Assignment 2

CSE 422, sec-03

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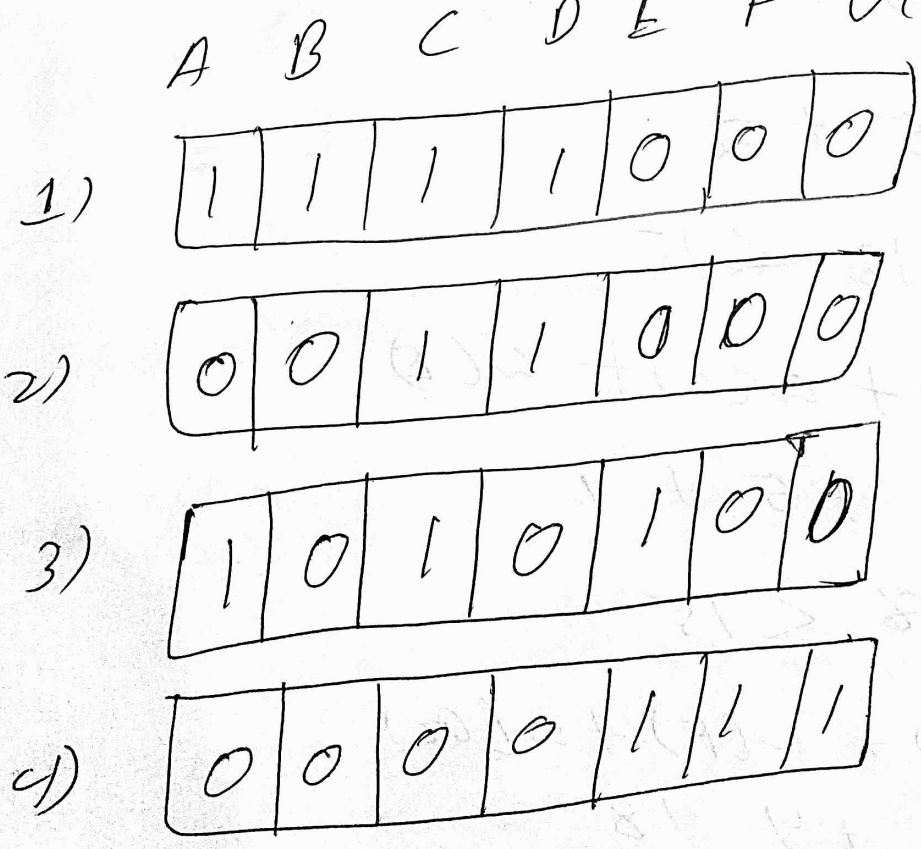
CSE

Q1) - Given,

	w	p
A	2	10
B	3	5
C	5	15
D	7	7
E	1	6
F	4	18
G	8	10

1) Creating 4 different chromosomes for initial population.



Q1) 2) Given - maximum weight is 15

calculating individual chromosomes weight

1) $w(A) + w(B) + w(C) + w(D)$

$= 2 + 3 + 5 + 7$

$= 17 \not< 15$

2) $w(C) + w(D)$

$= 5 + 7$

$= 12 < 15$

3) $w(A) + w(C) + w(E)$

$= 2 + 5 + 1$

$= 8 < 15$

4) $w(E) + w(P) + w(G)$

$= 1 + 4 + 8$

$= 13 < 15$

We will design the fitness function by calculating profits corresponding to selected items.

1) $f(P_1) = 10$ (as it crossed the maximum weight)

