

	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$x_7$	$x_8$	b
$z$	5.4+0.4M	5 - M	0	-0.6-0.1M	0	M	0.6 + 1.1M	0	0.6 - 0.9M
$r_1$	0.4	0	1	-0.1	0	0	0.1	0	0.1
$r_2$	-1.8	2	0	0.7	1	0	-0.7	0	4.3
$r_3$	-0.4	1	0	0.1	0	-1	-0.1	1	0.9

	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$x_7$	$x_8$	b
$z$	7.4	0	0	-1.1	0	5	0.1 + 1.M	-5+M	-3.9
$r_1$	0.4	0	1	-0.1	0	0	0.1	0	0.1
$r_2$	-1	0	0	0.5	1	2	-0.5	-2	2.5
$r_3$	-0.4	1	0	0.1	0	-1	-0.1	1	0.9

$x_4$  as the pivot variable, constraint would be  $r_2$ .

	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$	$x_7$	$x_8$	b
$z$	5.2	0	0	0	2.2	9.4	M	-9.4 + M	1.6
$r_1$	0.2	0	1	0	0.2	0.4	0	-0.4	0.6
$r_2$	-2	0	0	1	2	4	-1	-4	5
$r_3$	-0.2	1	0	0	-0.2	-1.4	0	1.4	0.4

Therefore the basic variables are  $x_2$  and  $x_3$ , corresponding value of 0.4&0.6

## Problem 2

Program from scratch a LP Solver, the program code and output is in following

---

```

Big M Mode Initiated
[[ 2005.4 -4995.      0.    -500.6      0.    5000.    5500.6      0.    -4499.4]
 [      0.4      0.      1.     -0.1      0.      0.      0.1      0.      0.1]
 [     -1.8      2.      0.      0.7      1.      0.     -0.7      0.      4.3]
 [     -0.4      1.      0.      0.1      0.     -1.     -0.1      1.      0.9]]
[[ 7.4      0.      0.     -1.1      0.      5.    5001.1  4995.     -3.9]
 [ 0.4      0.      1.     -0.1      0.      0.      0.1      0.      0.1]
 [-1.      0.      0.      0.5      1.      2.     -0.5     -2.      2.5]
 [-0.4      1.      0.      0.1      0.     -1.     -0.1      1.      0.9]]
[[ 5.2      0.      0.      0.      2.2      9.4  5000.    4990.6      1.6]
 [ 0.2      0.      1.      0.      0.2      0.4      0.     -0.4      0.6]
 [-2.      0.      0.      1.      2.      4.     -1.     -4.      5. ]
 [-0.2      1.      0.      0.     -0.2     -1.4      0.      1.4      0.4]]
Completed in 3 iterations
[0, 0.4, 0.6]

```

---

```

import numpy as np
from scipy.optimize import linprog

```