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Power Iterations

Problem 10.5

```
clear;

for N = [10, 100, 1000]
```

Setup

```
B = randn(N, N);
A = B + B';
[V, L, ~] = eig(A);
q0 = randn(N, 1);
q0 = q0 / norm(q0);
```

Iterations

```
qk = q0;
gammak = qk'*A*qk;
count = 0;
while 1
    count = count + 1;
    zk = A*qk;
    qk = zk / norm(zk);
    prevgamma = gammak;
    gammak = qk'*A*qk;
    if abs(gammak-prevgamma) <= eps
        break;
    end
end
disp(['For N = ' num2str(N)])
% Part a
disp(['Took ' num2str(count) ' iterations for N = ' num2str(N)]);
disp(['Ratio of Lambda1 / Lambda2 = ' num2str(L(1,1) / L(2,2))]);
% Part b
disp(['Eigen Value Estimate = ' num2str(gammak)]);
disp(['MATLAB computed largest Eigen Value = ' num2str(L(1,1))]);
disp(['Error in Estimate = ' num2str(abs(gammak - L(1,1)))]);
```

```
For N = 10
Took 33 iterations for N = 10
Ratio of Lambda1 / Lambda2 = 1.8035
Eigen Value Estimate = -10.045
```

```
MATLAB computed largest Eigen Value = -10.045  
Error in Estimate = 0
```

```
For N = 100  
Took 2975 iterations for N = 100  
Ratio of Lambda1 / Lambda2 = 1.0698  
Eigen Value Estimate = -27.5757  
MATLAB computed largest Eigen Value = -27.5757  
Error in Estimate = 8.2423e-13
```

```
For N = 1000  
Took 1829 iterations for N = 1000  
Ratio of Lambda1 / Lambda2 = 1.007  
Eigen Value Estimate = -89.1394  
MATLAB computed largest Eigen Value = -89.1394  
Error in Estimate = 1.8474e-12
```

```
end
```