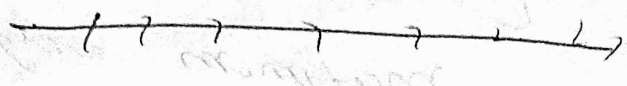
2) $f(P_2) = 15 + 7$
$= 22$

3) $f(P_3) = 10 + 15 + 6$
$= 31$

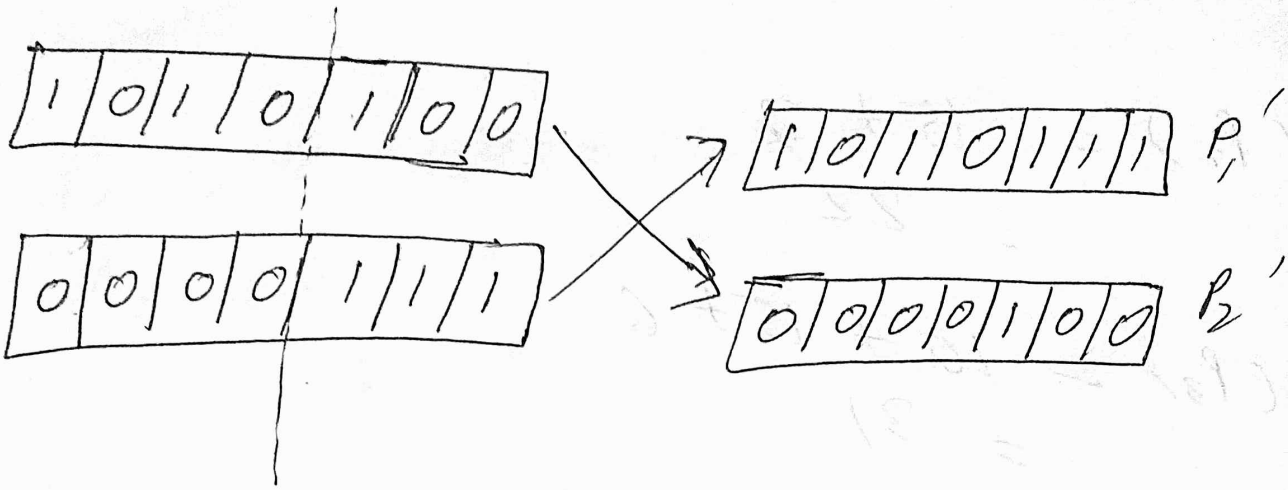
4) $f(P_4) = 6 + 18 + 10$
$= 34$

So Here, two fittest chromosomes would be 3 and 4.

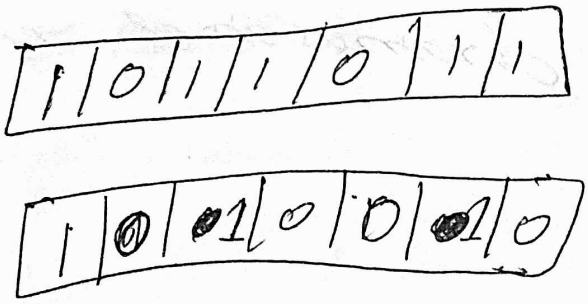
8) 3) Single point crossover



3)



