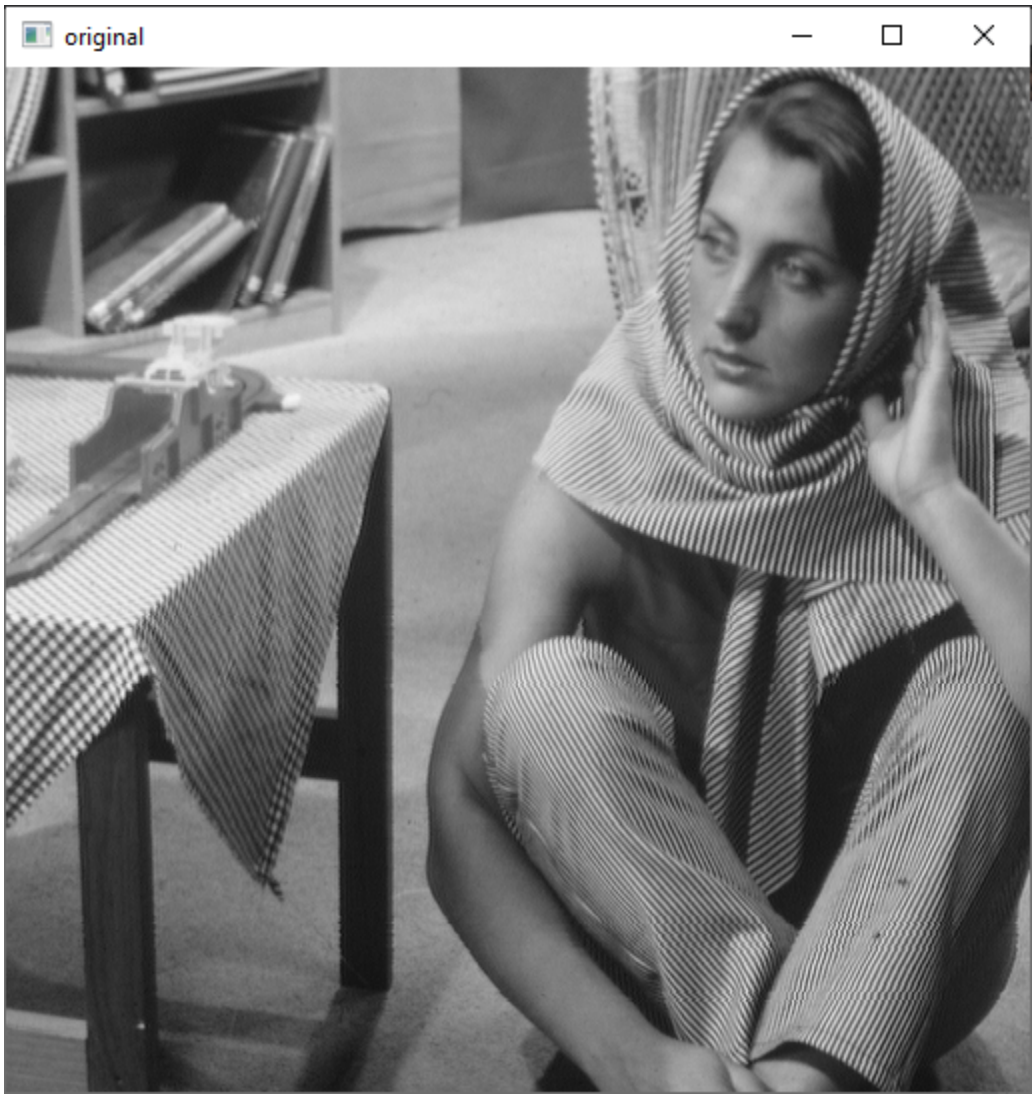
DIP ASSIGNMENT 1

Q3: Bilinear Interpolation: <u>Factor of 1.5 on both axes</u>



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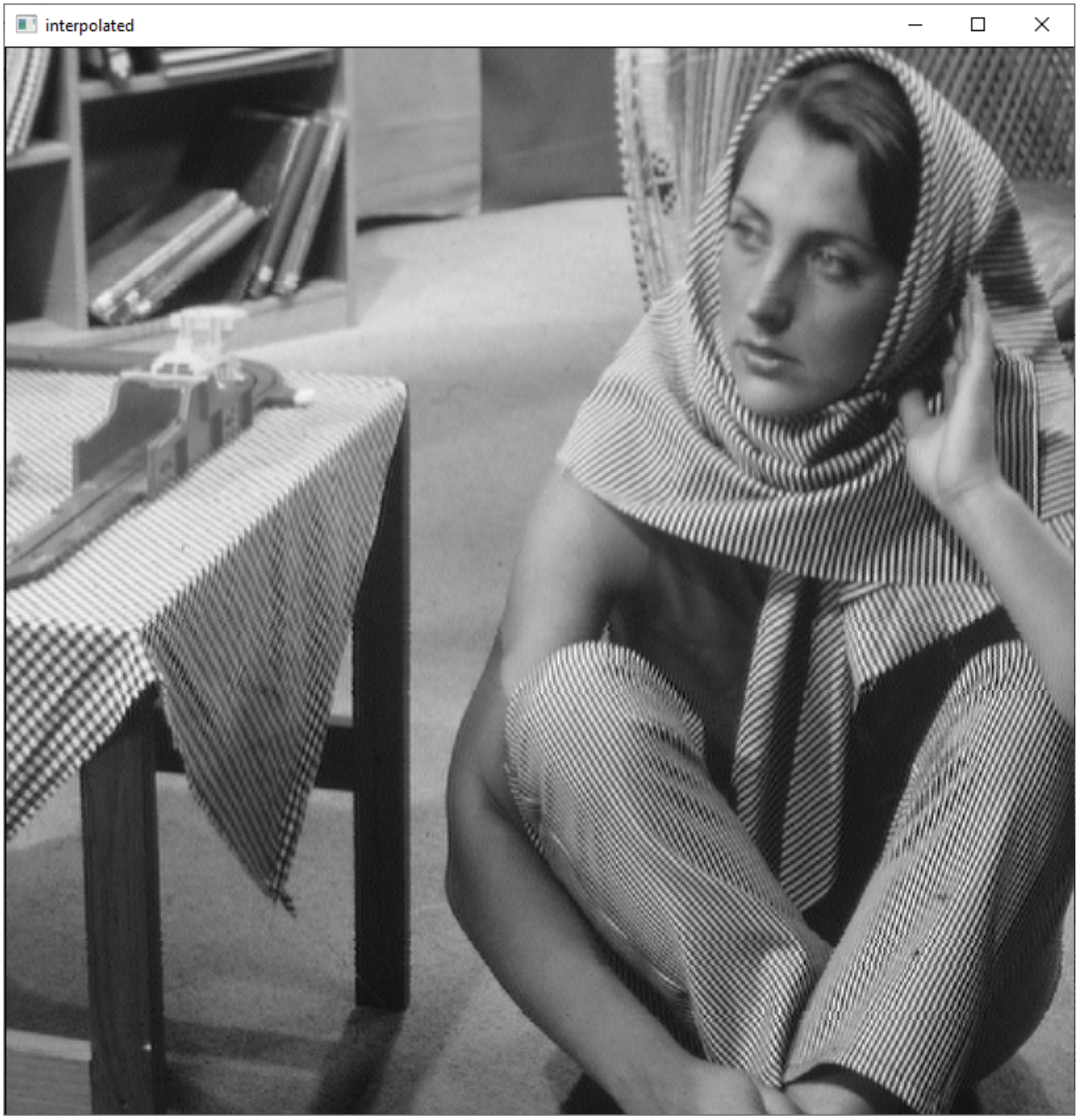

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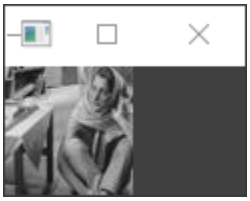
Q4: Geometric Transformations: rotate(pi/4) → scale(2,2) → translate(30,30)

Note:

- *While building the transformed image, we have assumed an output dimension of 500x500 which is divided into 4 quadrants, thus on both the axes, we have -250 to 249.*
- *The output we see below has the center as the origin.*
- *The output dimension can also be supplied as an optional argument to my GeometricTransformation function. Furthermore, note that the bottom right quadrant corresponds to the positive axes.*

