CSE422 : Artificial Intelligence

Date : ..../..../....

Assignment 2

Genetic Algorithm

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sec: 08

Answer to the Question no: 1

(1) Here, creating initial population of 4 different chromosomes,

	A	B	C	D	E	F	G	
P_1	1	1	1	1	0	0	0	
P2	1	0	1	0	1	0	0	
P3	0	1	0	1	0	1	0	
P4	1	0	0	1	0	0	1	

(2) 4 different chromosomes,

P1 : A+B+C+D = 3+2+6+8 = 19 [weight]

P2: A+C+E = 3+6+5 = 14 [weight]

P3 : B+D+F = 2+8+1 = 11 [weight]

P4: A+D+G = 3+8+4 = 15 [weight]

(3) now, using fitness function to calculate the fitness level of all the chromosomes,

$$P1 = \frac{P1}{P1+P2+P3+P4} \times 100\%$$

$$= \frac{19}{19+14+11+15} \times 100\%$$

$$= \frac{19}{59} \times 100\%$$

$$= 32\%$$

$$P2 = \frac{P2}{P1+P2+P3+P4} \times 100\%$$

$$= \frac{14}{19+14+11+15} \times 100\% = \frac{14}{59} \times 100\%$$

$$= 24\%$$

$$p3 = \frac{p3}{p1+p2+p3+p4} \times 100\%$$

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$$= \frac{11}{19+14+11+15} \times 100\% = \frac{11}{59} \times 100\%$$

$$= 19\%$$

$$p4 = \frac{p4}{p1+p2+p3+p4} \times 100\%$$

$$= \frac{15}{19+14+11+15} \times 100\% = \frac{15}{59} \times 100\%$$

$$= 25\%$$

(4)

now after findout probabilites value, we can choose p1, p2, p3, p4 all of this ~~weight~~ is ≤ 20 [below]

