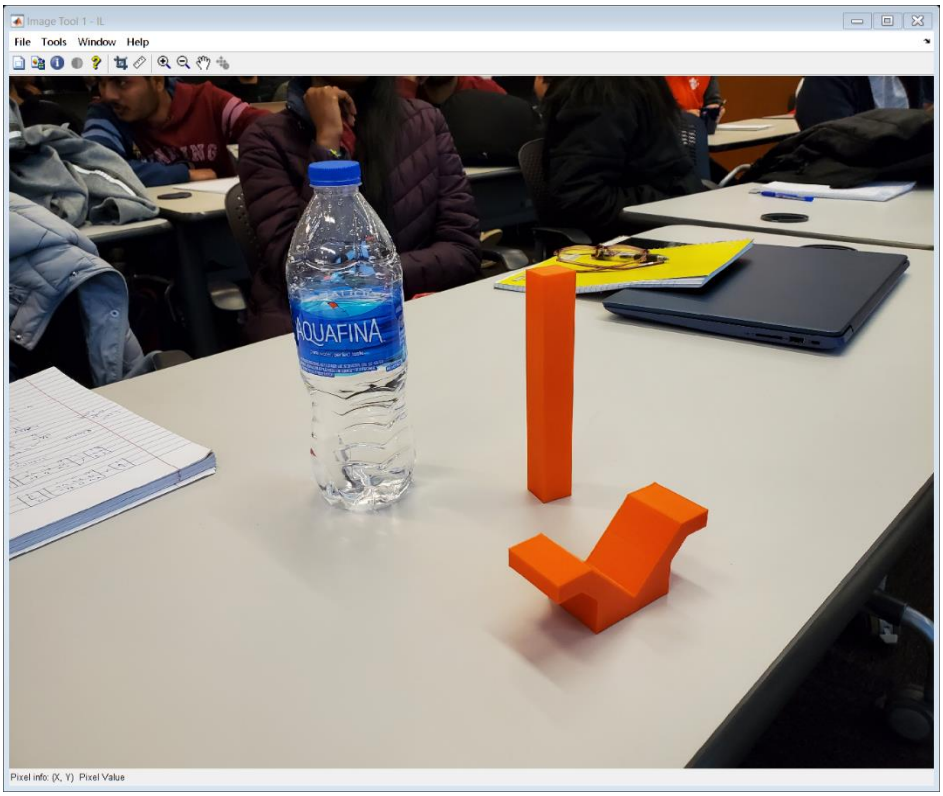
```
close all
clear all
clc

%--------------------------------------------------------------------------Q3_1--------------
--------------------------
%LEFT IMAGE
IL = imread('Left.jpg');
imtool(IL)
```




```
%Point Matrix
AL=[0 0 0]; UAL=[2387, 2223];
BL=[0 35 0];UBL=[2187, 2063];
CL=[100 35 0];UCL=[2819, 1778];
DL=[100,0,0];UDL=[3047, 1899];
EL=[75 0 -40];UEL=[2875, 2251];
FL=[25 0 -40];UFL=[2555, 2431];
GL=[50 0 -30];UGL=[2731, 2273];

% Get coordinates from image
left = [AL(1) AL(2) AL(3) 1 0 0 0 0 -UAL(1)*AL(1) -UAL(1)*AL(2) -UAL(1)*AL(3);
            0 0 0 0 AL(1) AL(2) AL(3) 1 -UAL(2)*AL(1) -UAL(2)*AL(2) -UAL(2)*AL(3);
            BL(1) BL(2) BL(3) 1 0 0 0 0 -UBL(1)*BL(1) -UBL(1)*BL(2) -UBL(1)*BL(3);
            0 0 0 0 BL(1) BL(2) BL(3) 1 -UBL(2)*BL(1) -UBL(2)*BL(2) -UBL(2)*BL(3);
            CL(1) CL(2) CL(3) 1 0 0 0 0 -UCL(1)*CL(1) -UCL(1)*CL(2) -UCL(1)*CL(3);
            0 0 0 0 CL(1) CL(2) CL(3) 1 -UCL(2)*CL(1) -UCL(2)*CL(2) -UCL(2)*CL(3);
            DL(1) DL(2) DL(3) 1 0 0 0 0 -UDL(1)*DL(1) -UDL(1)*DL(2) -UDL(1)*DL(3);
            0 0 0 0 DL(1) DL(2) DL(3) 1 -UDL(2)*DL(1) -UDL(2)*DL(2) -UDL(2)*DL(3);
            EL(1) EL(2) EL(3) 1 0 0 0 0 -UEL(1)*EL(1) -UEL(1)*EL(2) -UEL(1)*EL(3);
            0 0 0 0 EL(1) EL(2) EL(3) 1 -UEL(2)*EL(1) -UEL(2)*EL(2) -UEL(2)*EL(3);
```

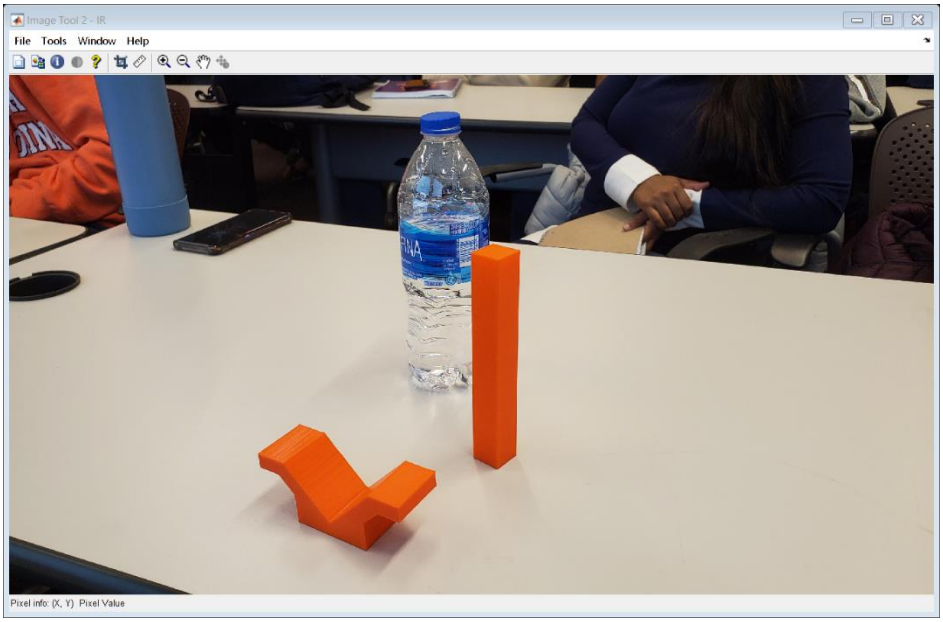
```
            FL(1) FL(2) FL(3) 1 0 0 0 0 -UFL(1)*FL(1) -UFL(1)*FL(2) -UFL(1)*FL(3);
            0 0 0 0 FL(1) FL(2) FL(3) 1 -UFL(2)*FL(1) -UFL(2)*FL(2) -UFL(2)*FL(3);
            GL(1) GL(2) GL(3) 1 0 0 0 0 -UGL(1)*GL(1) -UGL(1)*GL(2) -UGL(1)*GL(3);
            0 0 0 0 GL(1) GL(2) GL(3) 1 -UGL(2)*GL(1) -UGL(2)*GL(2) -UGL(2)*GL(3);];

 %Get values of pixel for respective points
 left_pix =
[UAL(1);UAL(2);UBL(1);UBL(2);UCL(1);UCL(2);UDL(1);UDL(2);UEL(1);UEL(2);UFL(1);UFL(2);UGL(1
);UGL(2)];

 PL = left\left_pix;
 fprintf("11 Parameters of Left camera are %f \n", PL)
```

```
11 Parameters of Left camera are 11.446478
11 Parameters of Left camera are -1.176841
