**Exercise 4.1**

1. >> A = [8 11 2 8

0 -7 2 -1

-3 -7 2 1

1 1 2 4]

A =

8 11 2 8

0 -7 2 -1

-3 -7 2 1

1 1 2 4

>> B = [1 -2 0 5

0 7 1 5

0 4 4 0

0 0 0 2]

B =

1 -2 0 5

0 7 1 5

0 4 4 0

0 0 0 2

>> det (A+B)

ans =

0

>> det (A-B)

ans =

1.0380e+03

>> det (A\*B)

ans =

3.6480e+03

>> det (inv(A))

ans =

0.0132

>> det (B')

ans =

48

**b)** Matrix A+B is not invertible because the determinant is equal to zero, which means it's singular

**c)** If you were to lose the original matrices, you would still be able to calculate the determinants of AB, the inverse of A, and the transpose of B. They have the following properties:

* det (A\*B) = det (A) \* det (B)
* det (inv(A)) = 1/det(A)
* det (B') = det (B)

**Exercise 4.2**

>> N = [0.02 0.003 0

1 0.01 0

0 0 0.005]

N =

0.0200 0.0030 0

1.0000 0.0100 0

0 0 0.0050

>> det (N^100)

ans =

0

I don't believe N 100 is invertible because the determinant is zero.

>> det (N)

ans =

-1.4000e-05

(-1.4000e-05)^100 = 4.1002e-486

Yes I would reconsider because the computer may give an inaccurate answer since not all entries are integers.

**Exercise 4.3**

1. >> V = [9 -4 -2 0;

-56 32 -28 44;

-14 -14 6 -14;

42 -33 21 -45]

V =

9 -4 -2 0

-56 32 -28 44

-14 -14 6 -14

42 -33 21 -45

>> v = eig (V)

v =

-17.5069

18.5069

-12.0000

13.0000

>> [P,D] = eig(V)

P =

0.1320 0.3481 0.1980 -0.4472

0.7776 -0.7354 0.6931 0.0000

0.1944 -0.1839 0.6931 0.8944

-0.5832 0.5516 -0.0000 -0.0000

D =

-17.5069 0 0 0

0 18.5069 0 0

0 0 -12.0000 0

0 0 0 13.0000

**b)** The matrix V is invertible because the eigenvalues multiplied together don't equal zero. The determinant of V is equal to all the eigenvalues multiplied together.

**c)** >> (inv(P))\*V\*P

ans =

-17.5069 -0.0000 -0.0000 -0.0000

0.0000 18.5069 0.0000 -0.0000

0.0000 -0.0000 -12.0000 0.0000

0.0000 -0.0000 0.0000 13.0000

You get the identity matrix of V with the eigenvalues in place of the 1's. This is the diagonalized matrix of V.

**Exercise 4.4**

1. >> F = [ 0 1; 1 1]

F =

0 1

1 1

>> [P,D] = eig(F)

P =

-0.8507 0.5257

0.5257 0.8507

D =

-0.6180 0

0 1.6180

>> P\*D\*(inv(P))

ans =

-0.0000 1.0000

1.0000 1.0000

**b)** >> F^10

ans =

34 55

55 89

>> P\*(D^10)\*(inv(P))

ans =

34.0000 55.0000

55.0000 89.0000

**c)** >> f=[1,1]'

f =

1

1

>> F\*f

ans =

1

2

>> (F^2)\*f

ans =

2

3

>> (F^3)\*f

ans =

3

5

>> (F^4)\*f

ans =

5

8

>> (F^5)\*f

ans =

8

13

The second row of every matrix is the sum of the two entries of the matrix before it, and the first row of each matrix is the second row of the previous matrix.

**d)** >> (F^29)\*f

ans =

832040

1346269

The 30th term of the sequence is 1346269.

**Exercise 4.5**

1. P =

0.8100 0.0800 0.1600 0.1000

0.0900 0.8400 0.0500 0.0800

0.0600 0.0400 0.7400 0.0400

0.0400 0.0400 0.0500 0.7800

>> x0 = [48.56; 51.01; 0.0013; 0.0030]

x0 =

48.5600

51.0100

0.0013

0.0030

>> [Q,D] = eig (P)

Q =

0.6656 0.7676 0.5432 -0.4641

0.6165 -0.2841 -0.8148 -0.1254

0.2946 -0.5682 0.1811 -0.2508

0.3001 0.0848 0.0905 0.8402

D =

1.0000 0 0 0

0 0.6730 0 0

0 0 0.7600 0

0 0 0 0.7370

**b)**

D =

1.0000 0 0 0

0 0.0000 0 0

0 0 0.0000 0

0 0 0 0.0000

**c)**

>> Pinf = Q\*(D^100)\*(inv(Q))

ans =

0.3547 0.3547 0.3547 0.3547

0.3285 0.3285 0.3285 0.3285

0.1570 0.1570 0.1570 0.1570

0.1599 0.1599 0.1599 0.1599

d) >> Pinf\*x0

ans =

35.3141

32.7090

15.6308

15.9203

My answer is very similar to part (b) of the exercise from last time.

**e)** >> y = [25;25;25;25]

y =

25

25

25

25

>> Pinf\*y

ans =

35.4651

32.8488

15.6977

15.9884

The entries of y are very similar to that of a single column of the vector Pinf, except for the fact that each entry is multiplied by 100. The initial distribution of y does not have a major effect on the distribution in the long term because Pinf is representative of what the party distribution will look like after many elections.

The matrix Pinf servs as a transformation for any initial vector, representing the distribution in the long run.

**Exercise 4.6**

**a)** >> L = [0,0,0,0,1,0,0,0;

0,0,0,0,0,0,0,1;

0,1/2,0,0,0,0,1,0;

1/2,0,1/2,0,0,0,0,0;

0,0,1/2,0,0,1,0,0;

1/2,0,0,0,0,0,0,0;

0,1/2,0,0,0,0,0,0;

0,0,0,1,0,0,0,0;]

L =

0 0 0 0 1.0000 0 0 0

0 0 0 0 0 0 0 1.0000

0 0.5000 0 0 0 0 1.0000 0

0.5000 0 0.5000 0 0 0 0 0

0 0 0.5000 0 0 1.0000 0 0

0.5000 0 0 0 0 0 0 0

0 0.5000 0 0 0 0 0 0

0 0 0 1.0000 0 0 0 0

>> e0 = [1;1;1;1;1;1;1;1]

e0 =

1

1

1

1

1

1

1

1

>> e10 = (L^10)\*e0

e10 =

1.0625

1.1250

1.1875

1.1250

1.1719

0.5781

0.5938

1.1563

>> e55 = (L^55)\*e0

e55 =

1.1429

1.1429

1.1428

1.1429

1.1428

0.5714

0.5714

1.1428

>> e56 = (L^56)\*e0

e56 =

1.1428

1.1428

1.1429

1.1429

1.1428

0.5714

0.5714

1.1429

The variable n must be around the value 55 to experience a change less than 1%. When n is 55, the first value is 1.1429. When n is 56 the value is 1.1428. The difference in these two values is 0.0001, which is less than 0.01.

**b)**