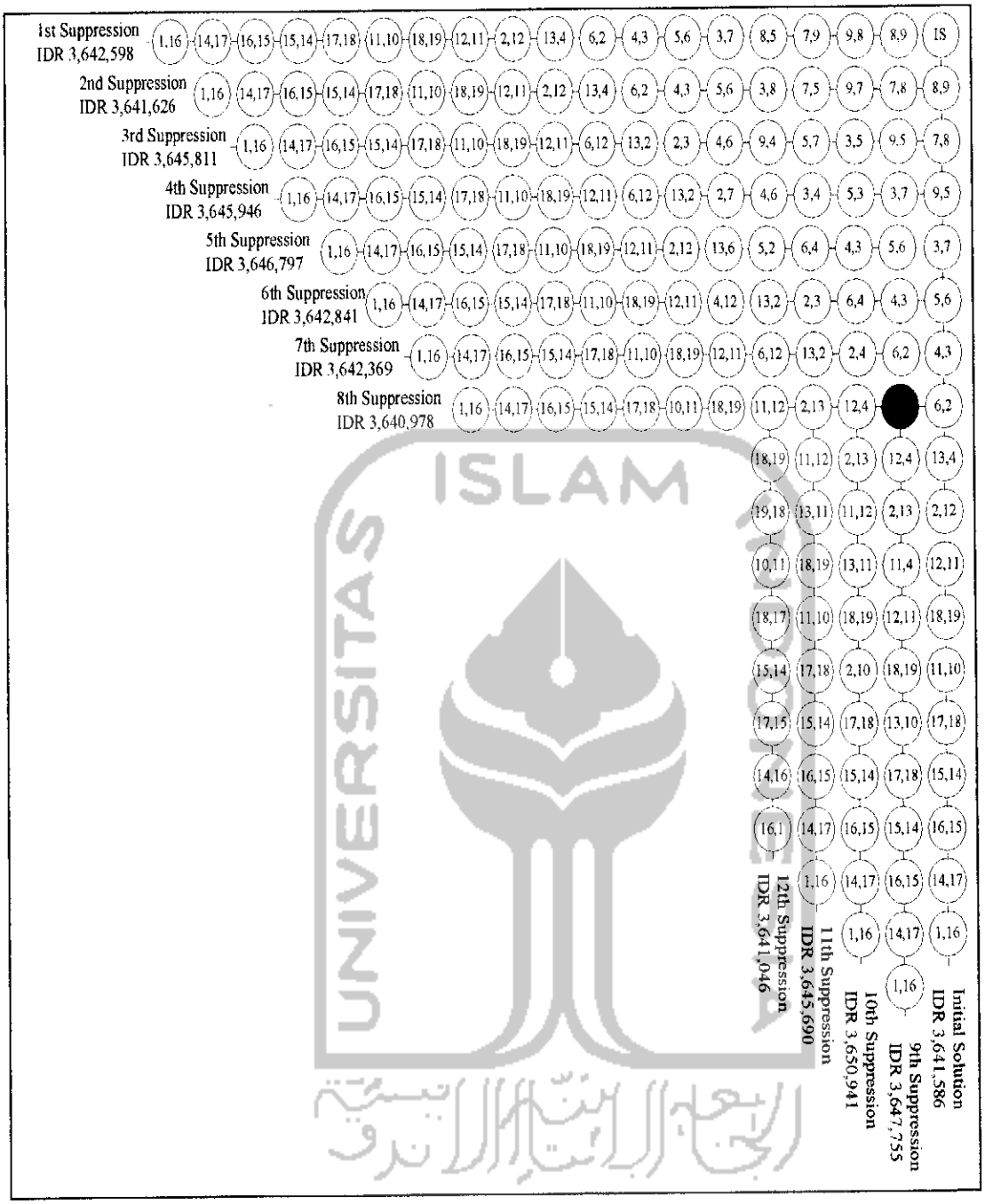

Figure 4.17 Twelfth Suppression's Tree Diagram

N. Thirteenth Suppression

The current best solution still eighth suppression and the twelfth suppression pair are returned to its value in the current saving matrix. The thirteenth suppression pair is saving $s_{10,11}$ and set $s_{10,11} = 0$ in the current saving matrix.

Table 4.18 Iteration of Thirteenth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	yes	13	1	5	37	0,12,4,3,7,8,9,5,6,2,13,0	
16	11.12	9899	yes	11	3	2	37	0,11,12,4,3,7,8,9,5,6,2,13,0	

Table 4.18 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	13.11	9559	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	10.11	7015	Temporary suppress						
20	13.10	7008	yes	10	2	0	32	0,11,12,4,3,7,8,9,5,6,2,13,10,0	
21	14.11	5524	no			0	32		
22	17.18	5284	yes	17	1	0	31		0,17,18,19,0
23	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
24	16.15	3131	yes	16	1	0	28		0,17,18,19,0;0,16,15,14,0
25	14.16	3121	no			0	28		
26	14.17	3101	yes			0	28		0,16,15,14,17,18,19,0;
27	1.11	2205	no			0	28		
28	10.01	2180	no			0	28		
29	10.16	1491	no			0	28		
30	1.16	1091	yes	1	10	0	18		0,1,16,15,14,17,18,19,0;
31	19.11	32	no			0	18		
32	19.01	17	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,11}$, $s_{14,16}$, $s_{19,1}$

Violating step 4.4.2 = $s_{14,11}$, $s_{1,11}$, $s_{10,1}$, $s_{10,16}$, $s_{19,11}$,

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 763$\alpha_{16,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (5027$\alpha_{0,11,2}$ + 309$\alpha_{11,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$ + 1935$\alpha_{13,10,2}$ + 3490$\alpha_{10,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1+ 1658 . 1 + 763 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (5027 . 1 + 309 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 .1 + 1092 . 1 + 954 . 1 + 1935 . 1 + 3490 . 1) + 1.390.000. 1) = IDR 3.641.073 per month

