

Corbin Muraro

Homework 2

Problem 1)

4. Since A is 100x100, here are some statistics of A without displaying the entire matrix:

- Mean: 5.6353×10^{-5}
- Size: 100x100 elements

5. Angle Between G and G' : 1.000; Length of G' : 1.000

Problem 2)

3.

Cosine of the angle between f and f':

0.1512

Length of $A * f'$:

0.1512

$A*f'$ and cos of the angle between f and f' should be and are the same value. This is because of the transformation done by A onto f'.

Problem 3)

For this program, I made made 50 matrices from pairs vectors of random elements, and then built a connectivity matrix as the sum of the 50 matrices.

4. b) Here's a section of output comparing the length of g' to the angle between g' and $g(i)$:

```
Length of g prime (output):  
0.0393  
  
Angle between g prime and g(i):  
0.0017  
  
Length of g prime (output):  
0.0445  
  
Angle between g prime and g(i):  
0.0027  
  
Length of g prime (output):  
0.1316  
  
Angle between g prime and g(i):  
-0.0089  
  
Length of g prime (output):  
1  
  
Angle between g prime and g(i):  
1.0000
```

4. c) Here's a section of output for the length of g'

```
Length of g prime:  
0.2560  
  
Length of g prime:  
1  
  
Length of g prime:  
0.1644  
  
Length of g prime:  
0.1352  
  
Length of g prime:  
0.1221  
  
Length of g prime:  
0.0650  
  
Length of g prime:  
0.0592  
  
Length of g prime:  
1.0000
```

4. d) Here's a section of output:

```
Length of product of A and the new vector:
0.8614

Difference between the new vector and the product of the vector and A
0.9386

Length of product of A and the new vector:
0.1306

Difference between the new vector and the product of the vector and A
0.8694

Length of product of A and the new vector:
0.1746

Difference between the new vector and the product of the vector and A
0.8252

Length of product of A and the new vector:
0.8845

Difference between the new vector and the product of the vector and A
0.9151

Average length of product of A and the new vectors
0.8726
```

5. With only one pair per trial, the output (g') is of length 1 and is in the same direction as g . However, as number of pairs increases, the output length mean increases.

Problem 4)

I chose Option #2. I wasn't able to get numbers randomly replaced on higher dimension matrices in a time efficient manner, but even with matrices based on 10-dimensional vectors, by replacing half of the matrix with zeroes, the average length between a new vector and the connectivity matrix doubled.

With matrices based on 50-dimensional vectors and replacing half of the matrix with zeroes, the average length between a new vector and the connectivity matrix quadrupled.

```
Length of product of connectivityMatrix and the new vector:
5.2862

Difference between the new vector and the product of the vector and connectivityMatrix
4.3982

Length of product of connectivityMatrix and the new vector:
6.5732

Difference between the new vector and the product of the vector and connectivityMatrix
5.7712

Length of product of connectivityMatrix and the new vector:
6.1660

Difference between the new vector and the product of the vector and connectivityMatrix
5.1862

Length of product of connectivityMatrix and the new vector:
4.9526

Difference between the new vector and the product of the vector and connectivityMatrix
7.9878

Average length of product of connectivityMatrix and the new vectors
7.1785
```