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B00
3.1

a.
```
>> A = [1 1; 100 100]

A =

     1     1
   100   100

>> inv(A)
Warning: Matrix is singular to working precision.


ans =

   Inf   Inf
   Inf   Inf
```

This warning indicates that the matrix does not exist, thus A is not invertible.

b.
```
>>  A = [5 3; 7 4]

A =

     5     3
     7     4

>> B = inv(A)

B =

   -4.0000    3.0000
    7.0000   -5.0000

>> A*B

ans =

    1.0000         0
         0    1.0000

>> B*A
```

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ans =

```
    1.0000         0
   -0.0000    1.0000
```

This proves that A is invertible because A*B and B*A equal the identity matrix.

c.

```
>> x = [2; 3]

x =

     2
     3

>> y = A*x

y =

    19
    26
```

d. If I multiply B*y I think it will output the column vector [2, 3] because I am multiplying the inverse by the output, thus I expect to get the original input.

e.

```
>> B*y

ans =

     2
     3
```

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3.2
1. San Diego > Los Angeles > Shanghai > Manila
2. San Diego > Los Angeles > Tokyo > Manila
3. San Diego > Seattle > Los Angeles > Manila
4. San Diego > Seattle > Tokyo > Manila
5. San Diego > Seattle > Shanghai > Manila

3.3
a.
```
>> A = [0 1 0 0 0 1; 1 0 1 1 1 1; 0 1 0 1 1 1; 0 1 1 0 1 1; 0 0 1 1 0 0; 1 1 1 1 0 0]

A =

     0     1     0     0     0     1
     1     0     1     1     1     1
     0     1     0     1     1     1
     0     1     1     0     1     1
     0     0     1     1     0     0
     1     1     1     1     0     0

>> A^2

ans =

     2     1     2     2     1     1
     1     4     3     3     2     3
     2     2     4     3     2     2
     2     2     3     4     2     2
     0     2     1     1     2     2
     1     3     2     2     3     4

>> A^3

ans =

     2     7     5     5     5     7
     7    10    12    12    10    11
     4    11     9    10     9    11
     4    11    10     9     9    11
     4     4     7     7     4     4
     7     9    12    12     7     8
```

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If flying for city i to city j with exactly n stops is $(A^{n+1})_{ij}$, then flying from San Diego(city 1) to Manila(city5) is $(A^{3})_{15}$, which is 5. This matches with the explicit answer that I manually found in 3.3.

b.

```
>> A

A =

     0     1     0     0     0     1
     1     0     1     1     1     1
     0     1     0     1     1     1
     0     1     1     0     1     1
     0     0     1     1     0     0
     1     1     1     1     0     0

>> A + A^2 + A^3 + A^4 + A^5

ans =

    56   109   110   110    90   109
   113   204   219   219   175   205
    96   185   192   193   157   185
    96   185   193   192   157   185
    56    96   109   109    84    96
   105   181   199   199   154   180
```

With Manila being city 5 and Seattle being city 6, if we want to find the total amount of ways to get from Manilla to Seattle with at MOST 4 stops, then it is the sum of all 5th row and 6th column entries of the matrix A being multiplied by itself 5 times. Using MATLAB I calculated that there is 96 possible ways to get from Seattle to Manilla with at MOST 4 stops.

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3.4
a.

```
>> 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 = [0.5106; 0.4720; 0.0075; 0.0099]

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 =

    0.5106
    0.4720
    0.0075
    0.0099
```

3 elections

```
>> P^3*x0

ans =

    0.3926
    0.4007
    0.1099
    0.0968
```

6 elections

```
>> P^6*x0

ans =

    0.3617
    0.3629
    0.1418
    0.1336
```

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10 elections
```
>> P^10*x0

ans =

    0.3540
    0.3407
    0.1534
    0.1518
```

b.
30 elections
```
>> P^30*x0

ans =

    0.3546
    0.3285
    0.1570
    0.1599
```

60 elections
```
>> P^60*x0

ans =

    0.3547
    0.3285
    0.1570
    0.1599
```

100 elections
```
>> P^100*x0

ans =

    0.3547
    0.3285
    0.1570
    0.1599
```

As k gets big, all values of x approach a value and will no longer change as long as x0 is the same, and the matrix P remains the same. It is evident that as k grows large, Democratic values

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approach 0.3546, Republicans 0.3285, Independents 0.1570, and Libertarians 0.1599. This is because the demographic reaches values where all parties gain and lose the same number of people, resulting in a net loss and gain of 0 every year with no additional changes.