Bruce Campbell OSU MATH 5603 HW #6

Problem 4

5.3.18

a)

```
clear all;
A = [1 1 1 ; -1 9 2 ; 0 -1 -2];
q= [1 1 1]';
iterate(:,1)=q;
A=inv(A-9*eye(3))
```

```
A = 3×3
  -7.6923e-02  -3.8462e-01  -7.6923e-02
   4.2308e-01  -3.3846e+00  -5.7692e-01
  -3.8462e-02   3.0769e-01  -3.8462e-02
```

```
for j=1:10
    q=A*q;
    [bgst,index] = max(abs(q));
    scale_factor(j+1) = q(index(1));
    q = q/scale_factor(j+1);
    iterate(:,j+1 ) =q;
end
```

b)

```
[V,D] =eig(A)
```

```
V = 3×3
  -1.1649e-01  -9.8968e-01  -2.6661e-01
  -9.8888e-01  -1.3632e-01  -1.9952e-01
   9.2460e-02   4.4070e-02   9.4293e-01
D = 3×3
  -3.2808e+00            0            0
            0  -1.2647e-01            0
            0            0  -9.2692e-02
```

```
format long e;
D(1,1)
```

```
ans =
    -3.280834369191753e+00
```

```
scale_factor(10)
```

```
ans =
    -3.280834369189691e+00
```

```
D(1,1) -scale_factor(10)
```

```
ans =
    -2.062350290543691e-12
```

We see that after 10 iterations we have agreement to 12 digits - far more than with the forward power iteration.

c)

```
format shortE;
v = V(:,1)'
```

```
v = 1×3
  -1.1649e-01  -9.8888e-01   9.2460e-02
```

```
[bgst,index] = max(abs(v));
scale_factor=v(index(1));
v = v /scale_factor'
```

```
v = 1×3
   1.1780e-01   1.0000e+00  -9.3500e-02
```

```
ratios=zeros(9,1);
for j=1:9
    ratios(j) = norm( iterate(:,j+1) -v) / norm(iterate(:,j) - v);
end
table(ratios')
```

```
ans = 1×1 table
```

...

	Var1							
1	5.9084e-01	9.8857e-01	9.9959e-01	9.9998e-01	1.0000e+00	1.0000e+00	1.0000e+00	1.0000e+00

d)

```
abs(D(2,2)/D(1,1))
```

```
ans =
   3.8549e-02
```

```
errors=zeros(9,1);
for j=1:9
    errors(j) = norm( iterate(:,j) -v) ;
end
ediff = diff(errors)';
table(ediff)
```

```
ans = 1×1 table
```

	ediff							
1	-9.9569e-01	-1.6436e-02	-5.8138e-04	-2.1348e-05	-7.9429e-07	-2.9833e-08	-1.1284e-09	-4.2901e-11

The ratios converge to 1 in about half the iterations as power iteration and the final errors are much smaller.