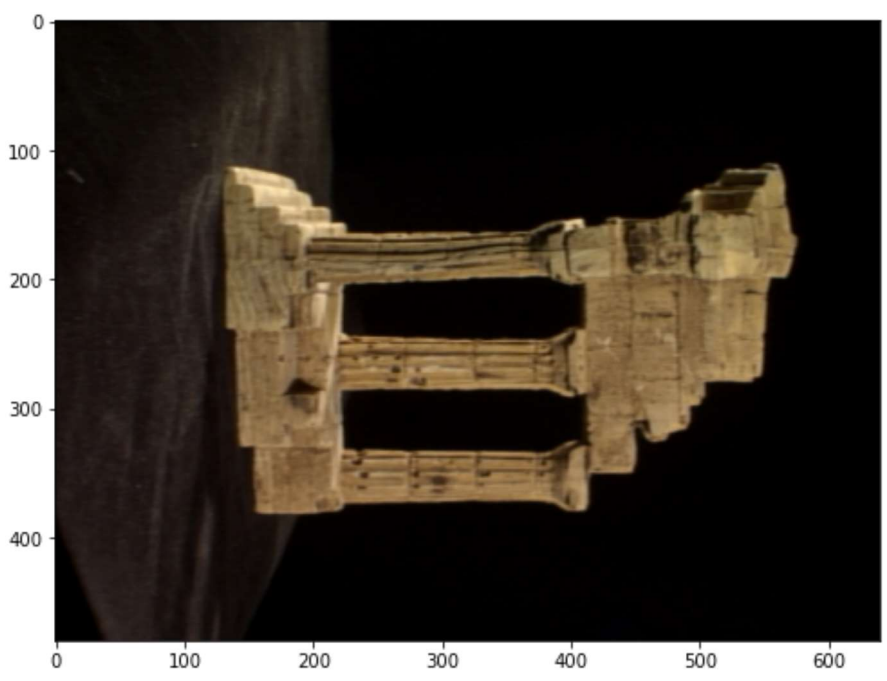
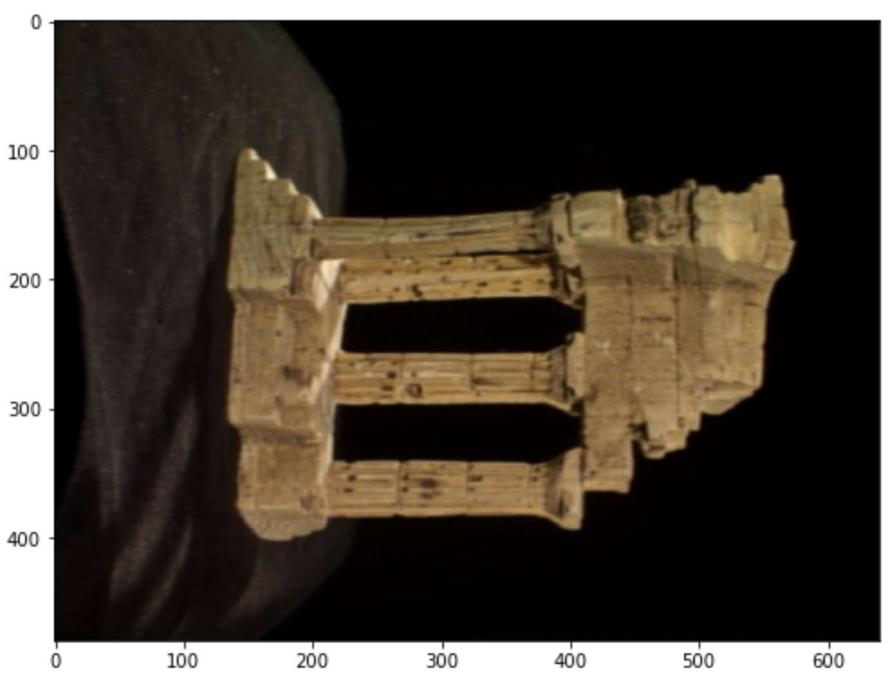
Name : Limalka Sadith

