Homeowrk2

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Problem1

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 10 \end{bmatrix} \cdot \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 6 \\ 15 \\ 25 \end{bmatrix}.$$

① Gaussian Elimination:

$r_2 - 4r_1$ and $r_3 - 7r_1$:

$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & 6 \\ 0 & -3 & -6 & -9 \\ 0 & -6 & -11 & -1 \end{array}\right] \Rightarrow$$

$r_3 - 2r_2$:

$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & 6 \\ 0 & -3 & -6 & -9 \\ 0 & 0 & 1 & 1 \end{array}\right] \Rightarrow \begin{cases} x_3 = 1 \\ x_2 = 1 \\ x_1 = 1 \end{cases}.$$

② LU Factorization:

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 10 \end{bmatrix} = \underset{L}{\begin{bmatrix} l_{11} & & \\ l_{21} & l_{22} & \\ l_{31} & l_{32} & l_{33} \end{bmatrix}} \cdot \underset{U}{\begin{bmatrix} 1 & u_{12} & u_{13} \\ & 1 & u_{23} \\ & & 1 \end{bmatrix}}$$

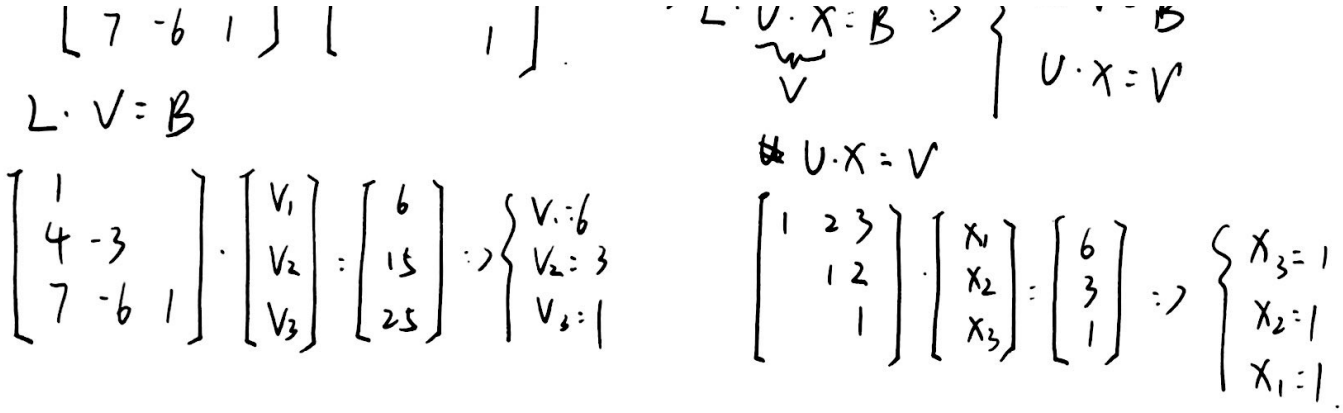
$$\Rightarrow \begin{bmatrix} \boxed{1} & & \\ \boxed{4} & l_{22} & \\ \boxed{7} & l_{32} & l_{33} \end{bmatrix} \cdot \begin{bmatrix} 1 & u_{12} & u_{13} \\ & 1 & u_{23} \\ & & 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 1 & & \\ 4 & l_{22} & \\ 7 & l_{32} & l_{33} \end{bmatrix} \cdot \begin{bmatrix} 1 & \boxed{2} & 3 \\ & \boxed{1} & u_{23} \\ & & 1 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 1 & & \\ 4 & \boxed{-3} & \\ 7 & \boxed{-6} & l_{33} \end{bmatrix} \cdot \begin{bmatrix} 1 & 2 & 3 \\ & 1 & u_{23} \\ & & 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 1 & & \\ 4 & -3 & \\ 7 & -6 & l_{33} \end{bmatrix} \cdot \begin{bmatrix} 1 & 2 & 3 \\ & 1 & \boxed{2} \\ & & 1 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 1 & & \\ 4 & -3 & \end{bmatrix} \cdot \begin{bmatrix} 1 & 2 & 3 \\ & 1 & 2 \end{bmatrix} \Rightarrow$$

