Ans. to Q No - A

(1)

	A	B	C	D	E	F	G	H
Chromosome - 1 :	0	1	0	1	0	0	0	1
Chromosome - 2 :	1	1	1	0	0	0	0	1
Chromosome - 3 :	0	1	0	1	1	0	1	1
Chromosome - 4 :	0	1	1	0	0	1	0	1

0 means i-th object not picked. And 1 means i-th object picked. Since we always have to carry 'H', it is always 1 in the chromosome.

(2)

Let, P_{sum} = total price of the objects we picked

and W_{sum} = total weight of the objects we picked

∴ An appropriate fitness function would be

fitness function, $f_i = \begin{cases} P_{sum} & \text{if } W_{sum} \leq 12 \\ 0 - P_{sum} & \text{if } W_{sum} > 12 \end{cases}$

Now,

$f(c_1) = 52$ [∵ $W_{sum} \leq 12$]

$f(c_2) = 42$ [∵ $W_{sum} \leq 12$]

$f(c_3) = -71$ [∵ $W_{sum} > 12$]

$f(c_4) = 47$ [∵ $W_{sum} \leq 12$]

∴ fittest 2 chromosomes are : c_1 and c_4

because, the higher the value of $f(c)$, the more fit the chromosome is.

(3)

Let us do single-point crossover after inden 1.

Best 2 fit

0	1	|	0	1	0	0	0	1
0	1	|	1	0	0	1	0	1

Childrens after cross-over

0	1	1	0	0	1	0	1	
0	1	0	1	0	0	0	1	

(4)

Mutation of the children

1	1	1	0	0	1	0	1	mutated inden 0
0	1	0	1	0	1	0	1	mutated inden 5

f(Child 1) = 67

f(Child 2) = -77 [weights exceed]

∴ [1 1 1 0 0 1 0 1] is more fit than previous chromosomes.

Ans. to Q No - B

(1)

Chromosome-1: AFBEGcDC

Chromosome-2: EDABFCGc

Chromosome-3: CBFADGcE

Chromosome-4: GcCFABED

The genes in the chromosomes are the names of each cities. As we have to visit all cities exactly once, there are 7 DNA's in each chromosome. And the sequence of the DNa refers to the sequence of visiting the cities.

(2)

Let P_{sum} = the sum of the path cost of visiting all the cities.

So, appropriate fitness function = $\min(P_{sum})$.

$f(C_1) = 10+8+6+11+9+8 = 52$

$f(C_2) = 17+7+15+8+5+2 = 54$

$f(C_3) = 3+8+10+7+9+11 = 48$

$f(C_4) = 2+5+10+15+6+17 = 55$

The minimum path costs are 48 and 52.

So, the fittest 2 chromosomes are: C_1 and C_3.

(3)

Fittest chromosomes

AFB | EGDC

CBF | ADGE

after single point crossover

AFB ADGE

CBF EGDC

No, they are not eligible as a solution.

Because, in the first children, we can see that A has been visited twice and in the second children, we can see that C has been visited twice.

This clearly violates our condition, which states that each city must be visited only once. So, they are not eligible solution.

(4)

No, the usual method of mutation won't work here because, it may lead to visit a city twice and not visiting a city even once. Both of these violates our condition, so, we shouldn't do the usual mutation here as it is ~~dtt~~ violating our principal.