4) Performing mutation



$F(P_1'')$, weights $= (2+5+2+4+8)$

$= 26 \not< 15$

$\therefore F(P_1'') = 0$

$F(P_2'')$

weights $= 2 + 3 + 4$

$= 11 < 15$

profit $= 10 + 15 + 18$

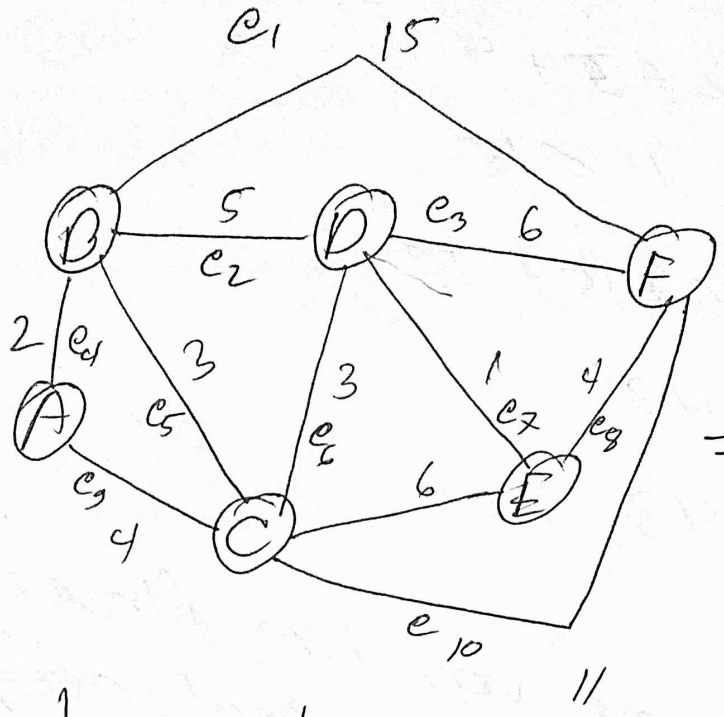
$= 43$

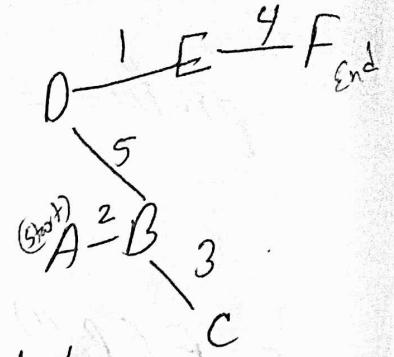
$\therefore F(P_2'') = 43$

~~So we got one very high fitness and one with 0 fitness in the final offsprings~~

We got a higher fitness of the final offspring P_2'' after mutation. while P_1'' has 0 fitness and is discarded.

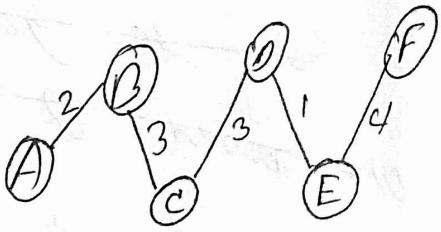
(Q2)





Solved using Kruskal's MST Alg = 15

(sorted) Weight	Src	Destn
1	D	E
2	A	B
3	B	C
4	A	C
4	E	F
5	B	D
6	C	E
6	D	F
11	C	F
15	B	F



Greedy approach.

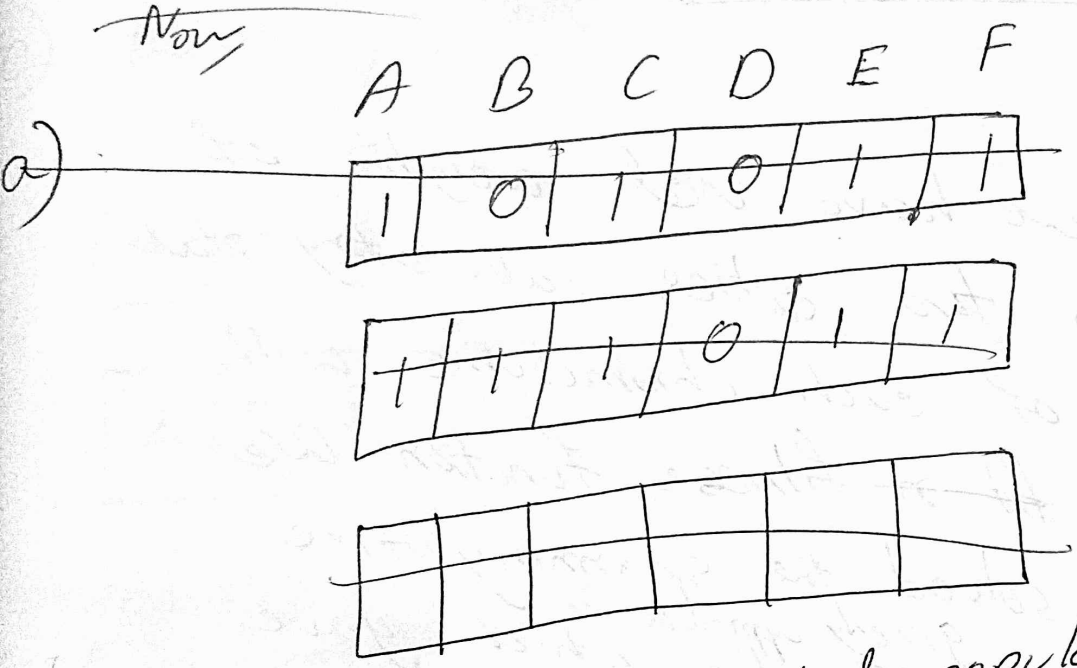
2+3+3+1+4

= 13

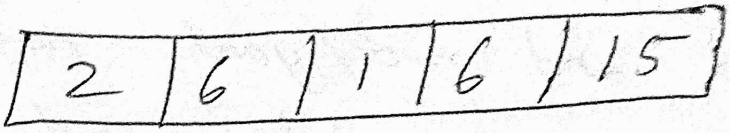
Every city visited only once ~~with~~ ~~be~~ in shortest path.