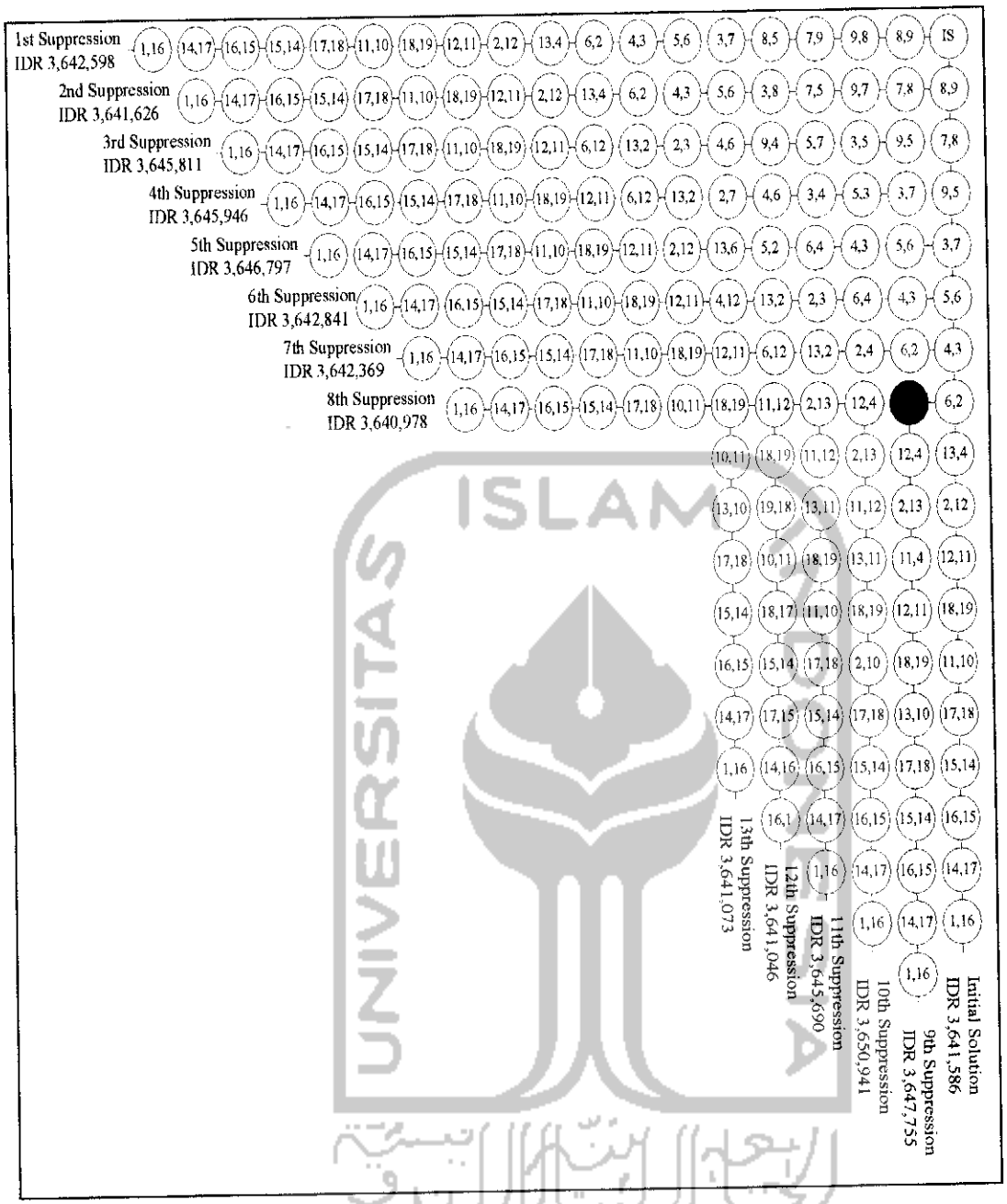

Figure 4.18 Thirteenth Suppression's Tree Diagram

O. Fourteenth Suppression

The current best solution still eight suppression and the thirteenth suppression pair is returned to its value in the current saving matrix. The fourteenth suppression pair is saving $s_{17,18}$ and set $s_{17,18} = 0$ in the current saving matrix.

Table 4.19 Iteration of Fourteenth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	yes	13	1	5	37	0,12,4,3,7,8,9,5,6,2,13,0	
16	11.12	9899	yes	11	3	2	37	0,11,12,4,3,7,8,9,5,6,2,13,0	

Table 4.19 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	13.11	9559	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	10.11	7015	yes	10	2	0	32	0,10,11,12,4,3,7,8,9,5,6,2,13,0	
20	13.10	7008	no			0	32		
21	13.14	6826	no			0	32		
22	14.10	5483	no			0	32		
23	17.18	5284	Temporary suppress						
24	15.14	4482	yes	15	1	0	31		0,18,19,0;0,15,14,0
				14	1	0	30		
25	13.15	4202	no			0	30		
26	17.15	3144	yes	17	1	0	29		0,18,19,0;0,17,15,14,0
27	14.16	3121	yes	16	1	0	28		0,18,19,0;0,17,15,14,16,0
28	13.17	2849	no			0	28		
29	16.17	2814	no			0	28		
30	13.18	2745	no			0	28		
31	16.18	2703	yes			0	28		0,17,15,14,16,18,19,0;
32	1.10	2190	no			0	28		
33	13.01	2178	no			0	28		
34	1.17	1076	yes	1	10	0	18		0,1,17,15,14,16,18,19,0;
35	19.10	18	no			0	18		
36	19.01	17	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,11}$, $s_{13,10}$, $s_{16,17}$, $s_{19,1}$

Violating step 4.4.2 = $s_{13,14}$, $s_{14,10}$, $s_{13,15}$, $s_{13,17}$, $s_{13,18}$, $s_{1,10}$, $s_{13,1}$, $s_{19,10}$,

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 2798$\alpha_{1,17,1}$ + 1882$\alpha_{17,15,1}$ + 1309$\alpha_{15,14,1}$ + 2058$\alpha_{14,16,1}$ + 5362$_{16,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (3520$\alpha_{0,10,2}$ + 1502$\alpha_{10,11,2}$ + 309$\alpha_{11,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$ + 5432$\alpha_{13,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1 + 2798 . 1 + 1882 . 1 + 1309 . 1 + 2058 . 1 + 5362 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (3520 . 1 + 1502 . 1 + 309 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 954 . 1 + 5432 . 1) + 1.390.000. 1) = IDR 3.684.229 per month