11 Parameters of Left camera are -2.195400
11 Parameters of Left camera are 2387.492256
11 Parameters of Left camera are -0.264238
11 Parameters of Left camera are 0.014600
11 Parameters of Left camera are -10.900646
11 Parameters of Left camera are 2225.564168
11 Parameters of Left camera are 0.001261
11 Parameters of Left camera are 0.002385
11 Parameters of Left camera are -0.001959
```

```
 %-------------------------------------------------------------------------Q3_2------------
-----------------------------
 %RIGHT IMAGE
 IR = imread('Right.jpg');
 imtool(IR)
```




```
 %Point Matrix
 AR=[0 0 0]; UAR=[1088, 1655];
 BR=[0 35 0];UBR=[1268, 1523];
 CR=[100 35 0];UCR=[1862, 1730];
 DR=[100,0,0];UDR=[1763, 1883];
 ER=[75 0 -40];UER=[1658, 2063];
 FR=[25 0 -40];UFR=[1262, 1946];
```

```
 GR=[50 0 -30];UGR=[1394, 1952];

 % Get coordinates from image
 right = [    AR(1) AR(2) AR(3) 1 0 0 0 0 -UAR(1)*AR(1) -UAR(1)*AR(2) -UAR(1)*AR(3);
              0 0 0 0 AR(1) AR(2) AR(3) 1 -UAR(2)*AR(1) -UAR(2)*AR(2) -UAR(2)*AR(3);
              BR(1) BR(2) BR(3) 1 0 0 0 0 -UBR(1)*BR(1) -UBR(1)*BR(2) -UBR(1)*BR(3);
              0 0 0 0 BR(1) BR(2) BR(3) 1 -UBR(2)*BR(1) -UBR(2)*BR(2) -UBR(2)*BR(3);
              CR(1) CR(2) CR(3) 1 0 0 0 0 -UCR(1)*CR(1) -UCR(1)*CR(2) -UCR(1)*CR(3);
              0 0 0 0 CR(1) CR(2) CR(3) 1 -UCR(2)*CR(1) -UCR(2)*CR(2) -UCR(2)*CR(3);
              DR(1) DR(2) DR(3) 1 0 0 0 0 -UDR(1)*DR(1) -UDR(1)*DR(2) -UDR(1)*DR(3);
              0 0 0 0 DR(1) DR(2) DR(3) 1 -UDR(2)*DR(1) -UDR(2)*DR(2) -UDR(2)*DR(3);
              ER(1) ER(2) ER(3) 1 0 0 0 0 -UER(1)*ER(1) -UER(1)*ER(2) -UER(1)*ER(3);
              0 0 0 0 ER(1) ER(2) ER(3) 1 -UER(2)*ER(1) -UER(2)*ER(2) -UER(2)*ER(3);
              FR(1) FR(2) FR(3) 1 0 0 0 0 -UFR(1)*FR(1) -UFR(1)*FR(2) -UFR(1)*FR(3);
              0 0 0 0 FR(1) FR(2) FR(3) 1 -UFR(2)*FR(1) -UFR(2)*FR(2) -UFR(2)*FR(3);
              GR(1) GR(2) GR(3) 1 0 0 0 0 -UGR(1)*GR(1) -UGR(1)*GR(2) -UGR(1)*GR(3);
