COMP4107 - Assignment 1

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1. Question 1

2. Question 2
   Implementation for question 2 can be found in q2.py. The results is

```
('A=', array([[1, 2, 3],
       [2, 3, 4],
       [4, 5, 6],
       [1, 1, 1]]))
('U=', array([[-0.33306893, -0.73220483,  0.20999988, -0.55573485],
       [-0.48640367, -0.34110504,  0.13689238,  0.79266594],
       [-0.79307315,  0.44109455, -0.34689227, -0.23693109],
       [-0.15333474,  0.39109979,  0.90378442, -0.08187267]]))
('S=', array([[  1.10528306e+01,   0.00000000e+00,   0.00000000e+00],
       [  0.00000000e+00,   9.13748280e-01,   0.00000000e+00],
       [  0.00000000e+00,   0.00000000e+00,   1.10715576e-16]]))
('V=', array([[-0.41903326, -0.56492763, -0.71082199],
       [ 0.81101447,  0.11912225, -0.57276996],
       [ 0.40824829, -0.81649658,  0.40824829]]))
```

3. Question 3
   Implementation for question 3 can be found in q3.py. The rank-2 approximation and $||A-A_2||$ is

```
yunkaideMacBook-Pro:yunkai jeremy$ python3 q3.py
A2= [[0.17447807 0.17754332 0.18056607 ... 0.18056607 0.17754332 0.1744
 [0.17754332 0.18059153 0.18359756 ... 0.18359756 0.18059153 0.1775433
 [0.18056607 0.18359756 0.18658718 ... 0.18658718 0.18359756 0.1805660
 ...
 [0.18056607 0.18359756 0.18658718 ... 0.18658718 0.18359756 0.1805660
 [0.17754332 0.18059153 0.18359756 ... 0.18359756 0.18059153 0.1775433
 [0.17447807 0.17754332 0.18056607 ... 0.18056607 0.17754332 0.1744780

||A - A2|| = 1.3311896328587232
```

4. Question 4
   Implementation for question 4 can be found in q4.py. The only learning rate that will work is when $\varepsilon = 0.01$, which will lead to the correct result with ≈ 420 iterations. The other ones won't work as we are descending too quickly, and therefore we will miss the correct answer and failed to come back. We set the program to stop

5. Question 5

6. Question 6

7. Question 7