Table 2: Heuristic value

	N_1	N_2	N_3	N_4	N_5
N_1	0	0.584	0.746	1.15	1.62
N_2	0.584	0	0.609	0.680	0.564
N_3	0.746	0.609	0	2.12	1.22
N_4	1.15	0.680	2.12	0	2.92
N_5	1.62	0.564	1.22	2.92	0

Since there are five nodes (five collection points), choose size of colony as 5, each ant will start its tour from different collection point (node). Each edge in the problem is given an initial pheromone value

$$\tau = \frac{1}{n}$$

Where, n = size of colony.

In our problem size of colony is 5. Therefore initial pheromone value is 0.2

Table 3: Initial Pheromone Value

	N_1	N_2	N_3	N_4	N_5
N_1	0	0.2	0.2	0.2	0.2
N_2	0.2	0	0.2	0.2	0.2
N_3	0.2	0.2	0	0.2	0.2
N_4	0.2	0.2	0.2	0	0.2
N_5	0.2	0.2	0.2	0.2	0

5.1 First Iteration

As the first ant starts its tour from first collection point n_1, there are four neighboring collection points to be considered by the first ant.

The probability of choosing any edge leading to another collection point is calculated above. These probabilities are tabulated below.

N_2	N_3	N_4	N_5
0.0704	0.114	0.273	0.541

Using proportional selection (Roulette Wheel), the ant chooses next collection point (node) say n_5.

The ant will update its memory and put node n_1 and n_5 in its tabu list.

When arrives at n_5, there are three nodes left to visit. The probability of choosing these nodes is tabulated below.

N2	N3	N4
0.030	0.14	0.82

Using proportional selection (Roulette Wheel), the ant chooses next collection point (node) say n_4.

The ant will update its memory and put node n_1, n_5& n_4 in its tabu list.

The probability of choosing any edge leading to another collection point is tabulated below.

N_2	N_3
0.093	0.90

Using proportional selection (Roulette Wheel), the ant chooses next collection point (node) say n_3.

When ant arrives at node n_3, there is only one node to visit n_2.

The path that was built by ant 1 is $n_1 \to n_5 \to n_4 \to n_3 \to n_2$

The length of this path = $n_1n_5 + n_5n_4 + n_4n_3 + n_3n_2$
= 0.614+0.342+0.471+1.64
= 3.067 km

Similarly this procedure is applied for all remaining four ants.

The following table summarizes solution built by all ants. The last column in table below is the gain obtained by each ant. Since the longest distance between nodes is 1.77 km, the solution built by the ant must not exceed 4×1.77 = 7.08. Thus, the gain of each ant can be formulated as $\frac{7.08}{L}$ with L as the length of the path of solution.

Ant	Path	Length of the path	$\Delta\tau = \frac{7.08}{l}$
Ant 1	$n_1 \to n_5 \to n_4 \to n_3 \to n_2$	3.067	2.3
Ant 2	$n_2 \to n_4 \to n_5 \to n_1 \to n_3$	3.76	1.88
Ant 3	$n_3 \to n_4 \to n_5 \to n_1 \to n_2$	3.13	2.26
Ant 4	$n_4 \to n_5 \to n_1 \to n_2 \to n_3$	4.306	1.64
Ant 5	$n_5 \to n_4 \to n_3 \to n_2 \to n_1$	4.163	1.70

5.2 Pheromone Update

Pheromone update is done as per formula 3.

Table 4: Pheromone update after 1st iteration

	N_1	N_2	N_3	N_4	N_5
N_1	0	5.7	1.98	No update	8.18
N_2	5.7	0	5.74	0.98	No update
N_3	1.98	5.74	0	6.36	No update
N_4	No update	0.98	6.36	0	9.88
N_5	8.18	No update	No update	9.88	0

As higher the pheromone value, more probability of choosing that edge. By observing table no. 4, we get best solution as shown in figure below.