              0 0 0 0 GR(1) GR(2) GR(3) 1 -UGR(2)*GR(1) -UGR(2)*GR(2) -UGR(2)*GR(3);];

 %Get values of pixel for respective points
 right_pix =
[UAR(1);UAR(2);UBR(1);UBR(2);UCR(1);UCR(2);UDR(1);UDR(2);UER(1);UER(2);UFR(1);UFR(2);UGR(1
);UGR(2)];

 PR = right\right_pix;
 fprintf("11 Parameters of Right camera are %f \n", PR)
```

```
11 Parameters of Right camera are 4.062761
11 Parameters of Right camera are 7.542674
11 Parameters of Right camera are -2.117637
11 Parameters of Right camera are 1086.574142
11 Parameters of Right camera are 0.569018
11 Parameters of Right camera are -0.907111
11 Parameters of Right camera are -8.119630
11 Parameters of Right camera are 1654.362520
11 Parameters of Right camera are -0.001299
11 Parameters of Right camera are 0.001820
11 Parameters of Right camera are -0.001441
```

```
 %-------------------------------------------------------------------------------------
--------------
 %Pixel coordinates of I,J,K,L,M,N,O,P,Q,R
  left_points=[2395, 2307;3043, 1958;2543, 2155;2323, 2003;2747, 1819;2939, 1951;2887,
2111;2571, 2287;2491, 2255;2955, 1999];
  UL= left_points(:,1);
  VL= left_points(:,2);

  right_points=[1100, 1709;1691, 1949;1196, 1703;1373, 1562;1736, 1688;1568, 1838;1544,
1958;1250, 1838;1178, 1742;1610, 1913];
  UR= right_points(:,1);
  VR= right_points(:,2);

  B11=PL(1);
  B12=PL(2);
  B13=PL(3);
  B14=PL(4);
```

```
 B21=PL(5);
 B22=PL(6);
 B23=PL(7);
 B24=PL(8);
 B31=PL(9);
 B32=PL(10);
 B33=PL(11);


 C11=PR(1);
 C12=PR(2);
 C13=PR(3);
 C14=PR(4);
 C21=PR(5);
 C22=PR(6);
 C23=PR(7);
 C24=PR(8);
 C31=PR(9);
 C32=PR(10);
 C33=PR(11);

%%%-------------------------------------------------------------------------Q3_3------------
-----------------------------

points = [];
pointnames=['I' 'J' 'K'  'L' 'M' 'N' 'O' 'P' 'Q' 'R'];
for i = 1:10
A=[B11-B31*UL(i) B12-B32*UL(i) B13-B33*UL(i);...
     B21-B31*VL(i) B22-B32*VL(i) B23-B33*VL(i);...
     C11-C31*UR(i) C12-C32*UR(i) C13-C33*UR(i);...
     C21-C31*VR(i) C22-C32*VR(i) C23-C33*VR(i)];

B=[UL(i)-B14; ...
    VL(i)-B24; ...
    UR(i)-C14; ...
