Name: Muhammad Laraib Akhtar
Roll no: 21L-5294
Section: BCS-6B

Assignment 3

Question 1:

1. • Gene: Each gene is represented by a city
e.g (A, B, C, D, E, F)

• Chromosome: A sequence of Genes representing the order of cities visited.

Initial population
[A, C, B, D, E, F]
[A, B, D, C, F, E]
[A, C, F, D, C, E]

2. Fitness = if valid sequence():
return 1/total Distance
else:
return 0

* A valid sequence is feasible and visits all cities once.

3. ① [A, C, B, D, E, F] = 4+3+5+1+4 = 1/17 = 0.0588
② [A, B, D, C, F, E] = 2+5+3+11+4 = 1/25 = 0.04
[A, C, F, D, C, E] = 3+11+6+3+6 = 1/29 = 0.034

FAST
Foundation for Advancement of Science & Technology

(1), (2) selected

4. | A C B | D E F | = | A C B C F E |
   | A B D | C F E | = | A B D D E F |

This is not the best way to crossover since it results in invalid sequences and have zero fitness. The sequence have cities repeated and miss at least one of the cities.

5. | A C B C F E | = | A D B C F E |
   | A B D D E E | = | A B D D F E F |

This is not the best way to perform mutation. It can cause both repeated cities, missing cities as well as invalid sequences.

Question 2

$f(x) = x^3 - 60x^2 + 900x + 100$

Chromosome	Binary String	X	Fitness
P_1	001111	15	3475
P_2	000100	4	2804

b) 001|111
000|100

001[1]00 → 001000
000[1]11 → 000011

Chromosome	Binary String	x	Fitness
O1	001000	8	3972
O2	000011	3	2287

c) P1 + P2 = 3475 + 2804 = 6549
O1 + O2 = 3972 + 2287 = 6259

No the overall fitness has reduced.

d) 001000

Question 3

	x	y	z	d
P_1	0	0	0	0
P_2	1	0	0	0
P_3	0	0	1	0
P_4	0	1	0	1
P_5	1	0	1	1
P_6	1	1	0	1
P_7	0	1	1	1
P_8	1	1	1	1

$\vec{w} = [-2\ 2\ 3\ 2]$

$\alpha = 1$

iteration 1 $[-2\ 2\ 3\ 2]$

$P_1(0,0,0)$ $d = 0$ no change

$y = 0$

$P_2(1,0,0)$ $d = 0$ ~~no change~~ $[-2\ 2\ 3\ 2] + [-1\ -1\ 0\ 0]$

$y = 1$ $= [-3\ 1\ 3\ 2]$

$P_3(0,0,1)$ $d = 0$ no change

$y = 0$

$P_4(0\ 1\ 0)$ $d = 1$ no change

$y = 1$

$P_5(1\ 0\ 1)$ $d = 1$ no change

$y = 1$

$P_6(1\ 1\ 0)$ $d = 1$ no change

$y = 1$

$P_7(0\ 1\ 1)$ $d = 1$ no change.

$y = 1$

$P_8(1\,1\,1)$ $d=1$ $y=1$ no change

Iteration 2 $[-3\ 1\ 3\ 2]$

$P_1(0,0,0)$	$d=0$	$y=0$	no change
$P_2(1,0,0)$	$d=0$	$y=0$	no change
$P_3(0,0,1)$	$d=0$	$y=0$	no change
$P_4(0,1,0)$	$d=1$	$y=1$	no change
$P_5(1,0,1)$	$d=1$	$y=1$	no change
$P_6(1\,1\,0)$	$d=1$	$y=1$	no change
$P_7(0\,1\,1)$	$d=1$	$y=1$	no change
$P_8(1\,1\,1)$	$d=1$	$y=1$	no change

No change in weights