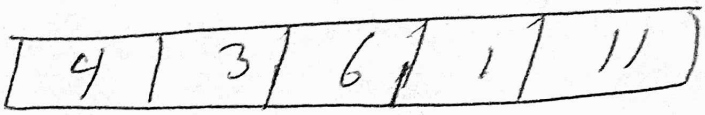
As we are free to choose any node ~~any~~ as start node and end node/goal node. Lets consider A as the start state and F as the goal state.

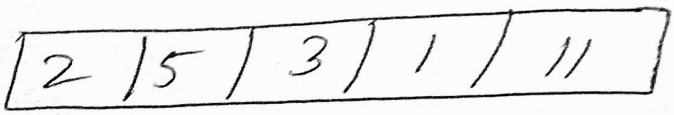
Now,



a) Generating an initial population of 3 chromosomes keeping at mind the start node and goal node, also making sure all ~~gene~~ cities are visited, for this we will be using weight of the edges connecting two cities as the genes for chromosome sets.

1) 

2) 

3) 

b) Now as we have used weights of edges between two cities, calculating total weights/costs of each chromosome will give us the ~~fit n~~ fitness function. We have already solved the spanning tree using ~~Kruskal's MST algo~~ greedy approach which gave the minimum cost of ~~15~~ 13. So the cost of the chromosomes nearer to the ~~15~~ 13 will be the best fit.

1) $F(P_1) = 2+6+1+6+15$
$= 30$

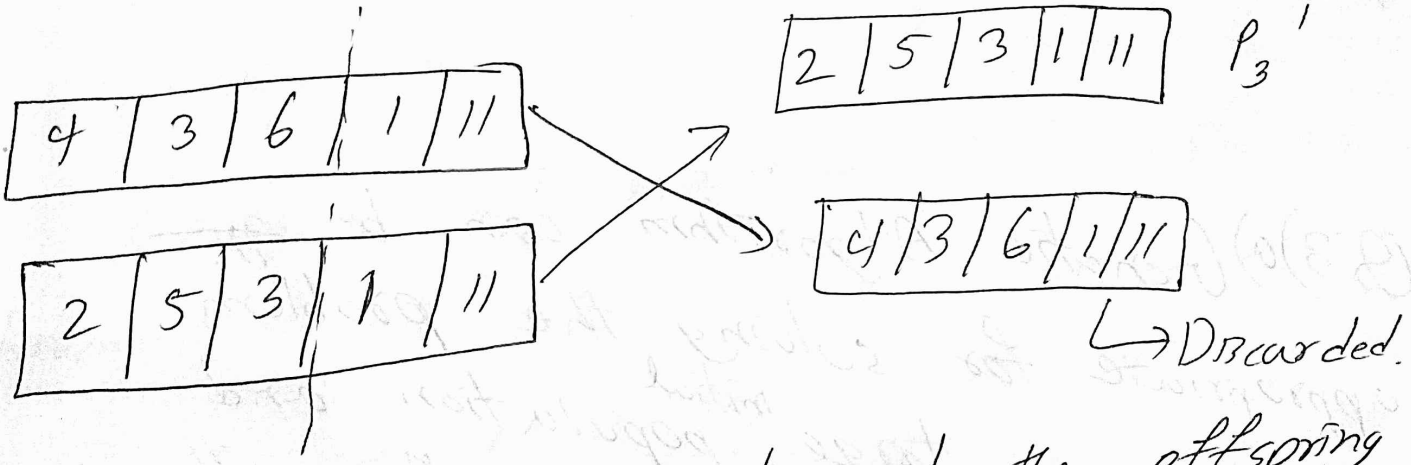
$F(P_2) = 4+3+6+1+11$
$= 25$

$F(P_3) = 2+5+3+1+11$

$= 22$

∴ Two fittest chromosomes are P_2 and P_3.

c) Performing cross-over between P_2 and P_3,



If we consider the parents and the offspring they are not eligible as an optimal solution. Because the cities are visited o more than once in the chromosome model and also it doesn't give the ~~optimal~~ minimum distance possible. So we have to perform mutation and repeat the processes until getting the optimal solution.

d)

2	5	3	1	11

from the above parent each ~~edges~~ weights used of specific edges between two cities are individual genes and the solution set is the chromosome.