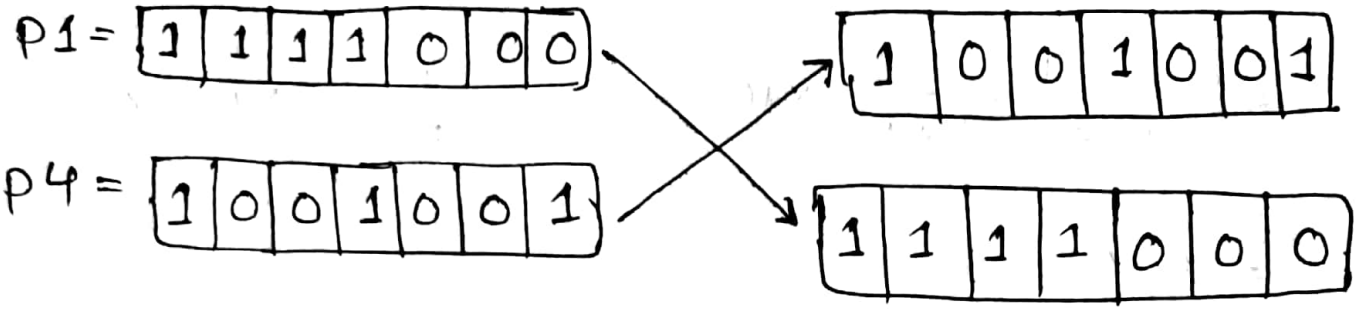
Then, if we look at the fitness level,

~~p1=24%~~, ~~p2=~~

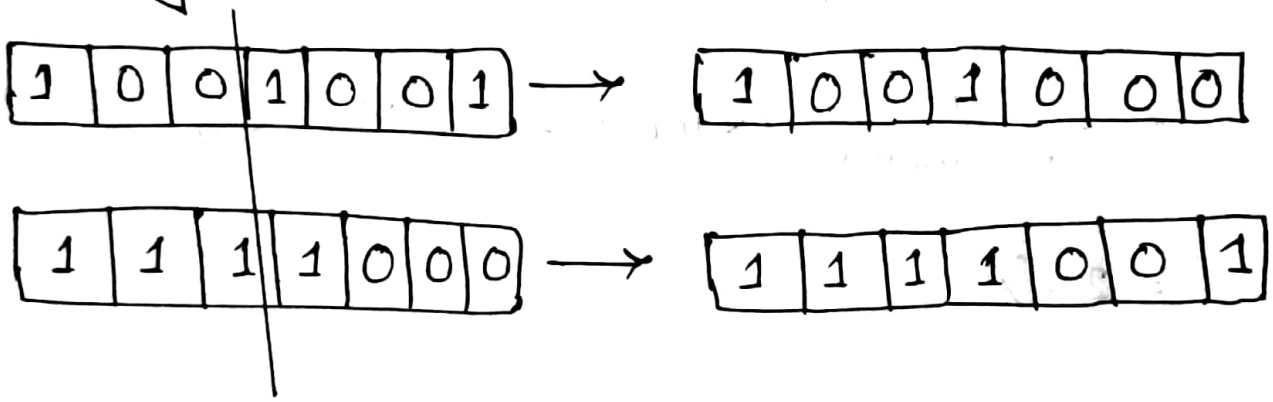
p1 = 32%, p2 = 24%, p3 = 8%, p4 = 25%

so p1 & p4 are the highest fitness level of chromosomes. thats why are choosing p1 and p4,

Selection:



⑤ performing crossover;



⑥ Performing mutation & checking fitness of the off-spring.

$1\ 0\ 0\ \underline{1}^{\rightarrow 0}\ 0\ 0\ 0 \longrightarrow 1\ 0\ 0\ 0\ 0\ 0\ 0$

$1\ 1\ \underline{1}^{\rightarrow 0}\ 1\ 0\ 0\ 1 \longrightarrow 1\ 1\ 0\ 1\ 0\ 0\ 1$

now, p1, $1000000 = 3$

p4, $1101001 = 17$

Here, P1 previous weight = 19

P1 new weight = 3

$\therefore 3 < 19$; better

again,

for, P4 previous weight = 15

P4 new weight = 17

$\therefore 17 > 15$; not better

now here, we got optimal solution for P1, but P4 solution is not optimal.

Answer to the Question no : 2

① using 3 bit binary encoding scheme,

Node	3 bit code
A	000
B	001
C	010
D	011
E	100
F	101

here A is source & F is the destination,

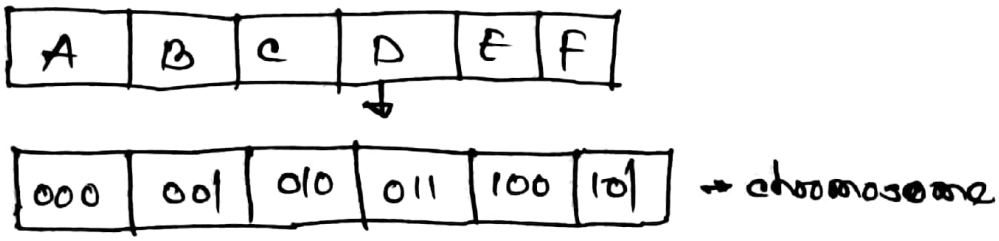
so 3 initial pathways.

1st path → A → B → C → D → E → F

2nd path → A → C → B → D → E → F

3rd path → A → B → D → E → C → F

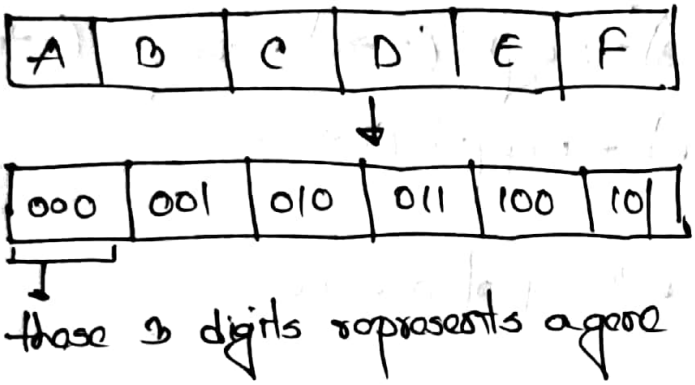
now,



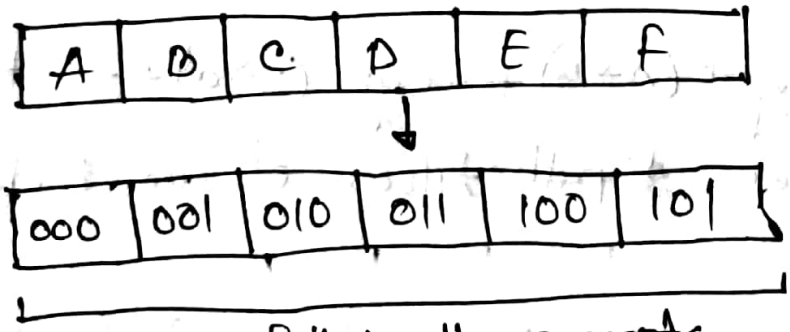
These are three distinctive chromosomes of a starting of population. Every time we run this algorithm, a diverse starting population made and so various chromosomes.