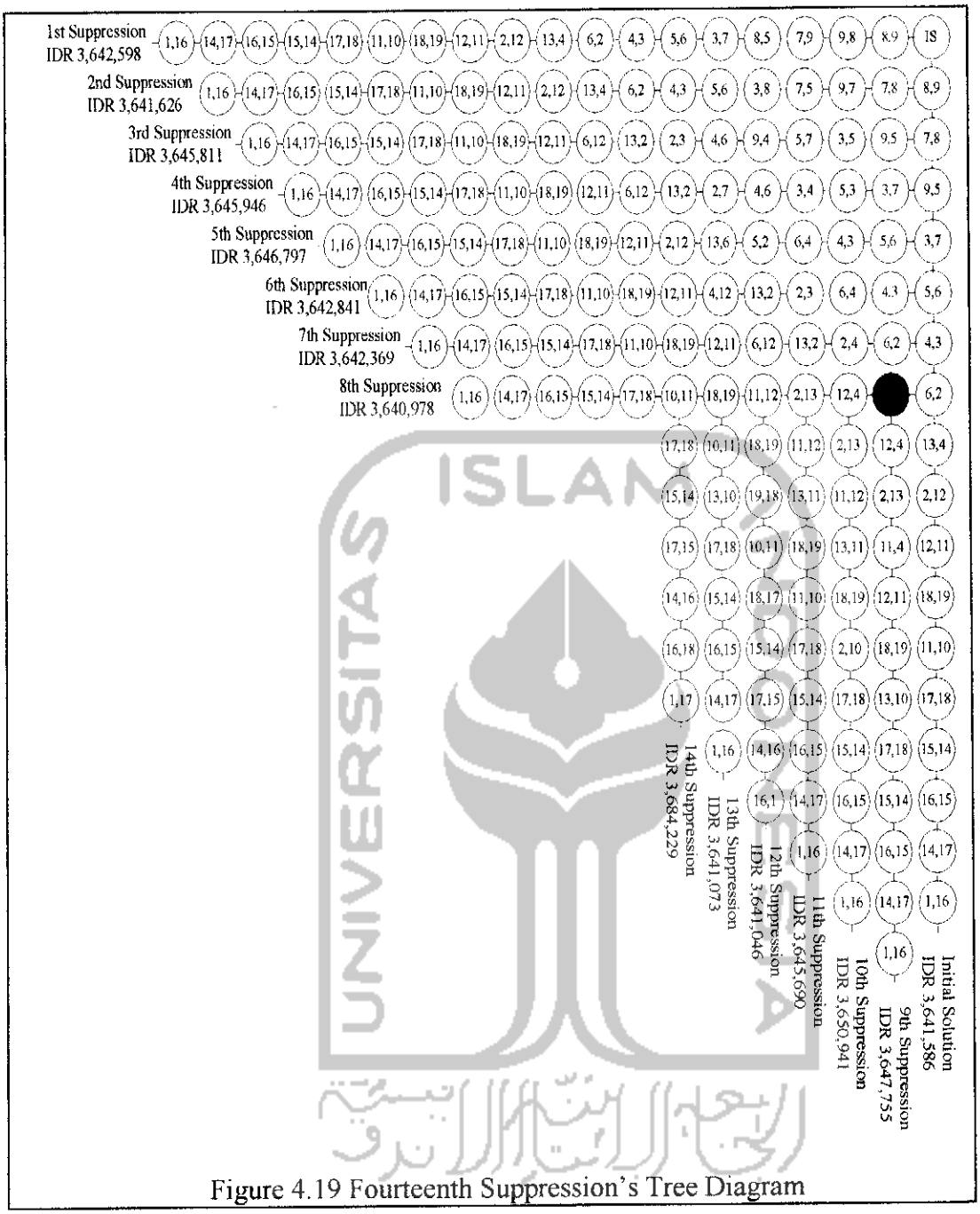

Figure 4.19 Fourteenth Suppression's Tree Diagram

P. Fifteenth Suppression

The current best solution stills eight suppression and the fourteenth suppression pair is returned to its value in the current saving matrix. The fifteenth suppression pair is saving $s_{15,14}$ and set $s_{15,14} = 0$ in the current saving matrix.

Table 4.20 Iteration of Fifteenth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	yes	13	1	5	37	0,12,4,3,7,8,9,5,6,2,13,0	
16	11.12	9899	yes	11	3	2	37	0,11,12,4,3,7,8,9,5,6,2,13,0	

Table 4.20 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	13.11	9559	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	10.11	7015	yes	10	2	0	32	0,10,11,12,4,3,7,8,9,5,6,2,13,0	
20	13.10	7008	no			0	32		
21	13.14	6826	no			0	32		
22	14.10	5483	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	Temporary suppress						
25	14.15	4452	yes	14	1	0	30		0,17,18,19,0;0,14,15,0
				15	1	0	29		
26	16.14	3131	yes	16	1	0	28		0,17,18,19,0;0,16,14,15,0
27	15.16	3121	no			0	28		
28	15.17	3109	yes			0	28		0,16,14,15,17,18,19,0;
29	13.16	2868	no			0	28		
30	1.10	2190	no			0	28		
31	13.01	2178	no			0	28		
32	1.16	1091	yes	1	10	0	18		0,1,16,14,15,17,18,19,0;
33	19.10	18	no			0	18		
34	19.01	17	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,11}$, $s_{13,10}$, $s_{15,16}$, $s_{19,1}$

Violating step 4.4.2 = $s_{13,14}$, $s_{14,10}$, $s_{13,16}$, $s_{1,10}$, $s_{13,1}$, $s_{19,10}$,

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1658$\alpha_{1,16,1}$ + 2068$\alpha_{16,14,1}$ + 1319$\alpha_{14,15,1}$ + 1910$\alpha_{15,17,1}$ + 3913 $\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (3520$\alpha_{0,10,2}$ + 1502$\alpha_{10,11,2}$ + 309$\alpha_{11,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$ + 5432$\alpha_{13,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1 + 1658 . 1 + 2068 . 1 + 1319 . 1 + 1910 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (3520 . 1 + 1502 . 1 + 309 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 954 . 1 + 5432 . 1) + 1.390.000. 1) = IDR 3.641.350 per month

