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ECE 2390 – Fall 2021

Problem Set 3 Report

PROBLEM 1

1a.

```
##### M #####  
[[-0.45827554  0.29474237  0.01395746 -0.0040258 ]  
 [ 0.05085589  0.0545847  0.54105993  0.05237592]  
 [-0.10900958 -0.17834548  0.04426782 -0.5968205 ]]
```

```
##### (U, V) PROJECTION #####  
[[ 1.04675229 -0.36260293]  
 [-1.68404882 -0.39789506]  
 [-0.94477667 -0.42048269]  
 [ 1.06696778  0.06863591]  
 [ 0.60831667 -0.07645742]  
 [ 1.25533763 -0.64667157]  
 [-0.26987846  0.86279526]  
 [-0.45690007 -0.36669535]  
 [-0.79178788  0.02891519]  
 [ 0.73206965  0.63635264]  
 [-1.05449234  0.32887551]  
 [ 0.34846672  0.33835573]  
 [ 0.31616771  0.1168917 ]  
 [-0.43138514  0.02509231]  
 [-0.48588986  0.29930809]  
 [ 0.61188852  0.08208573]  
 [-0.40810919  0.29262215]  
 [-0.11190705 -0.30046996]  
 [ 0.51226126 -0.05690154]  
 [ 0.14190608 -0.45184301]]
```

I generated the $\langle u, v \rangle$ projections for all 20 points, but the first and last ones are at the beginning and end of the array, respectively.

```
##### RESIDUAL CALCULATION #####  
0.00016877578217196153
```

1b.

```
##### RESIDUALS FOR EACH TRIAL #####
[[2.16579147e+04 4.31886489e+04 2.18320110e+04]
 [2.22292139e+04 6.83654670e+00 2.17389855e+04]
 [2.10702915e+04 2.33521890e+00 2.16851016e+04]
 [2.78144431e+00 3.02679736e+00 2.18409181e+04]
 [1.82940683e+02 2.06469606e+04 2.15774086e+04]
 [2.11740331e+04 6.35483882e-01 4.38438045e+04]
 [2.20067953e+04 2.19107553e+04 4.36555932e+04]
 [4.04064371e+04 2.20066831e+04 2.20401743e+04]
 [2.15618737e+04 3.37837538e+00 1.42446490e+00]
 [3.04309229e+00 6.59194464e+00 4.34997345e+04]]
```

It seems like generally, the residual values increase as k increases. This occurs because the extra points result in a phenomenon similar to overfitting, which causes the residual to be higher on the set of 4 points used to check the residual.

```
##### BEST M #####
[[ 6.76145886e-03 -3.81529875e-03 -1.58247713e-03 -8.29756275e-01]
 [ 1.50268377e-03 1.04861479e-03 -7.22343902e-03 -5.58010011e-01]
 [ 7.39029297e-06 3.72920322e-06 -2.08164671e-06 -3.32246279e-03]]
```

1c.

```
##### CAMERA CENTER #####
[[303.09873637]
 [307.18729308]
 [ 30.4214435 ]]
```

PROBLEM 2

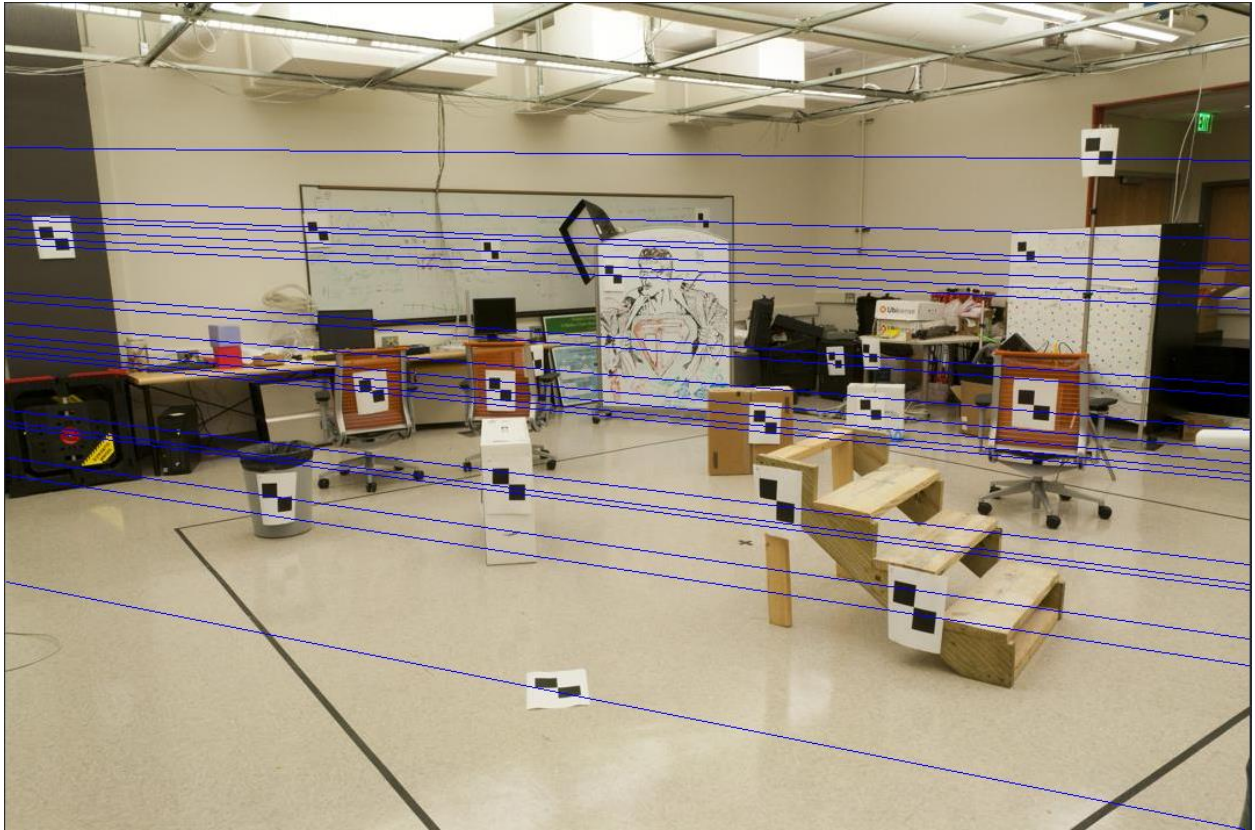
2a. $F \sim$ is below.

```
##### F GENERATED FROM LEAST SQUARES FUNCTION #####
[[-6.60698417e-07 8.82396296e-06 -9.07382302e-04]
 [ 7.91031621e-06 1.21382933e-06 -2.64234650e-02]
 [-1.88600198e-03 1.72332901e-02 9.99500092e-01]]
```

2b. F is below.

```
##### RANK 2 F AFTER DECOMPOSING #####
[[-5.36532415e-07 8.83981093e-06 -9.07836099e-04]
 [ 7.90760078e-06 1.21382365e-06 -2.64366809e-02]
 [-1.88694534e-03 1.72419095e-02 1.00000000e+00]]
```

2c. ps3-2-c-1.png



Ps3-2-c-2.png