    VR(i)-C24];
X=A\B;
 points(i,(1:3)) = X;
 fprintf("Cordinates of the point %s are [X,Y,Z] : %f\n", pointnames(i),X)
end
```

```
Cordinates of the point I are [X,Y,Z] : 1.856984
Cordinates of the point 9.518110e-01 are [X,Y,Z] : -11.965747
Cordinates of the point J are [X,Y,Z] : 93.887533
Cordinates of the point -5.725228e+00 are [X,Y,Z] : -4.100390
Cordinates of the point K are [X,Y,Z] : 19.662044
Cordinates of the point -2.096263e+00 are [X,Y,Z] : 1.108179
Cordinates of the point L are [X,Y,Z] : 19.378364
Cordinates of the point 3.474331e+01 are [X,Y,Z] : 0.301516
Cordinates of the point M are [X,Y,Z] : 82.747264
Cordinates of the point 3.073108e+01 are [X,Y,Z] : 2.855839
Cordinates of the point N are [X,Y,Z] : 77.340202
Cordinates of the point -4.028171e+00 are [X,Y,Z] : 3.735639
Cordinates of the point O are [X,Y,Z] : 71.066877
Cordinates of the point -4.397911e+00 are [X,Y,Z] : -16.319329
Cordinates of the point P are [X,Y,Z] : 26.450309
Cordinates of the point -4.102132e-01 are [X,Y,Z] : -21.432239
```

```
Cordinates of the point Q are [X,Y,Z] : 14.801353
Cordinates of the point 2.723427e-01 are [X,Y,Z] : -11.220775
Cordinates of the point R are [X,Y,Z] : 81.603668
Cordinates of the point -3.848054e+00 are [X,Y,Z] : -5.526517
```

```
%%%-------------------------------------------------------------------------Q3_4------------
-----------------------------
%Pixel coordinates of I,J,K,L,M,N,O,P,Q,R
 left_points=[2479, 847;2335, 826;2378, 824;2451, 1829];
 UL= left_points(:,1);
 VL= left_points(:,2);

 right_points=[2128, 767;2224, 776;2220, 769;2126, 1721];
 UR= right_points(:,1);
 VR= right_points(:,2);

  B11=PL(1);
 B12=PL(2);
 B13=PL(3);
 B14=PL(4);
 B21=PL(5);
 B22=PL(6);
 B23=PL(7);
 B24=PL(8);
 B31=PL(9);
 B32=PL(10);
 B33=PL(11);


 C11=PR(1);
 C12=PR(2);
 C13=PR(3);
 C14=PR(4);
 C21=PR(5);
 C22=PR(6);
 C23=PR(7);
 C24=PR(8);
 C31=PR(9);
 C32=PR(10);
 C33=PR(11);



bar_points = [];
for i = 1:4

A=[B11-B31*UL(i) B12-B32*UL(i) B13-B33*UL(i);...
     B21-B31*VL(i) B22-B32*VL(i) B23-B33*VL(i);...
     C11-C31*UR(i) C12-C32*UR(i) C13-C33*UR(i);...
     C21-C31*VR(i) C22-C32*VR(i) C23-C33*VR(i)];

B=[UL(i)-B14; ...
    VL(i)-B24; ...
```

```
    UR(i)-C14; ...
    VR(i)-C24];
 X=A\B;

    bar_points(i,(1:3)) = X;
 end
 points_X = bar_points(1,:)
```

```
points_Y = 1×3
   102.5985  102.1624  103.6220
```

```
 points_Y = bar_points(2,:)
```

```
points_Y = 1×3
   85.0065  107.1724  103.6220
```

```
 points_Z = bar_points(3,:)
```

```
points_Z = 1×3
   82.7372  108.6796  103.5307
```

```
 points_W = bar_points(4,:)
```

```
points_W = 1×3
   101.3461   99.4886  -39.6753
```

```


 %Length
 l = sqrt((points_W(1,3)-points_X(1,3))^2);
 fprintf("The length of the bar is %f mm \n", l)
```

```
The length of the bar is 142.937205 mm
```

```
 %Width
 w = sqrt((points_X(1,1)-points_Y(1,1))^2);
 fprintf("The width of the bar is %f mm \n", w)
```

```
The width of the bar is 19.665100 mm
```

```


 %Height
 h = sqrt((points_X(1,2)-points_Z(1,2))^2);
 fprintf("The height of the bar is %f mm \n", h)
```

```
The height of the bar is 20.565930 mm
```

```


 %%%-------------------------------------------------------------------------Q3_5------------
-----------------------------
 %Volume
 v = l*w*h;
 fprintf("The volume of the bar is %f mm \n", v)
```

```
The volume of the bar is 604563.61 mm
```