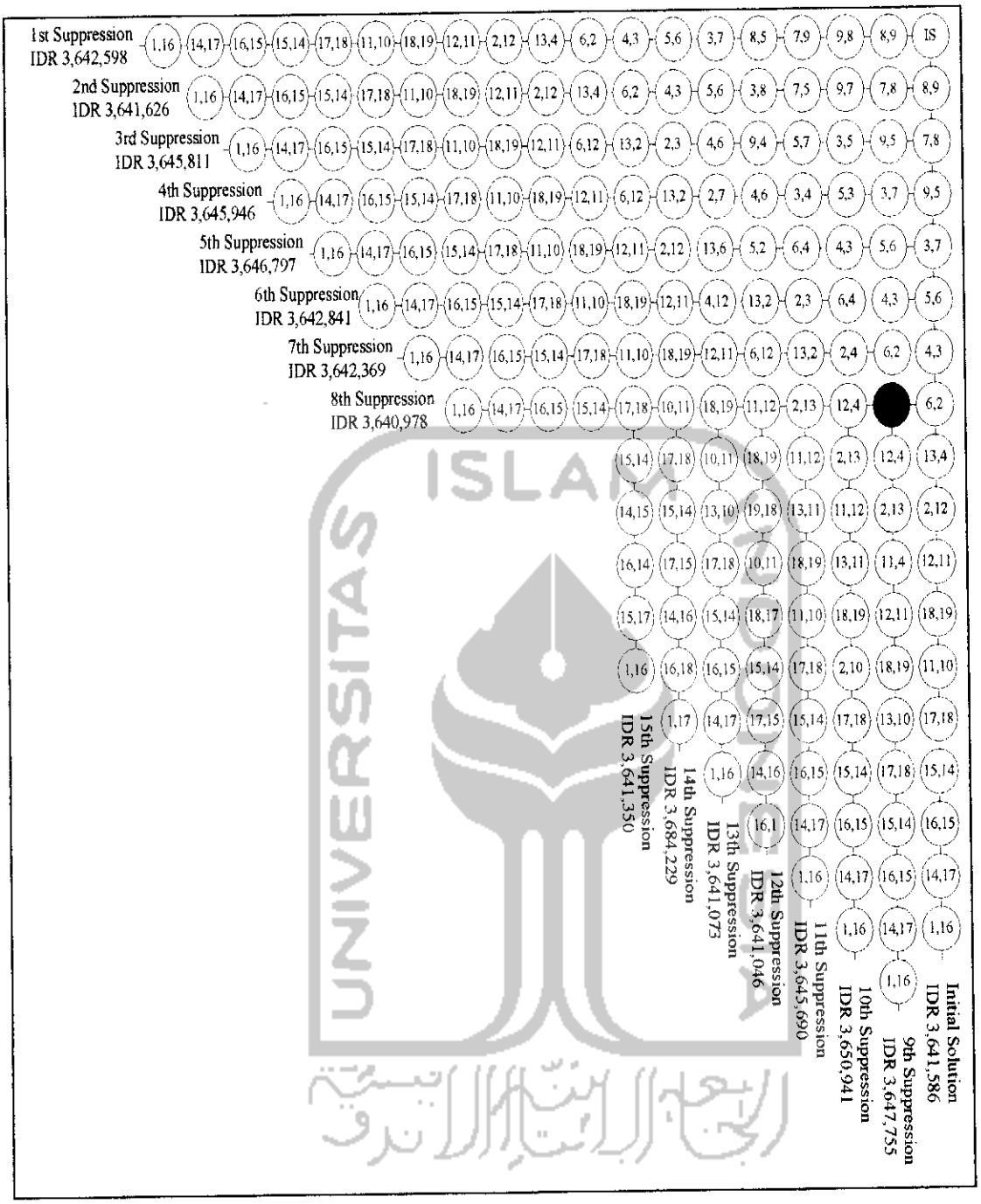

Figure 4.20 Fifteenth Suppression's Tree Diagram

Q. Sixteenth Suppression

The current best solution still eight suppression and the fifteenth suppression pair is returned to its value in the current saving matrix. The sixteenth suppression pair is saving $s_{16,15}$ and set $s_{16,15} = 0$ in the current saving matrix.

Table 4.21 Iteration of Sixteenth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	yes	13	1	5	37	0,12,4,3,7,8,9,5,6,2,13,0	
16	11.12	9899	yes	11	3	2	37	0,11,12,4,3,7,8,9,5,6,2,13,0	

Table 4.21 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	13.11	9559	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	10.11	7015	yes	10	2	0	32	0,10,11,12,4,3,7,8,9,5,6,2,13,0	
20	13.10	7008	no			0	32		
21	13.14	6826	no			0	32		
22	14.10	5483	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
25	13.15	4202	no			0	29		
26	16.15	3131	Temporary suppress						
27	14.16	3121	yes	16	1	0	28		0,17,18,19,0;0,15,14,16,0
28	13.17	2849	no			0	28		
29	16.17	2814	yes			0	28		0,15,14,16,17,18,19,0;
30	1.10	2190	no			0	28		
31	13.01	2178	no			0	28		
32	1.15	2146	yes	1	10	0	18		0,1,15,14,16,17,18,19,0;
33	19.10	18	no			0	18		
34	19.01	17	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,11}$, $s_{13,10}$, $s_{19,1}$

Violating step 4.4.2 = $s_{13,14}$, $s_{14,10}$, $s_{13,15}$, $s_{13,17}$, $s_{1,10}$, $s_{13,1}$, $s_{19,10}$,

Total cost = (16,875 (1093$\alpha_{0,1,1}$ + 1195$\alpha_{1,15,1}$ + 1309$\alpha_{15,14,1}$ + 2058$\alpha_{14,16,1}$ + 1613$\alpha_{16,17,1}$ + 3913 $\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (3520$\alpha_{0,10,2}$ + 1502$\alpha_{10,11,2}$ + 309$\alpha_{11,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$ + 5432$\alpha_{13,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1093 . 1 + 1195 . 1 + 1309 . 1 + 2058 . 1 + 1613 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (3520 . 1 + 1502 . 1 + 309 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 954 . 1 + 5432 . 1) + 1.390.000. 1) = IDR 3.628.187 per month

