Assignment 2

Q1.

Test case:

Size of matrix: 3*3

Augmented Matrix:

4 2 0 10

2 4 1 11.5

0 1 5 4.5

1.Gauss Elimination:

Solution Vector: (1.5, 2, 0.5)

2.Gauss Elimination with partial pivoting:

Solution Vector: (1.5, 2, 0.5)

- This method is more precise than previous one because round-off errors are minimized in this method because of pivoting.

3. Doolittle method:

Solution Vector: (1.5, 2, 0.5)

Lower triangular matrix:

1. 0. 0.

0.5 1. 0.

0. 0.333 1.

Upper Triangular Matrix:

4. 2. 0.

0. 3. 1.

0. 0. 4.66666667

4. Crout Method:

Solution Vector: (1.5, 2, 0.5)

Lower triangular matrix:

4.	0.	0.
2.	3.	0.
0.	1.	4.66666667

Upper Triangular matrix:

1.	0.5	0.
0.	1.	0.33333333
0.	0.	1.

5. Cholesky Method:

Solution Vector: (1.5, 2, 0.5)

Lower Triangular Matrix:

2.	0.	0.
1.	1.7320	0.
0.	0.5774	2.1602469

Upper Triangular Matrix:

2.	1.	0.
0.	1.7320	0.5774
0.	0.	2.1602469

- Crout, Doolittle and Cholesky are special cases of LU decomposition.
- These are direct methods, used for computation of solution for system of linear equations.
- Cholesky method is applied only on symmetric matrices.

Q2.

Test case:

Size of matrix: 3*3

Matrix:

```
 8.0  -1.0  -1.0
-1.0   4.0   -2.0
-1.0  -2.0   10.0
```

Maximum iterations: 100

Maximum relative approximate error: 0.001%

Find Eigenvalue closest to: 8

1. Power Method:

Eigenvalue: 10.779232986011769

Eigenvector: (-0.26840475, -0.25537689, 1)

Iterations: 31

2. Inverse Power method:

Eigenvalue: 3.074933303510444

Eigenvector: (0.26959276, 1, 0.32773697)

Iterations: 12

3. Inverse Power method with shifting:

Eigenvalue: 8.14613061987603

Eigenvector: (1, -0.32977431, 0.18364369)

Iterations: 6

4. QR decomposition method:

Eigenvalues:

10.77883534

8.14622345

3.07494121

Iterations: 23

- By using power method and inverse power method we can find just largest and smallest eigenvalues for a given matrix respectively.
- These above-mentioned methods are iterative methods of computation.
- The number of floating-point operations is less in power method as compared to inverse power and inverse power with shift.
- For a good initial guess convergence and stability of power method can be promised.
- QR method involves a lot of computation but, it provides value for all the eigenvectors of a matrix.