

Nature Inspired Computing

Assignment-2

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Vaccine Delivery Optimization

Youtube Link: <https://youtu.be/jZAVi4SoKMQ>

The objective function in both the cases(A&B), is to **minimise the sum of distances** between the nodes/cities in the path generated, i.e to minimise the total distance travelled by the vaccine delivery person.

Note that the travel routes considered here are not cycles, i.e the vaccine delivery person does not come back to his/her starting position after delivering vaccines to all the cities.

For example, suppose the path which a particle encompasses is:

Ahmedabad->Bhavnagar->Vadodara->Rajkot->Surat->Jamnagar->Junagadh->Gandhidham->Palanpur,

Then the objective function would yield the output:

distance(Ahmedabad,Bhavnagar) + **distance**(Bhavnagar,Vadodara) +
+ **distance**(Gandhidham, Palanpur).

Steps to incorporate restrictions.

- Initially, when random paths are generated for each of the particles, it is checked that:
 - (1). After every 'red' and 'yellow' city, there exists a 'white' city anywhere before a 'green' city occurs. **(using red_flag variable in code)**

- (2). Also it is checked that after every 'red' city there exists a 'white' city anywhere before a 'yellow' city occurs. (**using yellow_flag variable in code**)

If these two conditions are not satisfied, then another path is generated for the initialisation of the current particle. This is repeated until a satisfying path is **initialised** for each of the particles.

- Similarly, after performing **swap sequences** on the paths of each of the particles, the new-paths are again checked to see if it satisfies conditions (1) and (2).
 - If not, then another swap sequence is generated and performed, until it satisfies these restrictions.

Assumptions made for Case-B

The city of Ahmedabad (Node-0 in code), is allowed to be visited twice in this case. This is decided based on the fact that the sum of distances of all incoming routes to this city is lower, i.e there exists a path from city 'A' to city 'B' through Ahmedabad shorter than all other paths from city 'A' to city 'B' through any other city other than Ahmedabad.

Also, the colour status of Ahmedabad is 'white' and therefore much **safer** than 'red' or 'yellow' coloured cities. Allowing to visit a white colour city more than once would avoid the need to visit more covid prone 'red' and 'yellow' cities more than once if the need arises.

This way, the traveller is safer even though he/she has to travel a few extra miles. (7 miles here according to the results compared to case-A).

Results (Best path and cost)

CASE-A:

Best Path:

Gandhidham->Jamnagar->Rajkot->Junagadh->Bhavnagar->Palanpur->Ahmedabad->Vadodara->Surat.

Cost = 1355

CASE-B:

Best Path:

Gandhidham->Jamnagar->Rajkot->Junagadh->Bhavnagar->Ahmedabad->Palanpur->Ahmedabad->Vadodra->Surat

Cost = 1362