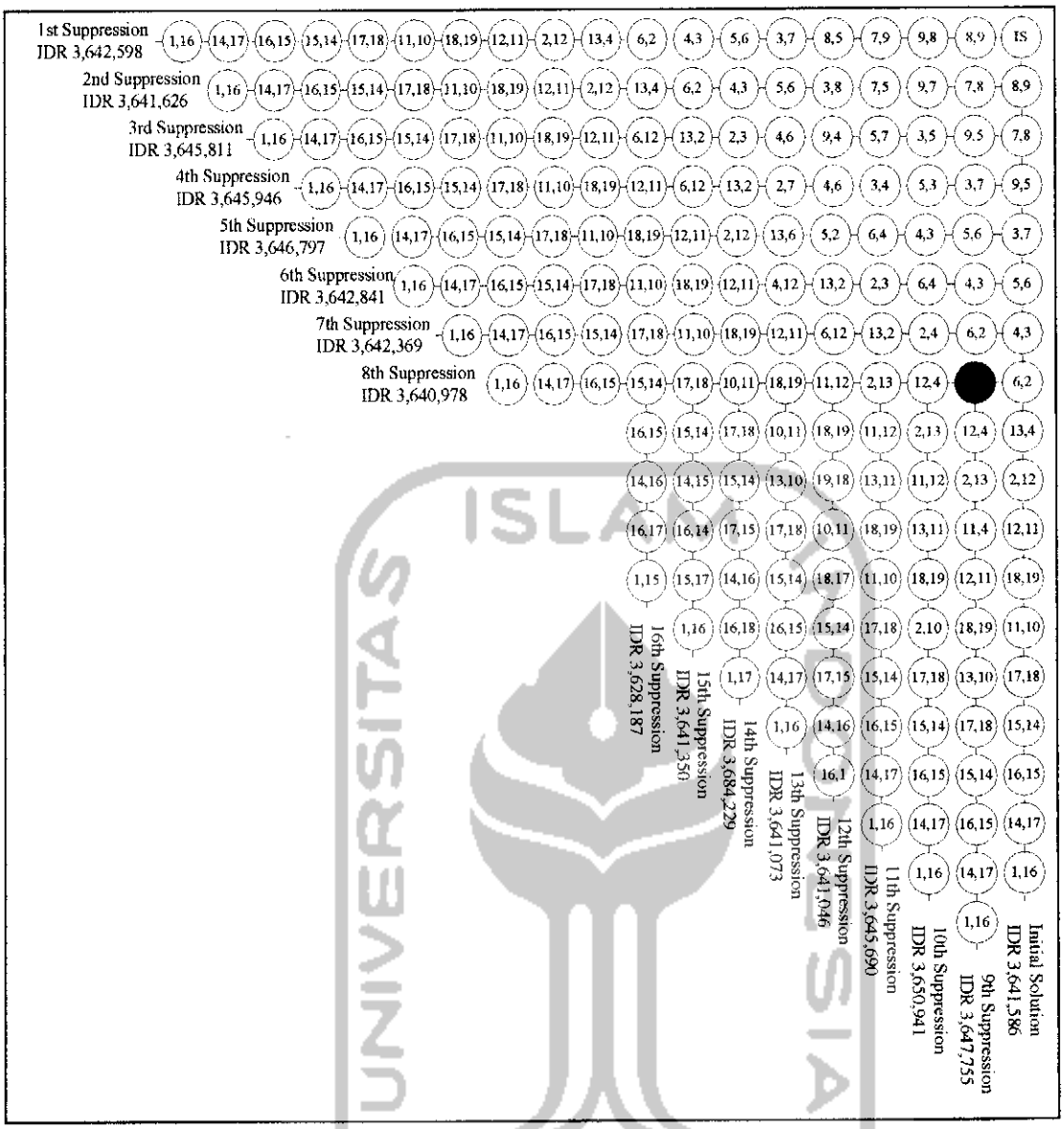

Figure 4.21 Sixteenth Suppression's Tree Diagram

R. Seventeenth Suppression

The current best solution is change to the result in sixteenth suppression and then the sixteenth suppression pair is removed permanently from the current saving matrix $s_{13,4}$ and set $s_{13,4} = 0$ in the current saving matrix and remains zero in all next iterations. The seventeenth suppression pair is saving $s_{14,16}$ and set $s_{14,16} = 0$ in the current saving matrix.

Table 4.22 Iteration of Seventeenth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	yes	13	1	5	37	0,12,4,3,7,8,9,5,6,2,13,0	
16	11.12	9899	yes	11	3	2	37	0,11,12,4,3,7,8,9,5,6,2,13,0	

Table 4.22 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	13.11	9559	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	10.11	7015	yes	10	2	0	32	0,10,11,12,4,3,7,8,9,5,6,2,13,0	
20	13.10	7008	no			0	32		
21	13.14	6826	no			0	32		
22	14.10	5483	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
25	16.15	3131	Permanently suppress						
26	14.16	3121	Temporary suppress						
27	14.17	3101	yes			0	29		0,15,14,17,18,19,0;
28	13.16	2868	no			0	29		
29	1.10	2190	no			0	29		
30	13.01	2178	no			0	29		
31	1.15	2146	yes	1	10	0	19		0,1,15,14,17,18,19,0;
32	16.10	1550	no			0	19		
33	16.01	1106	yes	16	1	0	18		0,16,1,15,14,17,18,19,0;
34	19.16	409	no			0	18		
35	19.10	18	no			0	18		

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,11}$, $s_{13,10}$, $s_{19,16}$,

Violating step 4.4.2 = $s_{13,14}$, $s_{14,10}$, $s_{13,16}$, $s_{1,10}$, $s_{13,1}$, $s_{16,10}$, $s_{19,10}$

Total cost = (16,875 (1646$\alpha_{0,16,1}$ + 1643$\alpha_{16,1,1}$ + 1195$\alpha_{1,15,1}$ + 1309$\alpha_{15,14,1}$ + 3203$\alpha_{14,17,1}$ + 3913 $\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 7404$\alpha_{19,0,1}$)+ 1.470.000 β_{11})+ (13,5 (3520$\alpha_{0,10,2}$ + 1502$\alpha_{10,11,2}$ + 309$\alpha_{11,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$ + 5432$\alpha_{13,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (1646 . 1 + 1643 . 1 + 1195 . 1 + 1309 . 1 + 3203 . 1 + 3913 . 1 + 6170 . 1 + 7404 . 1)+ 1.470.000. 1)+ (13,5 (3520 . 1 + 1502 . 1 + 309 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 954 . 1 + 5432 . 1) + 1.390.000. 1) = IDR 3.657.347 per month