(Q3) a) Genetic Algorithm can be ~~app~~ appropriate for solving the problem if have a large initial population and high mutation rate. As this will give us the solution in least number of generations.

b)

Given,

items	weight	Profit
M	3	10
N	5	5
O	2	15
P	10	7
Q	2	6
R	1	3

Creating initial population of 4 different chromosomes.

	M	N	O	P	Q	R
P_1	0	1	1	0	0	1
P_2	1	0	0	1	1	1
P_3	1	0	1	0	1	1
P_4	0	0	1	1	0	0

(d) for P_1,

weights $\rightarrow (5+2+1)$

$= 13 < 21$

$\therefore F(P_1) = (5+15+3)$

$= 23$ (profit)

for P_2,

weights $\rightarrow (3+10+2+1)$

$= 16 < 21$

$\therefore F(P_2) = (10+7+6+3)$

$= 33$

for P_3, weights $\rightarrow (3+7+2+1)$

$= 13 < 21$

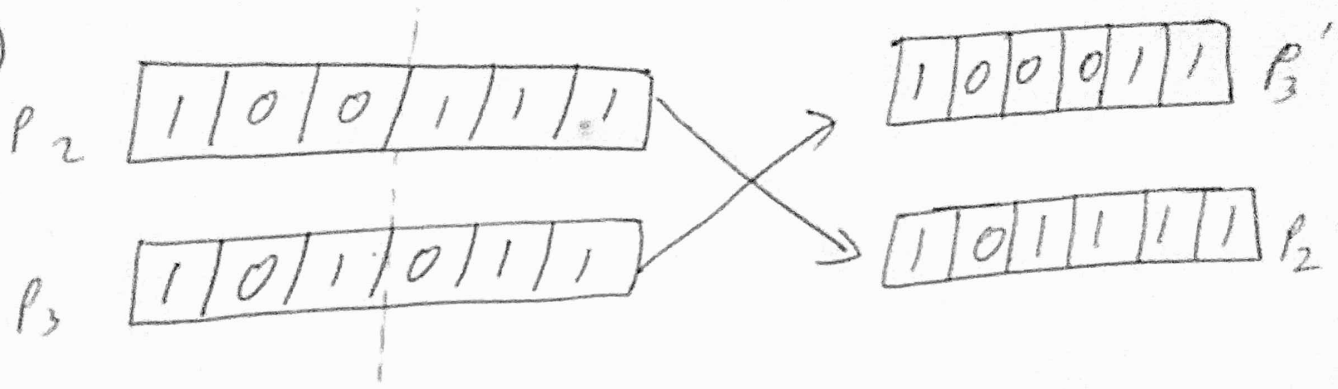
$F(P_3) = 34$

for P_4, weights $\rightarrow (7+10) = 17 < 21$

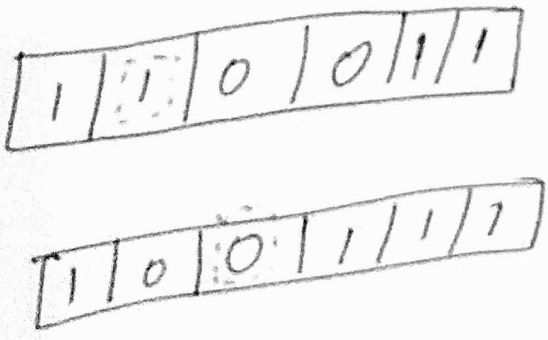
$F(P_4) = 15+7 = 22$

Here fitness function B used as to maximize the profit. We found the two fittest chromosome which are P_2 and P_3

c)



d) Performing mutation



For P_3'' weight → (3+5+2+1)
= 11 < 21

$F(P_3'') = 24$

For P_2'' weights → (3 + 10 + 2 + 1)
= 16 < 21

$F(P_2'') = 26$