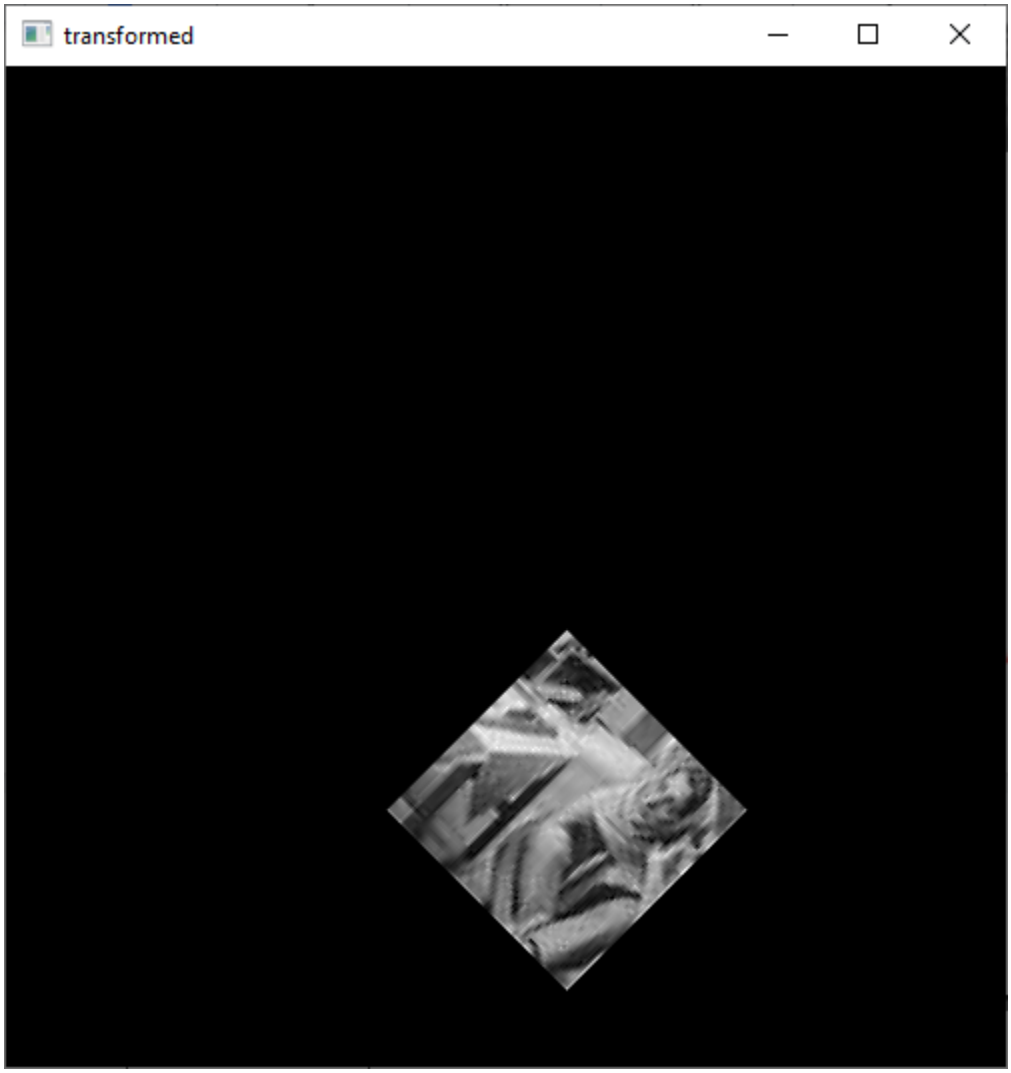
Input Image:



Transformation Matrix:

```
[[ 1.41421356 -1.41421356  0.        ]
 [ 1.41421356  1.41421356  0.        ]
 [30.         30.          1.        ]]
```

Output Image:



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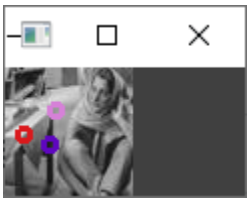
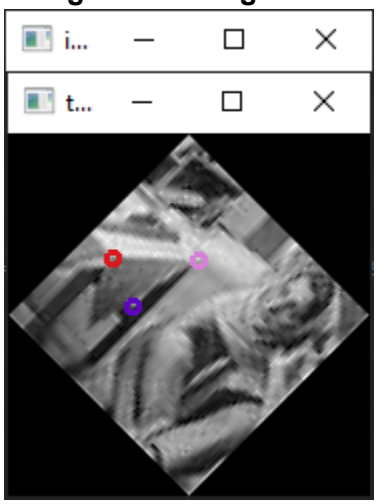
Q5: Image Registration

- **Note:** *Taking the transformed image from the output of the above question and not cropping the window bar to demonstrate the difference.*

a. Taking pivot points from the user input

Reference Image	Unregistered Image
	

```
PS C:\Users\Dushyant-PC\Desktop\2018033_DIP_A1\P_DushyantPanchal_2018033> python .\Dushyant_2018033_code.py Q5a
X = np.array([[21, 25, 1]])
X = np.array([[21, 25, 1], [33, 9, 1]])
X = np.array([[21, 25, 1], [33, 9, 1], [38, 22, 1]])
U = np.array([[94, 96, 1]])
U = np.array([[94, 96, 1], [93, 53, 1]])
U = np.array([[94, 96, 1], [93, 53, 1], [117, 63, 1]])
```

Taking final U and X from here to the next part:

```
X = np.array([[21, 25, 1], [33, 9, 1], [38, 22, 1]])
U = np.array([[94, 96, 1], [93, 53, 1], [117, 63, 1]])
```

b. Registering the unregistered image


```
PS C:\Users\Dushyant-PC\Desktop\2018033_DIP_A1\P_DushyantPanchal_2018033> python .\Dushyant_2018033_code.py Q5b
[[ 3.27788650e-01  3.90410959e-01  5.55111512e-17]
 [-2.86692759e-01  3.63013699e-01 -2.77555756e-17]
 [ 1.77103718e+01 -4.65479452e+01  1.00000000e+00]]
```

Transformation Matrix Calculated for registering back unregistered image, inv(Z):

```
[[ 3.27788650e-01  3.90410959e-01  5.55111512e-17]
 [-2.86692759e-01  3.63013699e-01 -2.77555756e-17]
 [ 1.77103718e+01 -4.65479452e+01  1.00000000e+00]]
```

Transformation Matrix that resulted the unregistered image, Z:

```
[[ 1.57203390e+00 -1.69067797e+00 -1.30270831e-16]
 [ 1.24152542e+00  1.41949153e+00 -3.04839756e-17]
 [ 2.99491525e+01  9.60169492e+01  1.00000000e+00]]
```

Significant difference because my unregistered image has a window bar increasing the y-direction coordinate.