

### 1.1.2

```
[4] # Insira seu código aqui
```

```
print(mu.shape)
print(mu)

(12, 1)
[[3.87113462e+05]
 [3.15384615e+00]
 [1.75000000e+00]
 [1.72557692e+03]
 [7.68476923e+03]
 [1.36538462e+00]
 [3.53846154e+00]
 [7.19230769e+00]
 [1.47557692e+03]
 [1.95815385e+03]
 [1.71030769e+03]
 [7.19411538e+03]]
```

### 1.1.3

```
[5] # Insira seu código aqui
```

```
print(X_mc.shape)
print(X_mc)

(12, 26)
[[-1.65213462e+05  1.50886538e+05 -2.07113462e+05  2.16886538e+05
  1.22886538e+05 -1.29613462e+05 -9.52634615e+04 -1.57613462e+05
 -6.41134615e+04  2.75386538e+05  8.08865385e+04 -7.71134615e+04
  1.28865385e+04  1.42886538e+05  2.62886538e+05  7.88653846e+03
  9.78865385e+04 -1.98113462e+05 -1.57113462e+05 -2.11346154e+03
 -1.02113462e+05 -1.34413462e+05 -5.81134615e+04 -1.54113462e+05
  2.79886538e+05  5.08865385e+04]
 [-1.53846154e-01 -1.53846154e-01 -1.15384615e+00  8.46153846e-01
 -1.53846154e-01 -1.53846154e-01 -1.53846154e-01 -1.53846154e-01
 -1.53846154e-01 -1.53846154e-01 -1.15384615e+00 -1.53846154e-01
 -1.53846154e-01  1.84615385e+00  8.46153846e-01 -1.53846154e-01
  8.46153846e-01 -1.15384615e+00 -1.53846154e-01  8.46153846e-01
  1.84615385e+00 -1.15384615e+00 -1.53846154e-01 -1.53846154e-01
 -1.53846154e-01 -1.53846154e-01]
 [-7.50000000e-01  5.00000000e-01 -7.50000000e-01  1.25000000e+00
  2.50000000e-01  5.00000000e-01 -2.50000000e-01 -7.50000000e-01
  7.50000000e-01  7.50000000e-01 -7.50000000e-01 -7.50000000e-01
  0.00000000e+00  2.50000000e-01  1.25000000e+00  2.50000000e-01
 -7.50000000e-01 -7.50000000e-01 -7.50000000e-01  0.00000000e+00
  7.50000000e-01 -2.50000000e-01  5.00000000e-01  2.50000000e-01
 -7.50000000e-01  0.00000000e+00]
 [-5.45576923e+02  8.44423077e+02 -9.55576923e+02  2.34423077e+02
 -4.55769231e+01 -1.05769231e+01 -6.65576923e+02  5.44230769e+01
  1.64423077e+02  1.83442308e+03 -5.65576923e+02 -2.95576923e+02
 -3.55576923e+02  8.44230769e+01  1.22442308e+03  1.64423077e+02
 -1.25576923e+02 -5.25576923e+02 -4.75576923e+02 -1.05576923e+02
  5.44423077e+02 -6.55576923e+02  7.24423077e+02 -1.55769231e+01
 -3.25576923e+02 -2.05576923e+02]
 [-2.03476923e+03 -4.42769231e+02  2.31523077e+03 -2.68476923e+03
  3.95230769e+02 -8.65769231e+02  2.02623077e+03 -2.14769231e+02
 -1.12476923e+03  2.11123077e+03 -1.68476923e+03  1.22162308e+04
  1.99523077e+03 -2.83476923e+03 -2.68476923e+03  6.35523077e+03
 -3.38476923e+03  2.16523077e+03  2.08923077e+03 -2.70476923e+03
 -1.38476923e+03  1.95823077e+03 -1.18476923e+03 -2.98776923e+03
 -6.10376923e+03 -1.30476923e+03]
 [-3.65384615e-01  6.34615385e-01 -3.65384615e-01 -3.65384615e-01
```