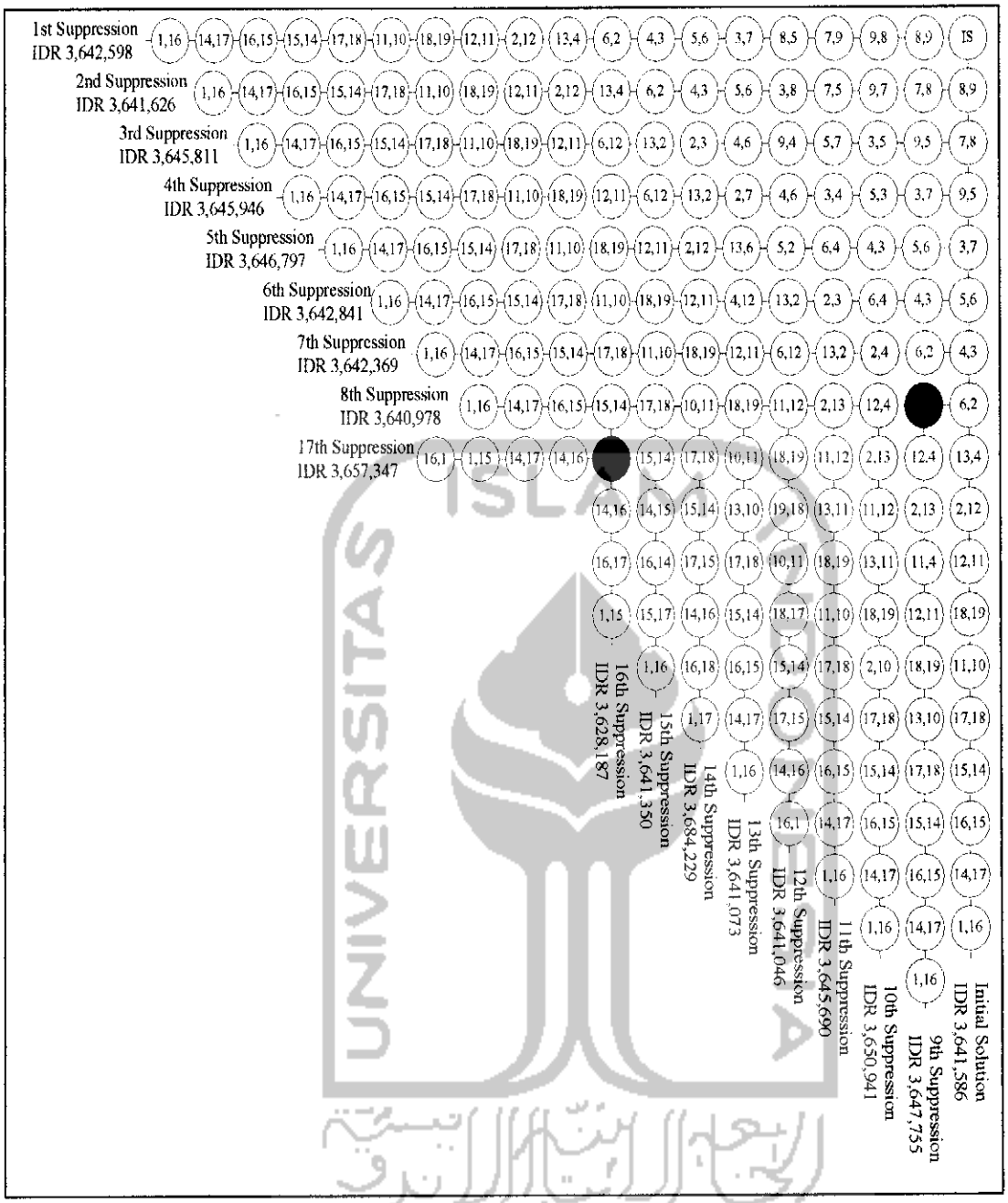

Figure 4.22 Seventeenth Suppression's Tree Diagram

S. Eighteenth Suppression

The current best solution still sixteenth suppression and the seventeenth suppression pair is returned to its value in the current saving matrix. The eighteenth suppression pair is saving $s_{16,17}$ and set $s_{16,17} = 0$ in the current saving matrix.

Table 4.23 Iteration of Eighteenth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	yes	13	1	5	37	0,12,4,3,7,8,9,5,6,2,13,0	
16	11.12	9899	yes	11	3	2	37	0,11,12,4,3,7,8,9,5,6,2,13,0	

Table 4.23 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	13.11	9559	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	10.11	7015	yes	10	2	0	32	0,10,11,12,4,3,7,8,9,5,6,2,13,0	
20	13.10	7008	no			0	32		
21	13.14	6826	no			0	32		
22	14.10	5483	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
25	16.15	3131	Permanently suppress						
26	14.16	3121	yes	16	1	0	28		0,17,18,19,0;0,15,14,16,0
27	13.17	2849	no			0	28		
28	16.17	2814	Temporary suppress						
29	1.10	2190	no			0	28		
30	13.01	2178	no			0	28		
31	1.15	2146	yes	1	10	0	18		0,17,18,19,0;0,1,15,14,16,0
32	19.17	1608	no			0	18		
33	16.10	1550	no			0	18		
34	16.01	1106	no			0	18		
35	19.10	18	no			0	18		
36	19.01	17	yes			0	18		0,17,18,19,1,15,14,16,0

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,11}$, $s_{13,10}$, $s_{19,17}$, $s_{16,1}$,

Violating step 4.4.2 = $s_{13,14}$, $s_{14,10}$, $s_{13,17}$, $s_{1,10}$, $s_{13,1}$, $s_{16,10}$, $s_{19,10}$

Total cost = (16,875 (2771$\alpha_{0,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170$\alpha_{18,19,1}$ + 8480$\alpha_{19,1,1}$ + 1195$\alpha_{1,15,1}$ + 1309 $\alpha_{15,14,1}$ + 2058$\alpha_{14,16,1}$ + 1656$\alpha_{16,0,1}$)+ 1.470.000 β_{11})+ (13,5 (3520$\alpha_{0,10,2}$ + 1502$\alpha_{10,11,2}$ + 309$\alpha_{11,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$ + 5432$\alpha_{13,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (2771 . 1 + 3913 . 1 + 6170 . 1 + 8480 . 1 + 1195 . 1 + 1309 . 1 + 2058 . 1 + 1656 . 1)+ 1.470.000. 1)+ (13,5 (3520 . 1 + 1502 . 1 + 309 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 954 . 1 + 5432 . 1) + 1.390.000. 1) = IDR 3.675.387 per month

