Reliable FLP.

Hierarchy FLP.

In early 1980s Daskin introduced the maximum expected coverage location problem (MEXCLP) that addressed the server congestion with a probabilistic optimization model. His approach attempted to maximize expected coverage given that the servers are busy and unavailable with a calculable system wide probability p. ---- ***Reliability***

ReVelle and Hogan developed the maximum availability location problem (MALP) which distributed a fixed number of servers to maximize the population covered with a server available within the response-time standard with reliability. They presented two versions of MALP, one with a system wide busy probability which is somewhat similar to MEXCLP, and the other version computed the local busy fractions for servers assuming that the immediate area of interest is isolated from the rest of the region.---- ***Reliability***

The resource allocation problem (RAP) which is a simplified version of facility location/allocation problem has been solved effectively by GAs using random keys.

**Initialization**

Random initialization requires creating feasible solutions randomly. Random keycoding requires no feasibility check since the decoding algorithm guarantees feasibility. When using integercoding though M ambulances were assigned to at most M random locations (with the possibility of assigningmore than one ambulance in one location) to guarantee feasibility.

Marginal coverage heuristic requires identifying locations that can offer the highest marginal objectivevalue. Those locations are ranked and M ambulances are assigned to at most M locations with the highestmarginal objective value. Note that, multiple ambulances can be assigned to the same location as long asthe marginal value of assigning the next is higher than assigning that ambulance somewhere else. Since thismethod can create only one such solution and not a population, after two copies of this solution the rest ofthe population members are created randomly.

*Procedure HYPERMUTATION*:

*Step 1*.

Randomly select a subset of 10% of the individuals

from the entire population.

*Step 2*.

FOR EACH individual *X* selected in Step 1 DO

Let *H* be the set of facility indexes that are not

currently present in the genotype of individual *X*

FOR EACH facility index “*i”* included in set *H* DO

*BEST* = *X*

FOR EACH facility index “*j”* that is currently

present in the genotype of the individual *X* DO

Let *Y* be a new individual with the set of

facilities given by: (*X* – {*j*}) ∪ {*i*}

Calculate the fitness of *Y*

If fitness(*Y*) <fitness(*BEST*) then

*BEST* = *Y*

END FOR

If fitness(*BEST*) < fitness(*X*) then

*X* = *BEST*

END FOR

Insert the new *X* into the population, replacing the

old*X*

END FOR

**Calculus-based methods**-

Hill climbing approach –

Utilize the single point search to gradually approximate the maximum value of the objective function. They are therefore unable to reach the global optimum since theirsearch space is limited to local areas.

**Enumerative schemes**

Dynamic programming -

Branch and bound –

Approaches calculate the objective function of each point in finite (discretized infinite) search spaces and reach the optimal solution

**Random search algorithms**

Improve thedrawbacks of the aforementioned methods and are able to savesearch time.

GAs work very well on unconstrained optimization problems without any further engineering on itssearch operators.

**Selection -**

**Crossover-**

Operators require two parents to be probabilisticallyselected based on their fitness values, where a high fitness value yields a higher chance of being selected forthe next generation.

**Mutation** -

Completely randomoperator, which is used to randomly alter the value of the digit of a selected string

*Various Representation scheme like random-key coding, integer representation, fixed length integer representation.*

*Different crossover operator used for various representations.*

*Random and marginal coverage heuristic are used for the initial populations.*