#### 1.1.4

```
[6] # Insira seu código aqui
```

```
print(var.shape)
print(var)

(12, 1)
[[2.39230175e+10]
 [6.15384615e-01]
 [4.40000000e-01]
 [3.92596654e+05]
 [1.28895891e+07]
 [1.91153846e-01]
 [4.98461538e-01]
 [4.01538462e-01]
 [2.29928654e+05]
 [8.28615385e+02]
 [1.95519262e+05]
 [6.47888755e+06]]
```

#### 1.1.5

```
[7] # Insira seu código aqui
```

```
print(desvio_pad)
print(Xz.shape)
print(Xz)
```

```
[[1.54670674e+05]
 [7.84464541e-01]
 [6.63324958e-01]
 [6.26575338e+02]
 [3.59020738e+03]
 [4.37211443e-01]
 [7.06018086e-01]
 [6.33670625e-01]
 [4.79508763e+02]
 [2.87856802e+01]
 [4.42175600e+02]
 [2.54536590e+03]]
(12, 26)
[[-1.06816281  0.97553424 -1.33906096  1.40224732  0.79450445 -0.83799636
 -0.61591159 -1.01902615 -0.41451595  1.78047028  0.52295976 -0.4985655
  0.08331598  0.92381144  1.69965341  0.05098923  0.6328707 -1.28087281
 -1.01579347 -0.01366427 -0.66019924 -0.86903003 -0.37572385 -0.99639742
  1.80956435  0.32899927]
 [-0.19611614 -0.19611614 -1.47087101  1.07863874 -0.19611614 -0.19611614
 -0.19611614 -0.19611614 -0.19611614 -0.19611614 -1.47087101 -0.19611614
 -0.19611614  2.35339362  1.07863874 -0.19611614  1.07863874 -1.47087101
 -0.19611614  1.07863874  2.35339362 -1.47087101 -0.19611614 -0.19611614
 -0.19611614 -0.19611614]
 [-1.13066754  0.75377836 -1.13066754  1.8844459  0.37688918  0.75377836
 -0.37688918 -1.13066754  1.13066754  1.13066754 -1.13066754 -1.13066754
  0.  0.37688918  1.8844459  0.37688918 -1.13066754 -1.13066754
 -1.13066754  0.  1.13066754 -0.37688918  0.75377836  0.37688918
 -1.13066754  0.  ]
 [-0.87072837  1.34768004 -1.52507905  0.3741339 -0.07273973 -0.01688053
 -1.06224564  0.08685799  0.26241549  2.92769754 -0.90264792 -0.47173405
 -0.56749269  0.13473731  1.95415141  0.26241549 -0.20041792 -0.83880883
 -0.75900996 -0.16849837  0.86888686 -1.04628587  1.15616277 -0.02486042
 -0.51961337 -0.3280961 ]
 [-0.56675535 -0.12332692  0.64487383 -0.74780338  0.11008578 -0.24114742
  0.56437708 -0.05982084 -0.31328809  0.5880526 -0.46926794  3.40265323
  0.55574248 -0.7895837 -0.74780338  1.77015701 -0.94277819  0.60309351
  0.58192482 -0.75337409 -0.38570731  0.54543667 -0.33000022 -0.83219962
 -1.70011606 -0.36342447]
 [-0.83571604  1.4515068 -0.83571604 -0.83571604 -0.83571604  1.4515068
 -0.83571604 -0.83571604  1.4515068 -0.83571604 -0.83571604  0.30789538
```