$A \cdot X = B$

$(L \cdot V = B$

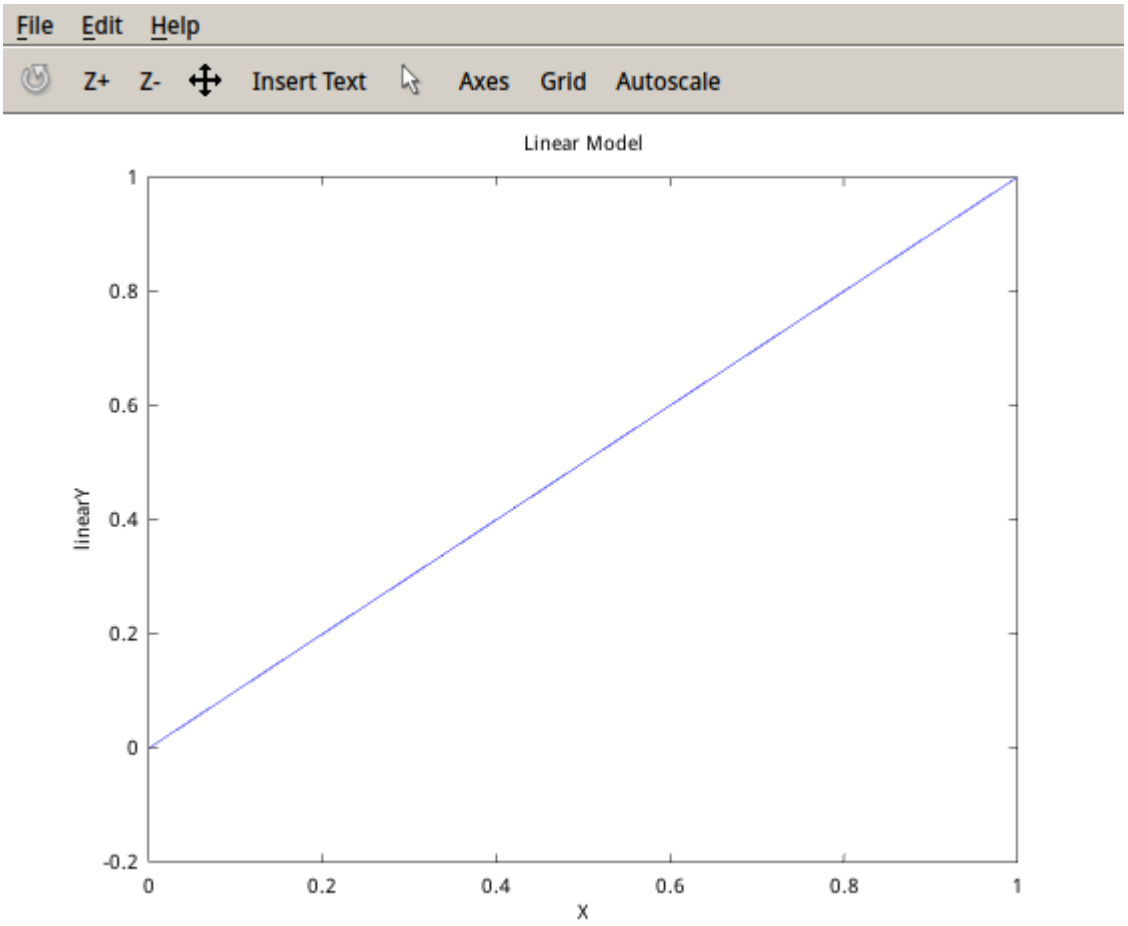


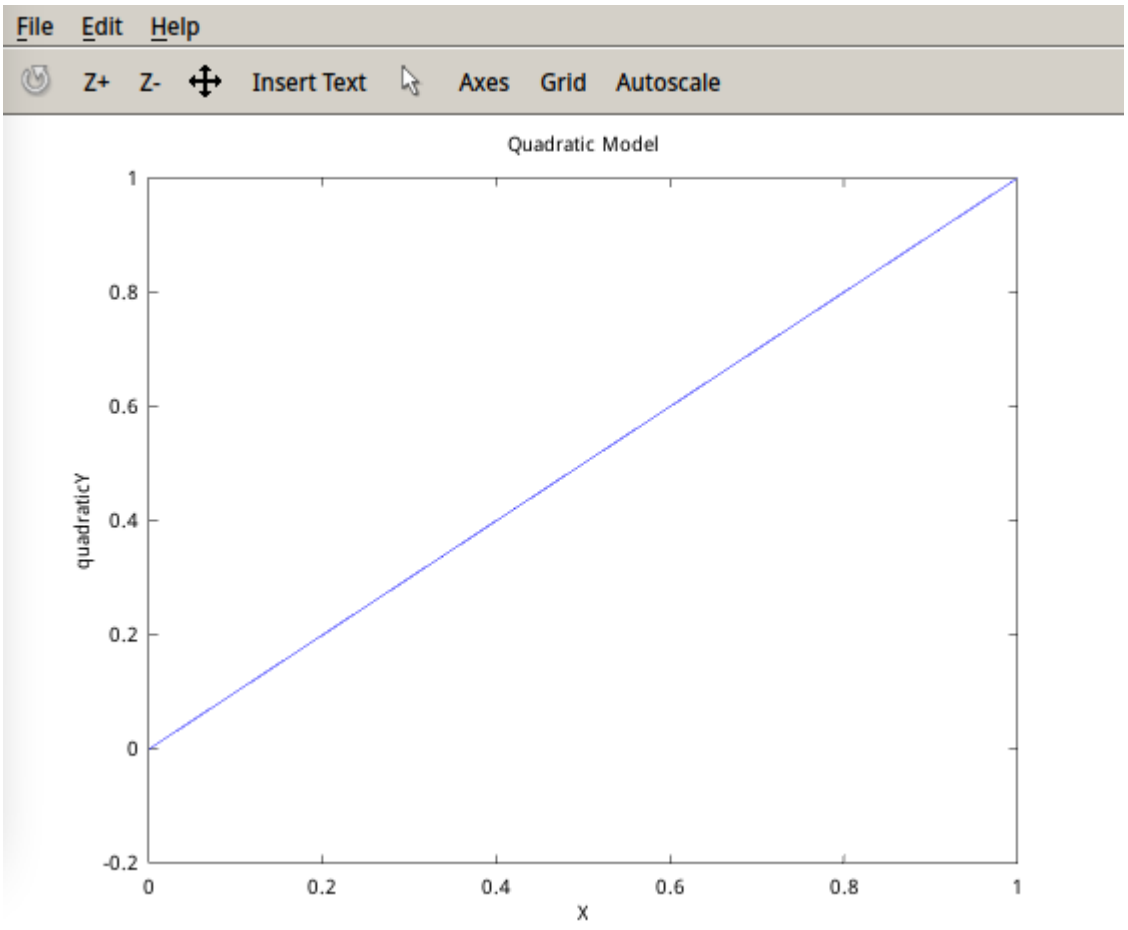
Problem2

Source Code

```
x = [0 : 0.25 : 1]';
y = [0 : 0.25 : 1]';
%rewrite the x matrix
x1 = [x, ones(5,1)];
x2 = [x.^2, x, ones(5,1)];
%solve the coefficients
c1 = x1 \ y;
c2 = x2 \ y;
%generate predicted y
y1 = x1 * c1;
y2 = x2 * c2;
%plot figure of linear model
figure(1);
plot(x, y1), xlabel('X'), ylabel('linearY'), title('Linear Model');
%plot figure of quadratic model
figure(2);
plot(x, y2), xlabel('X'), ylabel('quadraticY'), title('Quadratic Model');
```

Plot





Coefficient

```
>> c1
c1 =

   1.0000e+00
  -2.2044e-16

>> c2
c2 =

  -1.7659e-15
   1.0000e+00
  -1.1102e-16
```