(2) 1st path,

(1)



(11) now again taking 1st path,



③ To decide which chromosome is best to fit, utilize the weight of way as a walkway work. The lower the weight of the path is way better,

as we know, fitness function,

= sum of weights of paths taken

= weight (A→B) + weight (B→C) + weight (C→D) + weight (D→E) + weight (E→F).

lower fitness function gives better performance.

④ from ③ we get,

fitness function equation, such as,

fitness function = weight (A→B) + weight (B→C) + --- + weight (E→F)

now we will calculate ~~each~~ ~~3 paths~~ fitness of our 3 chromosomes,

1st,

A	B	C	D	E	F

= (A→B) + (B→C) + (C→D) + (D→E) + (E→F)

= 2 + 3 + 3 + 1 + 4

= 13.

2nd,

Date

| A | C | B | D | E | F |

$= (A \to C) + (C \to B) + (B \to D) + (D \to E) + (E \to F)$

$= 4 + 3 + 5 + 1 + 4$

$= 17$

3rd,

| A | B | D | E | C | F |

$= (A \to B) + (B \to D) + (D \to E) + (E \to C) + (C \to F)$

$= 2 + 5 + 1 + 6 + 11$

$= 25$

So, three fitness. are 9, 13, 17, 25

now we are taking two lowest distance,

so chosen 2 parents,

| A | B | C | D | E | F |

and

| A | C | B | D | E | f |

those two are fittest chromosome.

⑤ now from ④ no answer,
we got,
2 selected parents,

parent 1 : A B C D E F → 000001010011100101

parent 2 : A C B D E F → 000010001011100101

now performing crossover,

parent 1 : 0000|01010011100101 ⤵ crossover at point 4
parent 2 : 0000|10001011100101

now, we got,

offspring 1 : 0000|10001011100101

offspring 2 : 0000|01010011100101

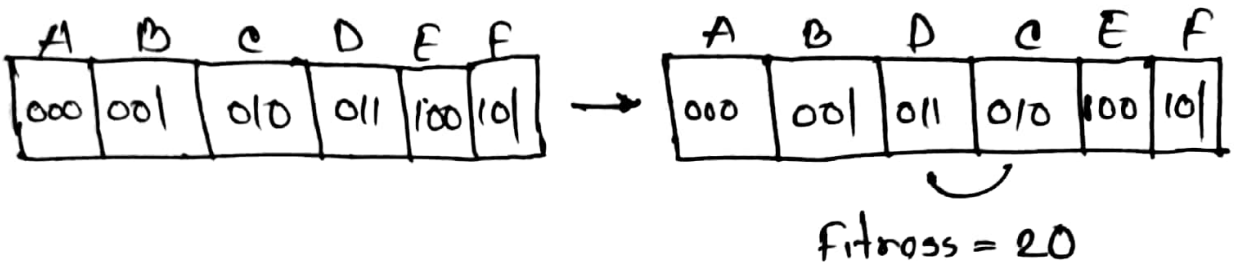
offspring 1 is identical to parent 2 [ACBDEF]
offspring 2 is identical to parent 1 [ABCDEF]

So, we can say that this is not the good way to perform as parents and children are identical.

(6) Mutation.

offspring 1:

offspring 2:



here A & F are source and destination so, we can't able to mutate them. Only B, C, D, E are mutable.

Again we look at the graph A only go to B or C, so A→B, A→C mutate posible because A has lowest number of edges which is 2, E has 3, B, F has 4 & C has maximum edges 5.

here also mutations are 'identical to the child,'

(AC BDEF → ABCDEF).

also we can add this, fitness depends on the weight of the path.

So it is not the best way to perform mutation. cause not many mutations are possible as variables are quite low and only 6 ~~ver~~ nodes are there.