## 1.2.1

```
# Insira seu código aqui

print(S.shape)
print(S)

(12, 12)
[[ 25.          9.19650951  10.99630979  14.21131802 -8.46517528
   3.14123357   3.52024272  14.33454671   6.08947349 -3.83015558
   1.9875408   -6.66643432]
 [ 9.19650951  25.          12.01103304  10.5542553  -8.75307523
   8.85908575  -0.27777778   8.51103633  10.22893619 -0.73580136
   1.55322615  -7.17639496]
 [ 10.99630979  12.01103304  25.          18.54444748 -5.47717469
  12.49942838  -3.73676584  10.70588565  14.63513722  13.73449395
   7.84675092  -2.48148441]
 [ 14.21131802  10.5542553  18.54444748  25.          -3.40102073
  12.10829999  -4.38108709  15.49485798  17.69976796   7.52271588
   9.38262418  -1.51877056]
 [-8.46517528 -8.75307523 -5.47717469 -3.40102073  25.
  -1.83464665  -5.5412809  -4.77529819 -1.36216534   3.44629678
   2.22501994  21.88361837]
 [  3.14123357   8.85908575  12.49942838  12.10829999 -1.83464665
    25.          -3.6134105   7.84368247  20.61572566   7.63092487
   12.2078691   0.69946056]
 [  3.52024272 -0.27777778 -3.73676584 -4.38108709 -5.5412809
   -3.6134105   25.          -3.78268281 -3.89339423 -9.84853464
  -10.93684496 -8.11909385]
 [ 14.33454671   8.51103633  10.70588565  15.49485798 -4.77529819
    7.84368247 -3.78268281  25.          12.38146367   7.35888485]
```

## 1.2.2

```
[9] # Insira seu código aqui

print(D_vet.shape, E.shape)
print(D_vet)
print(E)

(12,) (12, 12)
[[110.23923107  66.78645737  25.82540838  24.08461839  20.3567365
  17.39570785   0.54176754   2.1061148   3.82450112  12.07932993
   6.61040151  10.14972553]
 [-0.25392486  0.29771613 -0.5757828 -0.03338108  0.12088819 -0.04267729
   0.31297636 -0.06626003 -0.11881969 -0.27339469  0.55150868 -0.04942313]
 [-0.27082817  0.2313906   0.1262835 -0.16516833 -0.01783075  0.7514786
   0.11502601  0.06036685 -0.10963411  0.05287985 -0.07843283  0.47644686]
 [-0.39509345  0.00962857  0.01140096  0.05466674 -0.46504995  0.06668118
  -0.36349781 -0.29846015  0.47205623 -0.41563648 -0.00374787 -0.05619829]
 [-0.4139718   0.02260976 -0.23906854 -0.07097244 -0.04890814 -0.01386375
   0.02527345  0.49563389 -0.21809819 -0.13844022 -0.55169198 -0.38203773]
 [ 0.11661629 -0.48154263 -0.33671047 -0.37896753  0.03658636  0.12374161
   0.43391892 -0.05776156  0.50084702  0.02381127 -0.18841448  0.04837049]
 [-0.3445626  -0.10795084  0.43637138 -0.34816954  0.20173934 -0.15075849
  -0.03301642  0.47124338  0.27805891  0.05131073  0.43388278 -0.05648108]
 [ 0.12248055  0.35054984 -0.02282575 -0.54016767 -0.26170941 -0.4927883
  -0.01263985  0.02963601 -0.07029754 -0.11540449 -0.19142474  0.45004181]
 [-0.34122187  0.0755269  -0.38104437  0.19333815  0.12688487 -0.18932551
  -0.28297108  0.00883739  0.24317604  0.64863944 -0.06568185  0.28109144]
 [-0.39574724 -0.08759492  0.20102619 -0.35662836  0.06601133 -0.09519183
   0.12756279 -0.6269171  -0.30422775  0.27387041 -0.07016108 -0.27003249]
 [-0.21821695 -0.3501441  0.10412663  0.31968326 -0.5862236  -0.18539127
   0.42559204  0.13101935 -0.21429658  0.12690905  0.14327462  0.24054415]
 [-0.25384914 -0.26612221  0.11079193  0.24648676  0.53535494 -0.23103859
   0.04179753 -0.12894412 -0.06978823 -0.4448759  -0.21412312  0.4297883 ]
 [ 0.04766861 -0.53291519 -0.28671313 -0.28185726 -0.07179983  0.12363327
  -0.53599386  0.06366483 -0.40971889 -0.06529261  0.22203072  0.13736012]]
```

