

" Knapsack Problem Using Genetic Algorithm "

Items	N1	N2	N3	N4	N5'	N6
Value	14	23	8	9	17	15'
Weight	1	3	7	4	5'	6

Knapsack = 10

1. Initialization:

Chromosome	item Selected
1 0 1 1 0 1	N1, N3, N4, N6
0 1 1 0 1 0	N2, N3, N5'
1 1 0 0 0 1	N1, N2, N6
1 0 0 1 1 0	N1, N4, N5'
0 1 1 1 0 0	N2, N3, N4
1 0 1 0 1 1	N1, N3, N5, N6
1 0 0 1 0 1	N1, N4, N6
1 1 0 0 1 0	N1, N2, N5'

pop-size = 8

1 = included

0 = not included

2. Fitness Function:

calculate total value of the selected items and penalizing solutions that exceeds the physical capacity of knapsack.

→ if weight of chromosome exceeds

knapsack capacity

total value = value - weight.

Date: _____

chromosome	value	T. weight	Fitness
101101	$14+8+9+15=54$	$1+7+5+9=19$	$19 > 10 \rightarrow 54-19=35$
011010	48	15	33
110001	52	10	52
100110	40	10	40
011100	40	14	26
101011	54	19	35
100101	37	14	23
110010	46	8	46
			1

3. Selection:

Select 2 best chromosome.

Chromosome	Fitness	Probability	
101101	35	$35/290 = 0.120$	
011010	33	0.113	
110001	52	0.179	★
100110	40	0.137	
011100	26	0.089	
101011	35	0.120	
100101	23	0.079	
110010	46	0.158	★
	290		

Select 2 best

~~011010~~ (110001)
110010

4. Crossover:

Let's one-point crossover

P1 110|001 } Ch1 110010
P2 110|010 } Ch2 110001

Date: _____

5. Mutation:-

$$\text{mut_prob} = 0.1$$

→ Generate random number between 0-1 ^{for each item.} If random number less than 0.1 accept flip for item otherwise move for next item.

Mutation child-1 :- (1 1 0 0 1 0)

Bit Position	Current Bit	random number	flip	New Bit
1	1	0.25	No	1
2	1	0.05	Yes	0
3	0	0.80	No	0
4	0	0.10	Yes	1
5	1	0.90	No	1
6	0	0.07	Yes	1

Mutation for child 1 :- 1 0 0 1 1 1

Mutation for child 2 :- 0 1 1 0 1

6. Replacement:-

Replace lowest fit chromosome with new child.

1. if there is chromosome with weight's exceed's knapsack ~~then~~ replace the lowest-fit chromosome among them with offspring.
2. if no chromosome exceed's the capacity, replace the lowest-fit

Date: _____

chromosome with offspring.

7. Termination:

Repeat step 3-6
for max-gen generations
and print the highest
value chromosome which weight
do not exceeds knapsack.