Index No : 190538N

In [ ]:

```
#Q1
import numpy as np
import matplotlib.pyplot as plt
import cv2 as cv

f = open(r'templeSparseRing/templeSR_par.txt', 'r')
assert f is not None

n = int(f.readline())
l = f.readline().split()
im1_fn = l[0]

K1 = np.array([float(i) for i in l[1:10]]).reshape((3,3))
R1 = np.array([float(i) for i in l[10:19]]).reshape((3,3))
t1 = np.array([float(i) for i in l[19:22]]).reshape((3,1))

l = f.readline().split()
im2_fn = l[0]

K2 = np.array([float(i) for i in l[1:10]]).reshape((3,3))
R2 = np.array([float(i) for i in l[10:19]]).reshape((3,3))
t2 = np.array([float(i) for i in l[19:22]]).reshape((3,1))

fig, ax = plt.subplots( 1, 2, figsize = (18, 8))

im_1 = cv.imread(r'templeSparseRing/' + im1_fn, cv.IMREAD_COLOR)
im_2 = cv.imread(r'templeSparseRing/' + im2_fn, cv.IMREAD_COLOR)

ax[0].imshow(cv.cvtColor(im_1, cv.COLOR_BGR2RGB))
ax[1].imshow(cv.cvtColor(im_2, cv.COLOR_BGR2RGB))
plt.show()
```





In [ ]:

```
#Q2, Q3, Q4
sift = cv.xfeatures2d.SIFT_create()
kp1, decs1 = sift.detectAndCompute(im_1, None)
kp2, decs2 = sift.detectAndCompute(im_2, None)

FLANN_INDEX_KDTREE = 1
index_params = dict(algorithm =FLANN_INDEX_KDTREE, trees = 5 )
search_params = dict(checks=100)
flann = cv.FlannBasedMatcher(index_params, search_params)
matches = flann.knnMatch(decs1, decs2, k=2)

good = []
pts1 = []
pts2 = []
for i, (m,n) in enumerate(matches):
    if m.distance < 0.7*n.distance:
        good.append(m)
        pts1.append(kp1[m.queryIdx].pt)
        pts2.append(kp2[m.trainIdx].pt)

pts1 = np.array(pts1)
pts2 = np.array(pts2)

F,mask = cv.findFundamentalMat(pts1, pts2, cv.FM_RANSAC)
print ("F:\n",F)

E = K2.T @ F @ K1
print ("E:\n",E)

retval, R, t, mask = cv.recoverPose(E, pts1, pts2, K1)
```

```
R_t_1 = np.concatenate((R1, t1), axis =1) # 3 x 4
R2_ = R1 @ R
t2_ = R1 @ t
R_t_2 = np.concatenate((R2_, t2_), axis =1)

P1 = K1 @ np.hstack((R1, t1))
P2_ = K2 @ R_t_2
```

```
F:
 [[ 1.49034037e-06  1.44154168e-05 -2.53948320e-02]
 [-8.25788252e-06  8.67005344e-08  4.00767127e-03]
 [ 2.27526901e-02 -7.28270380e-03  1.00000000e+00]]
E:
 [[ 3.44509489e+00  3.34434549e+01 -3.25145725e+01]
 [-1.91581088e+01  2.01870994e-01  2.33852108e+00]
 [ 3.21786978e+01 -4.43004055e+00 -6.22266684e-03]]
```

In [ ]:

```
#Q5
points4d = cv.triangulatePoints(P1, P2_, pts1.T, pts2.T)
points4d /= points4d[3, :]
import matplotlib.pyplot as plt
X = points4d[0, :]
Y = points4d[1, :]
Z = points4d[2, :]

fig = plt.figure(1)
ax = fig.add_subplot(111, projection='3d')

ax.scatter(X, Y, Z, s=1, cmap='gray')
plt.show()
```