### 1.2.3

```
[10] # Insira seu código aqui

indx

array([ 0,  1,  2,  3,  4,  5,  9, 11, 10,  8,  7,  6])
```

### 1.2.4

```
[11] # Insira seu código aqui

print(E.shape)
print(Eo)
print(D_vo)

(12, 12)
[[-0.25392486  0.29771613 -0.5757828 -0.03338108  0.12088819 -0.04267729
 -0.27339469 -0.04942313  0.55150868 -0.11881969 -0.06626003  0.31297636]
 [-0.27082817  0.2313906  0.1262835 -0.16516833 -0.01783075  0.7514786
  0.05287985  0.47644686 -0.07843283 -0.10963411  0.06036685  0.11502601]
 [-0.39509345  0.00962857  0.01140096  0.05466674 -0.46504995  0.06668118
 -0.41563648 -0.05619829 -0.00374787  0.47205623 -0.29846015 -0.36349781]
 [-0.4139718  0.02260976 -0.23906854 -0.07097244 -0.04890814 -0.01386375
 -0.13844022 -0.38203773 -0.55169198 -0.21809819  0.49563389  0.02527345]
 [ 0.11661629 -0.48154263 -0.33671047 -0.37896753  0.03658636  0.12374161
  0.02381127  0.04837049 -0.18841448  0.50084702 -0.05776156  0.43391892]
 [-0.3445626 -0.10795084  0.43637138 -0.34816954  0.20173934 -0.15075849
  0.05131073 -0.05648108  0.43388278  0.27805891  0.47124338 -0.03301642]
 [ 0.12248055  0.35054984 -0.02282575 -0.54016767 -0.26170941 -0.4927883
 -0.11540449  0.45004181 -0.19142474 -0.07029754  0.02963601 -0.01263985]
 [-0.34122187  0.0755269 -0.38104437  0.19333815  0.12688487 -0.18932551
  0.64863944  0.28109144 -0.06568185  0.24317604  0.00883739 -0.28297108]
 [-0.39574724 -0.08759492  0.20102619 -0.35662836  0.06601133 -0.09519183
  0.27387041 -0.27003249 -0.07016108 -0.30422775 -0.6269171  0.12756279]
 [-0.21821695 -0.3501441  0.10412663  0.31968326 -0.5862236 -0.18539127
  0.12690905  0.24054415  0.14327462 -0.21429658  0.13101935  0.42559204]
 [-0.25384914 -0.26612221  0.11079193  0.24648676  0.53535494 -0.23103859
 -0.4448759  0.4297883 -0.21412312 -0.06978823 -0.12894412  0.04179753]
 [ 0.04766861 -0.53291519 -0.28671313 -0.28185726 -0.07179983  0.12363327
 -0.06529261  0.13736012  0.22203072 -0.40971889  0.06366483 -0.53599386]]
[110.23923107  66.78645737  25.82540838  24.08461839  20.3567365
 17.39570785  12.07932993  10.14972553  6.61040151  3.82450112
 2.1061148  0.54176754]
```

