matrix multiplication

$$A = \begin{pmatrix} 3 & -4 & 1 \\ 4 & 5 & -4 \end{pmatrix} \qquad B = \begin{pmatrix} -2 & 5 \\ 1 & -4 \\ 5 & 5 \end{pmatrix}$$

$$A = \underset{R}{2} \times \underset{C}{3} \qquad B = \underset{R}{3} \times \underset{C}{2}$$

$$A * B = 2 \times 2$$

$$A * B = \begin{pmatrix} (3*-2)+(-4*1)+(1*5) & (3*5)+(-4*-4)+(1*5) \\ (4*-2)+(5*1)+(-4*5) & (4*5)+(5*-4)+(-4*5) \end{pmatrix}$$

$$= \begin{pmatrix} -5 & 36 \\ -23 & -20 \end{pmatrix}$$

Cayley-Hamilton Theorum

```
>> A=randi([-5 5],4,4)

A =

     3     1     5     5
     4    -4     5     0
    -4    -2    -4     3
     5     1     5    -4

>> charpoly(A)

ans =

     1     9    -2  -107     4
```

__**Expressed in coeffiecients: X^4+9x^3-2x^2-107x+4**__

```
>> polyvalm([1 9 -2 -107],A)

ans =

    29   -54   225   205
    -1     2    -5    -5
   -24    44  -184  -168
     6   -12    50    46
```

Markov Chain

```
 Classroom License -- for classroom instructional use only.

>> A=[0 1 0 0 0 1;0 0 0 0 1 0;1 1 0 1 1 0;0 0 0 1 0 0;0 0 0 1 0 0;1 0 1 0 1 0]

A =

     0     1     0     0     0     1
     0     0     0     0     1     0
     1     1     0     1     1     0
     0     0     0     1     0     0
     0     0     0     1     0     0
     1     0     1     0     1     0
```

b.)

```
>> D=diag([1/2 1 1/4 1 1 1/3])*A

D =

         0    0.5000         0         0         0    0.5000
         0         0         0         0    1.0000         0
    0.2500    0.2500         0    0.2500    0.2500         0
         0         0         0    1.0000         0         0
         0         0         0    1.0000         0         0
    0.3333         0    0.3333         0    0.3333         0
```

c.)

```
>> D

D =

         0    0.5000         0         0         0    0.5000
         0         0         0         0    1.0000         0
    0.2500    0.2500         0    0.2500    0.2500         0
         0         0         0    1.0000         0         0
         0         0         0    1.0000         0         0
    0.3333         0    0.3333         0    0.3333         0

>> T=D'

T =

         0         0    0.2500         0         0    0.3333
    0.5000         0    0.2500         0         0         0
         0         0         0         0         0    0.3333
         0         0    0.2500    1.0000    1.0000         0
         0    1.0000    0.2500         0         0    0.3333
    0.5000         0         0         0         0         0
```

d.)

```
>> T*[0;0;1;0;0;0]

ans =

    0.2500
    0.2500
         0
    0.2500
    0.2500
         0
```

```
>> T^10*[0;0;1;0;0;0]

ans =

    0.0002
    0.0003
    0.0001
    0.9984
    0.0008
    0.0002
```

```
>> T^100*[0;0;1;0;0;0]

ans =

    0.0000
    0.0000
    0.0000
    1.0000
    0.0000
    0.0000
```

e.)

```
>> T*[0;0;0;0;1;0]

ans =

     0
     0
     0
     1
     0
     0
```

```
>> T^10*[0;0;0;0;1;0]

ans =

     0
     0
     0
     1
     0
     0
```

```
>> T^100*[0;0;0;0;1;0]

ans =

     0
     0
     0
     1
     0
     0
```

The results differ in that when we start on page 5, the number then gets stuck on page 4 immediately and does not change after that. It is intuitive that we get stuck on page 4, because we look at the diagram there is nothing leaving that page 4. There a no values increasing or decreasing during this time in regards to other pages.

When we start on page 3, the values change when there are 10 clicks. At 10 clicks it becomes heavily weighted on page 4. Once we 100 clicks, the values become stuck on page 4 once again.

f.)

Based on the results, I would rank the pages in the following order:

4,5,2,1,6,3

4 is the most authoritative because once it gets to that page, the probability only increases

Elementary Matrices

```
>> %E21(3/2)
>> E1=eye(3);E1(2,1)=3/2;
>> E1*A

ans =

     2     0    -2
     0     1     0
    -4     8    -1

>> %E31(2)
>> E2=eye(3);E2(3,1)=2;
>> E2*E1*A

ans =

     2     0    -2
     0     1     0
     0     8    -5
```

```
>> E3=eye(3);E3(3,2)=-8;
>> %E23(-8)
>> E3=eye(3);E3(3,2)=-8;
>> E3*E2*E1*A

ans =

     2     0    -2
     0     1     0
     0    -8    -5
```

```
>> %E3(-1/5)
>> E4=diag([1 1 -1/5]);
>> E4*E3*E2*E1*A

ans =

    2.0000         0   -2.0000
         0    1.0000         0
    0.0000         0    1.0000
```

```
>> %E13(2)
>> E5=eye(3);E5(1,3)=2;
>> E5*E4*E3*E2*E1*A

ans =

    2.0000         0   -0.0000
         0    1.0000         0
    0.0000         0    1.0000
```

```
>> %E1(1/2)
>> E6=diag([1/2 1 1])

E6 =

    0.5000         0         0
         0    1.0000         0
         0         0    1.0000

>> E6*E5*E4*E3*E2*E1*A

ans =

    1.0000         0   -0.0000
         0    1.0000         0
    0.0000         0    1.0000
```