

Optimizing The Satisfaction Of A Person On Receiving A Gift Using Genetic Algorithm

Micky

140010059

Description

- Giving a gift to a friend so that her/his satisfaction on receiving the gift would be (near) optimum. And taking into consideration that our budget for the gift is under control.
- The gift would contain things from a pool of 15 different things
- The budget constraint is Rs 2500
- Satisfaction values were given out of 1000

15 Different Options- Satisfaction, Cost, Constraints

| Count | Item Name | Cost Per Piece | Satisfaction Per Piece | Max Number | Genes Allocated |
|-------|----------------|----------------|------------------------|------------|-----------------|
| 1. | Rose | 30 | 150 | 2 | 2 |
| 2. | Orchid | 60 | 250 | 2 | 2 |
| 3. | Bouquet | 300 | 500 | 1 | 1 |
| 4. | Earrings | 50 | 175 | 2 | 2 |
| 5. | Perfumes | 450 | 375 | 1 | 1 |
| 6. | Photo-Frames | 40 | 200 | 1 | 1 |
| 7. | Handbags | 700 | 850 | 1 | 1 |
| 8. | Bangles | 60 | 300 | 2 | 2 |
| 9. | Wristbands | 35 | 200 | 1 | 1 |
| 10. | Wrist-Watch | 500 | 600 | 1 | 1 |
| 11. | Books | 250 | 250 | 1 | 1 |
| 12. | Ferrero Rocher | 25 | 300 | 6 | 3 |
| 13. | Dark Chocolate | 200 | 500 | 1 | 1 |
| 14. | Soft Toy | 350 | 650 | 1 | 1 |
| 15. | Knife | 200 | 75 | 1 | 1 |

Cost Function(Constraint)

- Total cost ≤ 2500
- $1*30 + 2*60 + 3*300 + 4*50 + 5*450 + 6*40 + 7*700 + 8*60$
 $+ 9*35 + 10*500 + 11*250 + 12*25 + 13*200 + 14*350 +$
 $15*200 < 2500$

Number Of Generations/Iterations, Population Size

- The total number of iterations is kept as parameter.
- The population size is also a parameter.

Fitness Function(Initial)

- The fitness function measures the fitness of a particular chromosome

$$F = (\text{chromosome satisfaction}) / (\text{summation of satisfactions})$$

Penalties

- If in a chromosome the number of a particular thing exceeds the prescribed maximum, multiply the fitness ratio of that chromosome by 0.79
- If the budget is greater than the twice the prescribed budget , multiply that chromosome fitness ratio by 0.5. Else multiply the fitness ratio by $(1 - (x - \text{budget}) * 0.0002)$
- If the total number of distinct things in the gift < 3 , multiply the chromosome fitness ratio by 0.84

Modified Fitness Function

$$F_{\text{new}} = (\text{New Satisfaction}) / (\text{Summation Of New Satisfactions})$$

Cross - Over

- Now the mating pool is generated using the concept of a pie chart, more the fitness ratio, more is the sector area. The roulette wheel is partitioned into the number of population size with their proportion of area proportional to their fitness ratio.
- The wheel is rotated and RANDOMLY it is touched(Analogy). The region where our finger touches is chosen as mating pool member. The wheel is rotated for the number of population size, and thus the mating pool is obtained.
- The successive members mate and one member can mate only with one member of the mating pool.
- The position for crossover is calculated using random number generator

Mutation

- The mutation probability is 0.01
- The iteration number is fixed, therefore I calculated the total number of iterations that would happen and assigned the iteration number in which they would occur using random number generator function(0, size-1)

Results

- Optimized Solution:-

```
Roses: 2
Orchids: 1
Bouquet: 1
Earrings: 3
Perfumes: 1
Photo-Frames: 1
Handbags: 1
Bangles: 3
Wristbands: 1
Wrist-Watch: 0
Books: 1
Ferrero Rocher: 3
Dark Chocolate: 1
Soft Toy: 0
Knife: 0
Cost: 2470
Satisfaction: 0.027
```

- No of iterations = 5000
- Population Size = 50

Results(Doubling The Iteration Number)

- Optimized Solution:-

```
Roses: 1
Orchids: 3
Bouquet: 1
Earrings: 1
Perfumes: 0
Photo-Frames: 1
Handbags: 0
Bangles: 1
Wristbands: 1
Wrist-Watch: 1
Books: 1
Ferrero Rocher: 5
Dark Chocolate: 1
Soft Toy: 1
Knife: 1
Cost: 2320
Satisfaction: 0.017
```

- No of iterations = 10000
- Population Size = 50

THANK YOU