### 1.2.5

```
[12] # Insira seu código aqui

print(P.shape)

(12, 12)
```



## 1.2.6

```
[13] # Insira seu código aqui
```

```
print(Y.shape)
print(Y)

(12, 26)
[[ 1.81505509e+00 -2.05358622e+00  2.93782732e+00 -5.30394971e-01
 -9.28069541e-01 -1.32992769e+00  1.55007231e+00  1.32819471e+00
 -1.98867387e+00 -2.85312893e+00  2.32927926e+00  1.63288521e+00
  9.99348762e-01 -9.42600318e-01 -4.81221360e+00 -1.09007271e+00
  2.64704516e-01  2.90258812e+00  1.99341561e+00  8.94102154e-01
 -3.59220202e+00  1.99778479e+00 -2.81640691e+00  1.14046864e+00
  5.63530126e-02  1.09519729e+00]
 [ 3.17407470e-01 -2.25557565e-01 -1.76868548e+00  2.51140902e+00
 -4.47614091e-01 -1.34981396e+00 -1.20191174e+00 -7.07978088e-01
 -1.55704877e+00 -6.18895136e-01  1.09432109e+00 -2.48767229e+00
 -6.40711890e-01  2.23086043e+00  1.03385652e+00 -3.36858500e+00
  2.20590016e+00  5.87652894e-01 -5.38041055e-01  1.79939263e+00
 -6.36022449e-01 -1.29597962e+00 -5.26562531e-01  1.70852613e+00
  3.29756668e+00  5.84186631e-01]
 [ 6.90557448e-01  1.17961231e-01  8.57967565e-01 -7.77912958e-01
 -1.15284449e+00  1.72613925e+00 -2.97457295e-01  5.90441202e-02
  1.49991908e+00 -2.65176399e+00 -6.67198176e-01 -1.28263833e+00
 -7.89001411e-01  3.76743773e-01 -7.18196864e-01 -3.62369198e-01
  5.59902101e-01  9.59451868e-02 -8.09040864e-02  4.73017280e-02
  1.39783612e+00 -1.84853109e-01  8.33052421e-01  1.78961232e+00
 -5.78022347e-01 -5.08820087e-01]
 [ 1.07645290e+00 -8.16450243e-01  1.14099677e+00 -3.10787464e-01
  1.12340604e+00  6.08911003e-01  5.88704312e-01  9.39490066e-01
  5.83156011e-01  4.30508912e-01  4.83410480e-01 -2.67037348e+00
 -4.97162911e-01 -6.93441283e-01  9.20544128e-01 -1.35582844e+00
 -7.04702794e-01 -4.03680720e-01 -4.18003410e-01  4.05095036e-01
  6.72521599e-02  9.57656817e-01 -6.00063174e-01 -1.65425079e+00
 -4.24774416e-01  1.22393450e+00]
 [ 3.32826696e-02  3.58525759e-01  1.89371696e+00 -2.08085503e+00
```

## 1.2.7

```
[14] # Insira seu código aqui
```

```
print(Y_3.shape)
print(Y_3)

(3, 26)
[[ 1.81505509 -2.05358622  2.93782732 -0.53039497 -0.92806954 -1.32992769
  1.55007231  1.32819471 -1.98867387 -2.85312893  2.32927926  1.63288521
  0.99934876 -0.94260032 -4.8122136  -1.09007271  0.26470452  2.90258812
  1.99341561  0.89410215 -3.59220202  1.99778479 -2.81640691  1.14046864
  0.05635301  1.09519729]
 [ 0.31740747 -0.22555756 -1.76868548  2.51140902 -0.44761409 -1.34981396
 -1.20191174 -0.70797809 -1.55704877 -0.61889514  1.09432109 -2.48767229
 -0.64071189  2.23086043  1.03385652 -3.368585  2.20590016  0.58765289
 -0.53804106  1.79939263 -0.63602245 -1.29597962 -0.52656253  1.70852613
  3.29756668  0.58418663]
 [ 0.69055745  0.11796123  0.85796756 -0.77791296 -1.15284449  1.72613925
 -0.2974573  0.05904412  1.49991908 -2.65176399 -0.66719818 -1.28263833
 -0.78900141  0.37674377 -0.71819686 -0.3623692  0.5599021  0.09594519
 -0.08090409  0.04730173  1.39783612 -0.18485311  0.83305242  1.78961232
 -0.57802235 -0.50882009]]
```

2.1

```
[16] # Insira seu código aqui

print(mu_x, mu_y)

1725.576923076923 387113.46153846156
```

2.2

```
[17] # Insira seu código aqui

print(b1,b0)

140.3230551849408 144975.2357356781
```

3.1

```
[20] #vector_b = np.linalg.lstsq(**Preencha os parametros desta função**, rcond=-1)[0]

print(vector_b.shape)
print(vector_b)

(12,)
[ 9.13909817e+06 -4.25983834e+04  1.90650348e+05  2.81368656e+01
 -3.82301141e+01  2.02712677e+04  1.66968897e+04  1.74711542e+05
 -1.13105428e+02 -5.26384748e+03 -2.85939556e+01  6.58660650e+01]
```

3.2

```
[21] # Insira seu código aqui

print(preco_0)
print(preco_1)
print(preco_2)

222038.59419613416
488951.4341040056
193675.48463321337
```

