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MA 423: Matrix Computations
Lab - 1

Question - 1

(a) Wilkinson matrix for n = 4:

$$\begin{bmatrix} 1 & 0 & 0 & 1 \\ -1 & 1 & 0 & 1 \\ -1 & -1 & 1 & 1 \\ -1 & -1 & -1 & 1 \end{bmatrix}$$

(b) Hamiltonian matrix for n = 4:

$$\begin{bmatrix} 0.3123 & -1.4627 & -0.4679 & 0.1562 & -3.0219 & 0.7802 & 0.7961 & 0.2430 \\ -0.5152 & -0.2573 & 0.8756 & 0.2902 & 0.7802 & -0.3076 & -0.3962 & 0.4468 \\ 0.2708 & -0.7940 & 0.2130 & 0.7369 & 0.7961 & -0.3962 & -0.1908 & -0.7512 \\ -0.7796 & 0.3427 & -0.4569 & 0.0122 & 0.2430 & 0.4468 & -0.7512 & -0.7093 \\ 1.8562 & 1.1919 & 0.5629 & -0.8149 & -0.3123 & 0.5152 & -0.2708 & 0.7796 \\ 1.1919 & -0.5226 & 1.0122 & 1.4383 & 1.4627 & 0.2573 & 0.7940 & -0.3427 \\ 0.5629 & 1.0122 & 1.7716 & 0.2500 & 0.4679 & -0.8756 & -0.2130 & 0.4569 \\ -0.8149 & 1.4383 & 0.2500 & -1.9057 & -0.1562 & -0.2902 & -0.7369 & -0.0122 \end{bmatrix}$$

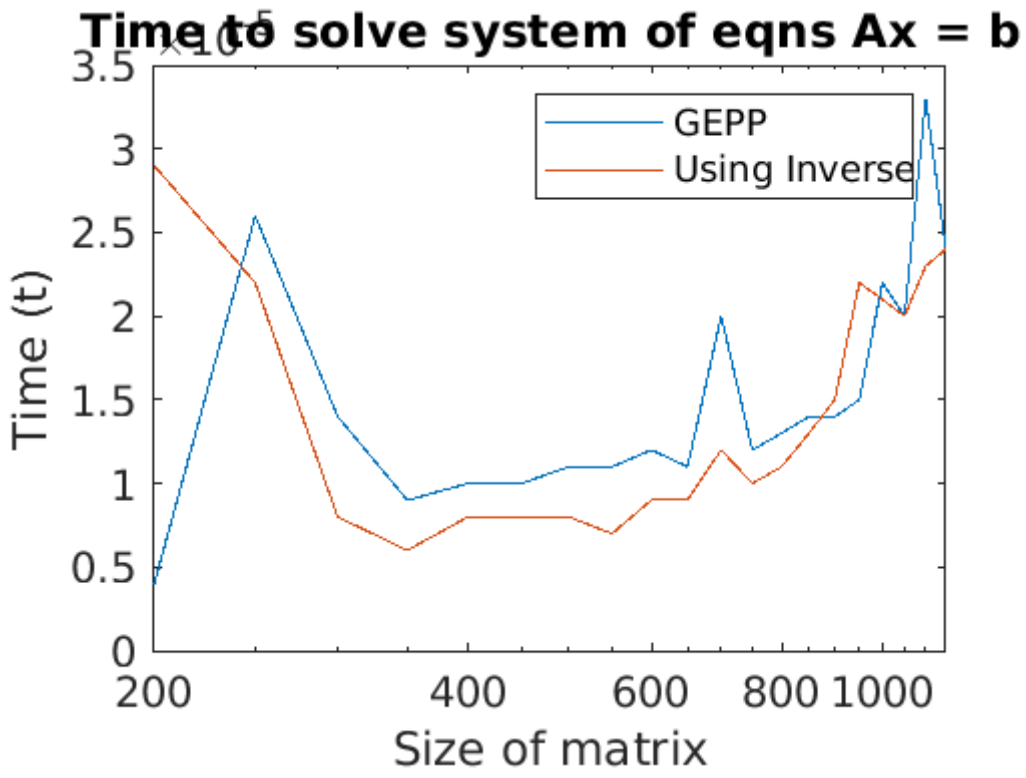
Question - 2

(a) s = 7.485471
(b) scf = 7.484600
(c) scb = 7.484900

Result: (c) is closer to (a) than (b) which is evident from below:

|s - scf| = 0.000871
|s - scb| = 0.000571

Question - 3



Question - 4

(a) The column oriented back substitution method to solve upper triangular system for $Ux = b$:

```
U = [ 2     4     5
      0     2     6
      0     0     2 ]

b = [ 4
      5
      6 ]


x =  [  7.5000
       -6.5000
        3.0000  ]
```

(b) The row oriented forward substitution method to solve upper triangular system for $Lx = b$:

```
L =  [ 2     0     0
       2     4     0
       2     4     8 ]

b =  [ 4
       5
       6 ]

x =  [  2.0000
        0.2500
        0.1250 ]
```

Question - 5

An example for the function program using the matrix A defined as below is:

```
A = [  1     3     1
       2     9     4
       3     4     7  ]

LU factorization for matrix A -
     L: [  1.0000          0          0
           2.0000    1.0000          0
           3.0000   -1.6667    1.0000   ]

     U: [  1.0000    3.0000    1.0000
                0    3.0000    2.0000
                0         0    7.3333   ]

     LU: [  1     3     1
            2     9     4
            3     4     7   ]
```