a1_printed_outputs

```
Question 1
----------

Question 1(a):
[[0.5507979  0.70814782 0.29090474 0.51082761 0.89294695]
 [0.89629309 0.12558531 0.20724288 0.0514672  0.44080984]
 [0.02987621 0.45683322 0.64914405 0.27848728 0.6762549 ]
 [0.59086282 0.02398188 0.55885409 0.25925245 0.4151012 ]]

Question 1(b):
[[0.28352508]
 [0.69313792]
 [0.44045372]
 [0.15686774]]

Question 1(c):
[[0.5507979  0.70814782 0.29090474 0.51082761 0.89294695 0.89629309
  0.12558531 0.20724288 0.0514672  0.44080984]
 [0.02987621 0.45683322 0.64914405 0.27848728 0.6762549  0.59086282
  0.02398188 0.55885409 0.25925245 0.4151012 ]]

Question 1(d):
[[ 0.26727282  0.42462274  0.00737966  0.22730252  0.60942187]
 [ 0.20315517 -0.56755261 -0.48589504 -0.64167072 -0.25232807]
 [-0.41057751  0.01637951  0.20869033 -0.16196644  0.23580118]
 [ 0.43399508 -0.13288586  0.40198635  0.10238471  0.25823346]]

Question 1(e):
[0.28352508 0.69313792 0.44045372 0.15686774]

Question 1(f):
[[0.5507979  0.70814782 0.29090474 0.28352508 0.89294695]
 [0.89629309 0.12558531 0.20724288 0.69313792 0.44080984]
 [0.02987621 0.45683322 0.64914405 0.44045372 0.6762549 ]
 [0.59086282 0.02398188 0.55885409 0.15686774 0.4151012 ]]

Question 1(g):
[[ 0.57442982  0.42462274  0.00737966  0.22730252  0.60942187]
 [ 0.9003808  -0.56755261 -0.48589504 -0.64167072 -0.25232807]
 [ 1.08959777  0.01637951  0.20869033 -0.16196644  0.23580118]
 [ 0.71572183 -0.13288586  0.40198635  0.10238471  0.25823346]]

Question 1(h):
[[0.5507979  0.70814782 0.29090474 0.28352508 0.89294695]
 [0.89629309 0.12558531 0.20724288 0.69313792 0.44080984]
 [0.02987621 0.45683322 0.64914405 0.44045372 0.6762549 ]]

Question 1(i):
[[0.70814782 0.28352508]
 [0.12558531 0.69313792]
 [0.45683322 0.44045372]
 [0.02398188 0.15686774]]
```

Question 1(j):
[[-0.59638732 -0.34510242 -1.23475942 -1.26045469 -0.1132281]
 [-0.10948781 -2.07476999 -1.57386385 -0.36652628 -0.81914169]
 [-3.51069274 -0.78343689 -0.43210063 -0.81994991 -0.3911852]
 [-0.52617141 -3.73045663 -0.58186686 -1.85235226 -0.87923294]]

Question 1(k):
9.087621365532033

Question 1(l):
[0.89629309 0.70814782 0.64914405 0.69313792 0.89294695]

Question 1(m):
2.7263225002245983

Question 1(n):
[[1.57884629 -0.35284012 -0.187686   -0.3942709   0.26913377]
 [1.03478465 0.23371525 0.04918167 0.0088431   0.51378681]
 [1.46099184 -0.05772761 0.26157029 -0.11477974 0.42237427]
 [1.37914438 -0.28663212 -0.17972284 -0.4355982   0.14225624]
 [1.94377489 0.08489845 0.1003952 -0.14691625 0.69960743]]

Question 1(o):
[[2.22648013]]

Question 2

Question 2(c):
timing (100)
Execution time of matrix_poly is : 1.478083610534668
Execution time of functions numpy.matmul and + is : 0.0009729862213134766
Time difference: 2.1504850287842e-11
timing (300)
Execution time of matrix_poly is : 42.77997446060181
Execution time of functions numpy.matmul and + is : 0.001961231231689453
Time difference: 1.8474951623669846e-09
timing (1000)
Execution time of matrix_poly is : 1525.7041056156158
Execution time of functions numpy.matmul and + is : 0.0688161849975586
Time difference: 1.0248671945972416e-07

Question 3

Question 3(d):
a = 3.1294146191912073 b = 4.719354385844762
Training error = 0.8557483910540565
Test error = 0.9608049758277345

Question 4

Question 4(a):

weight vector: [0.01694442 1.49601981 0.03738886]
bias term: -2.6250489555396475

Question 4(b):
accuracy1: 0.856
accuracy2: 0.856
accuracy2 - accuracy1: 0.0

Question 5

Question 5(e):
final weight vector (including the bias term at index 0): [-2.638166 0.01740979 1.50266708 0.03800213]
the number of iterations: 413
learning rate: 1

Question 6

Question 6(c):
the best value of K: 3
validation accuracy 0.9905013192612138
test accuracy 0.9929729729729729

Question 6(d):
the best value of K: 9
validation accuracy 0.9975996159385502
test accuracy 0.9965174129353234
---A1 END---