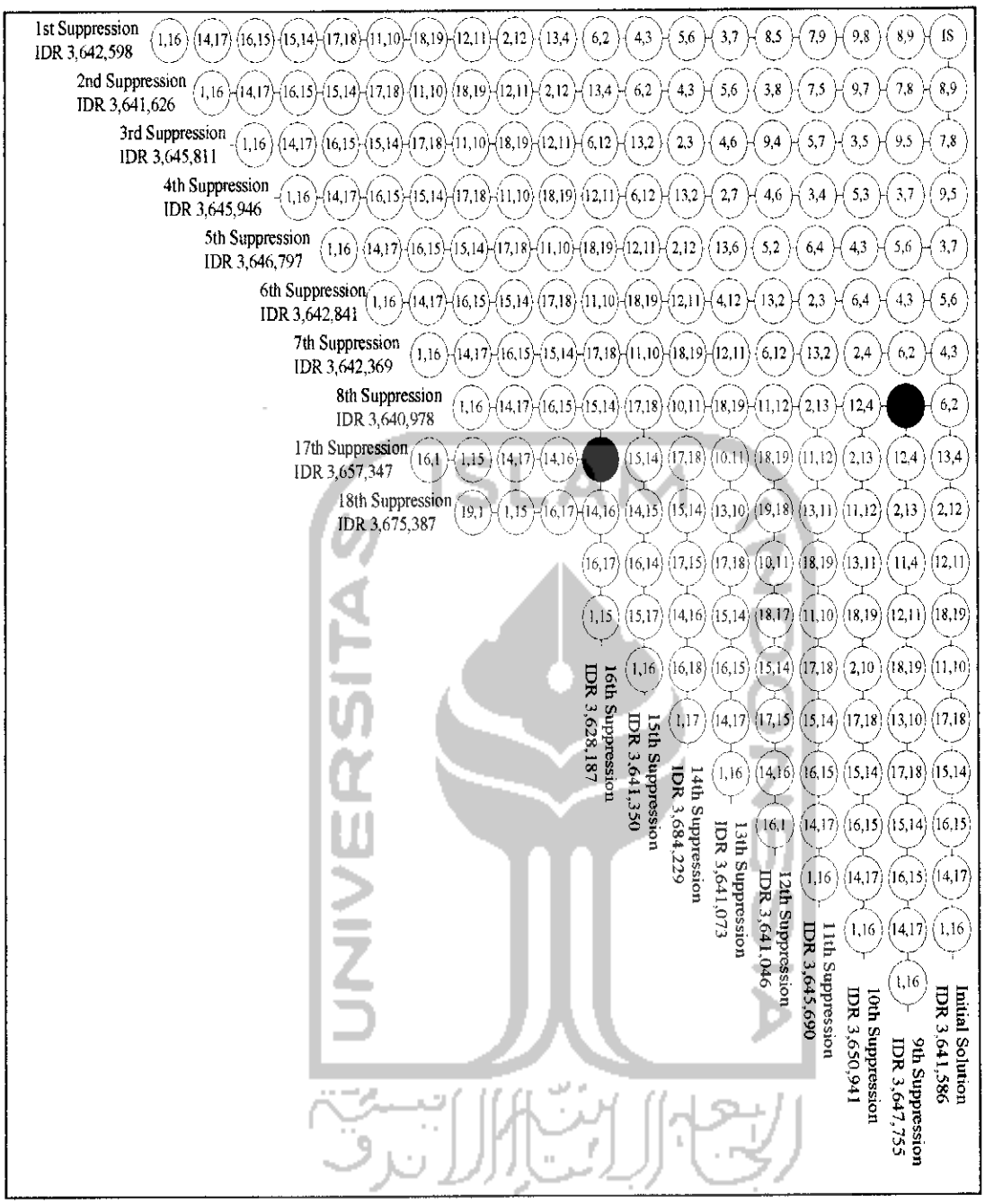

Figure 4.23 Eighteenth Suppression's Tree Diagram

T. Nineteenth Suppression

The current best solution still sixteenth suppression and the eighteenth suppression pair is returned to its value in the current saving matrix. The nineteenth suppression pair is saving $s_{1,15}$ and set $s_{1,15} = 0$ in the current saving matrix.

Table 4.24 Iteration of Nineteenth Suppression

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
1	8.09	19910	yes	8	2	25	37	0,8,9,0	
				9	1	24	37		
2	7.08	15111	yes	7	2	22	37	0,7,8,9,0	
3	9.07	15099	no			22	37		
4	9.05	12444	yes	5	1	21	37	0,7,8,9,5,0	
5	5.07	12432	no			21	37		
6	3.07	12427	yes	3	4	17	37	0,3,7,8,9,5,0	
7	5.03	12411	no			17	37		
8	5.06	12317	yes	6	2	15	37	0,3,7,8,9,5,6,0	
9	4.03	12109	yes	4	3	12	37	0,4,3,7,8,9,5,6,0	
10	6.04	12036	no			12	37		
11	6.02	11758	yes	2	5	7	37	0,4,3,7,8,9,5,6,2,0	
12	2.04	11754	no			7	37		
13	13.04	10534	Permanently suppress						
14	12.04	10387	yes	12	1	6	37	0,12,4,3,7,8,9,5,6,2,0	
15	2.13	10295	yes	13	1	5	37	0,12,4,3,7,8,9,5,6,2,13,0	
16	11.12	9899	yes	11	3	2	37	0,11,12,4,3,7,8,9,5,6,2,13,0	

Table 4.24 Continued

No.	Feasible Pair	Saving	Merge Feasibility Yes/No	xi	ci	Remain Capacity		Route	
						C2 (27)	C1 (37)	Panther (C2)	Truck (C1)
17	13.11	9559	no			2	37		
18	18.19	7601	yes	18	4	2	33		0,18,19,0
				19	1	2	32		
19	10.11	7015	yes	10	2	0	32	0,10,11,12,4,3,7,8,9,5,6,2,13,0	
20	13.10	7008	no			0	32		
21	13.14	6826	no			0	32		
22	14.10	5483	no			0	32		
23	17.18	5284	yes	17	1	0	31		0,17,18,19,0
24	15.14	4482	yes	15	1	0	30		0,17,18,19,0;0,15,14,0
				14	1	0	29		
25	16.15	3131	Permanently suppress						
26	14.16	3121	yes	16	1	0	28		0,17,18,19,0;0,15,14,16,0
27	13.17	2849	no			0	28		
28	16.17	2814	yes			0	28		0,15,14,16,17,18,19,0;
29	1.10	2190	no			0	28		
30	13.01	2178	no			0	28		
31	1.15	2146	Temporary suppress						
32	19.10	18	no			0	28		
33	19.01	17	yes	1	10	0	18		0,15,14,16,17,18,19,1,0;

The infeasible merging saving are:

Violating step 4.4.1 = $s_{9,7}$, $s_{5,7}$, $s_{5,3}$, $s_{6,4}$, $s_{2,4}$, $s_{13,11}$, $s_{13,10}$,

Violating step 4.4.2 = $s_{13,14}$, $s_{14,10}$, $s_{13,17}$, $s_{1,10}$, $s_{13,1}$, $s_{19,10}$

