

Initially No. of ants = No. of cities.

Start at 4.  $\alpha = 0.5$   $\beta = 0.75$  ( $0 \leq 1$ )

$Q = 100$

$\rho = 0.1$

Take random values for  $\tau_{ij}$  initially.

$\tau = 0$

$$\tau_{12} = \tau_{21} = 0.54$$

$$\tau_{13} = \tau_{31} = 0.53$$

$$\tau_{14} = \tau_{41} = 0.35$$

$$\tau_{15} = \tau_{51} = 0.24$$

$$\tau_{23} = \tau_{32} = 0.53$$

$$\tau_{24} = \tau_{42} = 0.39$$

$$\tau_{25} = \tau_{52} = 0.18$$

$$\tau_{34} = \tau_{43} = 0.32$$

$$\tau_{35} = \tau_{53} = 0.90$$

$$\tau_{45} = \tau_{54} = 0.68$$

	1	2	3	4	5
1	0	65	52	69	72
2	65	0	39	28	43
3	52	39	0	72	62
4	69	28	72	0	49
5	72	43	62	49	0

~~adenine, guanine, thymine, cytosine.~~



## Next Transition Probability

P

$$P_{41} = \frac{(T_{41})^\alpha (n_{41})^\beta}{(T_{41})^\alpha (n_{41})^\beta + (T_{42})^\alpha (n_{42})^\beta + (T_{43})^\alpha (n_{43})^\beta + (T_{45})^\alpha (n_{45})^\beta}$$

$\gamma_{dij}$
$n_{41} = 0.014$
$n_{45} = 0.02$
$n_{43} = 0.014$
$n_{42} = 0.036$

$$= \frac{(0.35)^{0.5} (0.014)^{0.75}}{(0.35)^{0.5} (0.014)^{0.75} + (0.399)^{0.5} (0.036)^{0.75} + (0.326)^{0.5} (0.014)^{0.75} + (0.683)^{0.5} (0.02)^{0.75}}$$

$$= \frac{0.024}{0.143} = 0.168$$

$$P_{42} = \frac{0.053}{0.142} = 0.364 \text{ max}$$

$$P_{43} = \frac{0.023}{0.143} = 0.160$$

$$P_{45} = 0.300$$

Since  $P_{42}$  is max, move from 4 to 2.

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Current best list (4,2)

Pheromone updation ( $t=1$ )

$$\tau_{12} = \rho(\tau_{12}) + \Delta\tau_{12} = 0.054$$

$$\tau_{13} = 0.053$$

$$\tau_{14} = 0.035$$

$$\tau_{15} = 0.024$$

$$\tau_{23} = 0.05$$

$$\tau_{24} = 0.039 + \frac{100}{28} = 3.610$$

$$\tau_{25} = 0.018$$

$$\tau_{34} = 0.032$$

$$\tau_{35} = 0.09$$

$$\tau_{45} = 0.68$$

New ant is at 2

$$P_{21} = 0.196$$

$$P_{23} = 0.690 \quad - \quad \underline{\underline{\text{max}}}$$

$$P_{25} = 0.106$$

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Now ant moves to 3.

pheromone updation ( $t = 2$ )

$$\tau_{12} = 0.005$$

$$\tau_{13} = 0.005$$

$$\tau_{14} = 0.003$$

$$\tau_{15} = 0.002$$

$$\tau_{23} = \rho(0.05) + 100/39 = 2.569$$

$$\tau_{24} = (0.1)(3.616) = 0.361$$

$$\tau_{25} = 0.001$$

$$\tau_{34} = 0.003$$

$$\tau_{35} = 0.009$$

$$\tau_{45} = 0.006$$

from 3, find  $P_{31}, P_{35}$

$$P_{31} = 0.554 \text{ — max.}$$

$$P_{35} = 0.446.$$

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From 3, ant moves to 1.

~~U, 2, 3, 1~~

Tabu list  $[4, 2, 3, 1]$

pheromone updation  $t = 3$

$$\tau_{12} = 0.0005$$

$$\tau_{13} = (0.1)(0.0005) + 100/52 = 1.9235$$

$$\tau_{14} = 0.0003$$

$$\tau_{15} = 0.002$$

$$\tau_{23} = 0.25$$

$$\tau_{24} = 0.03$$

$$\tau_{25} = 0.0001$$

$$\tau_{34} = 0.0003$$

$$\tau_{35} = 0.0009$$

$$\tau_{45} = 0.0006.$$

From 1, Now move to 5. Since it is the only non visited city.

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Phasemone Updation,  $t = 4$ .

$$T_{12} = 0.00005$$

$$T_{13} = 0.019$$

$$T_{14} = 0.00003$$

$$T_{15} = 0.00002 + 100/72 = 1.388.$$

$$T_{23} = 0.025$$

$$T_{24} = 0.003$$

$$T_{25} = 0.00001$$

$$T_{34} = 0.00003$$

$$T_{35} = 0.00009$$

$$T_{45} = 0.00006.$$

$$\rightarrow \underline{32451}$$

$$\rightarrow \underline{42315}$$

$$\rightarrow \underline{13245}$$

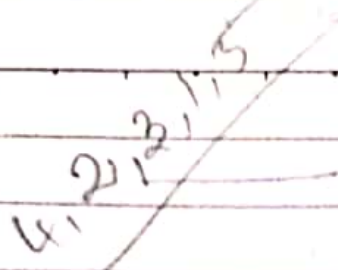
$$\rightarrow \underline{24531}$$

Now back to origin since all states visited

$$\text{update } T_{45} = 0.000006 * 100/49$$

$$T_{45} = 2.0408.$$




$$f(x, \varepsilon)$$
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