Total cost = (16,875 (2238$\alpha_{0,15,1}$ + 1309$\alpha_{15,14,1}$ + 2058$\alpha_{14,16,1}$ + 1613$\alpha_{16,17,1}$ + 3913$\alpha_{17,18,1}$ + 6170 $\alpha_{18,19,1}$ + 8480$\alpha_{19,1,1}$ + 1103$\alpha_{1,0,1}$)+ 1.470.000 β_{11})+ (13,5 (3520$\alpha_{0,10,2}$ + 1502$\alpha_{10,11,2}$ + 309$\alpha_{11,12,2}$ + 954$\alpha_{12,4,2}$ + 172$\alpha_{4,3,2}$ + 1347$\alpha_{3,7,2}$ + 2405$\alpha_{7,8,2}$ + 1521$\alpha_{8,9,2}$ + 5670$\alpha_{9,5,2}$ + 1090$\alpha_{5,6,2}$ + 1092$\alpha_{6,2,2}$ + 954$\alpha_{2,13,2}$ + 5432$\alpha_{13,0,2}$) + 1.390.000 β_{22})

Total cost = (16,875 (2238 . 1 + 1309 . 1 + 2058 . 1 + 1613 . 1 + 3913 . 1 + 6170 . 1 + 8480 . 1 + 1103 . 1)+ 1.470.000. 1)+ (13,5 (3520 . 1 + 1502 . 1 + 309 . 1 + 954 . 1 + 172 . 1 + 1347 . 1 + 2405 . 1 + 1521 . 1 + 5670 . 1 + 1090 . 1 + 1092 . 1 + 954 . 1 + 5432 . 1) + 1.390.000. 1) = IDR 3.664.114 per month

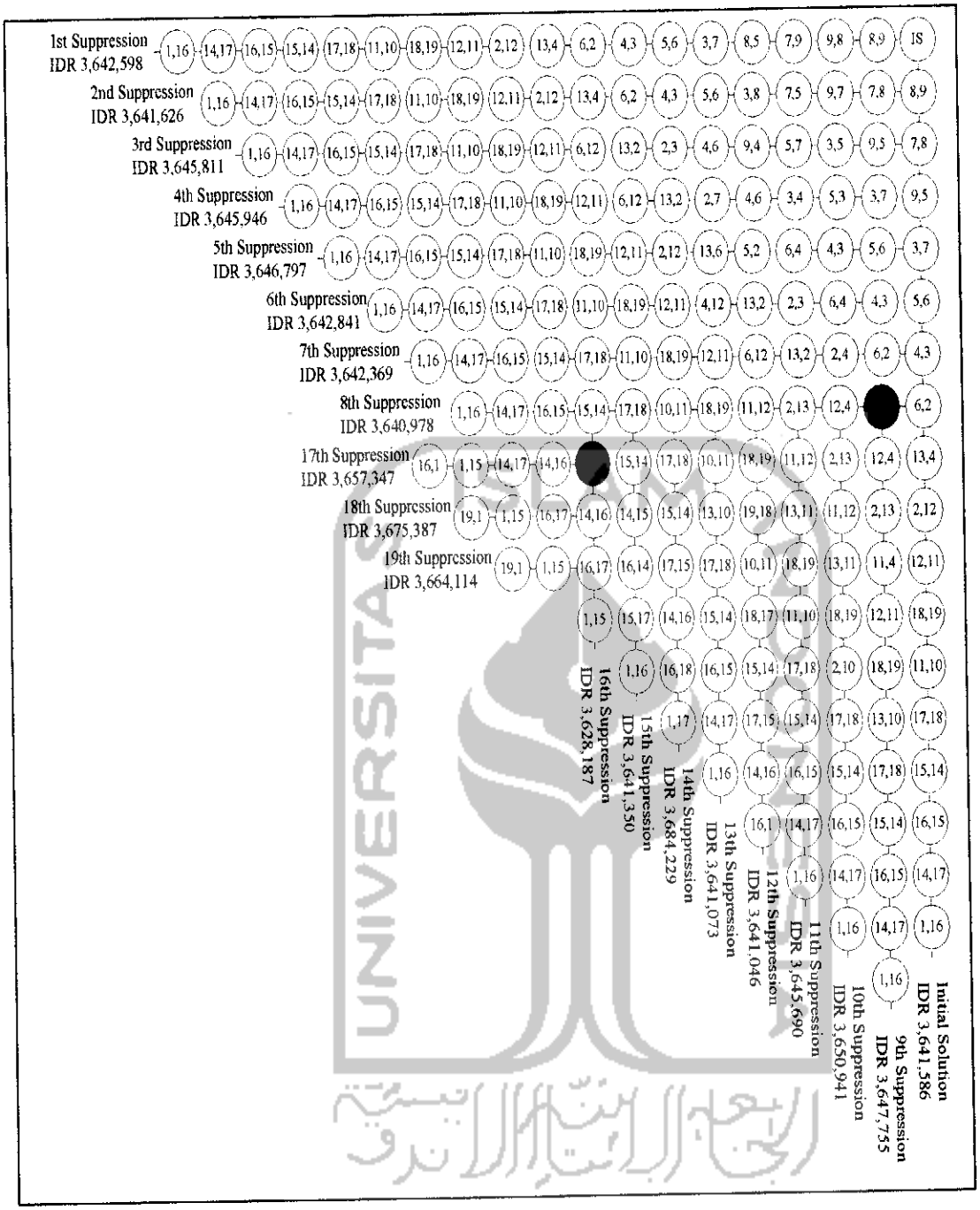

Figure 4.24 Nineteenth Suppression's Tree Diagram

4.4 Total Cost and Distance Difference

The current vehicle routes compared with the best result from Holmes and Parker algorithm to know the difference of the routes based on the total cost. The best result

of new vehicle routes from Holmes and Parker algorithm is in the sixteenth suppression. The total cost of sixteenth suppression is IDR 3.628.187 per month.

The difference of Total cost = IDR 3.701.590 per month - IDR 3.628.187 per month

= IDR 73.403

The graph of sixteenth suppression is in the appendix.

The difference of distance travelled between current routes and new routes for every vehicle is below.

The difference of distance travelled by Truck

= Distance travelled by truck in current route – distance travelled by truck in new vehicle route

= 26.092 meters per day - 24.755 meters per day

= 1.337 meters

The difference of distance travelled by Panther

= Distance travelled by panther in current route – distance travelled by panther in new vehicle route

= 29.725 meters per day - 25.959 meters per day

= 3.766 meters