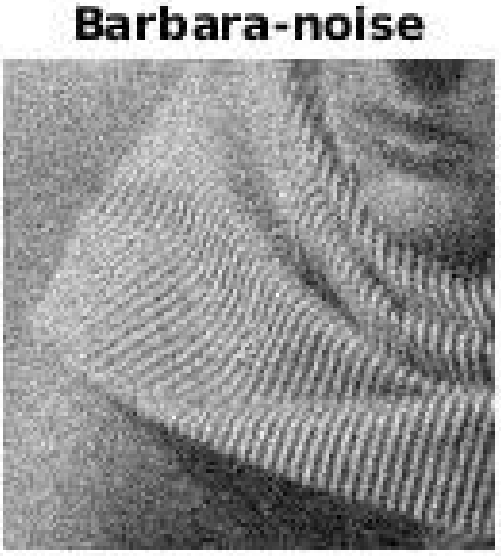
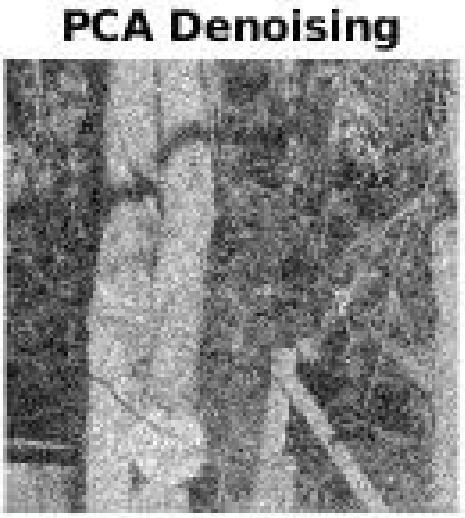
Q5)
Original images:-

Gaussian noise:-

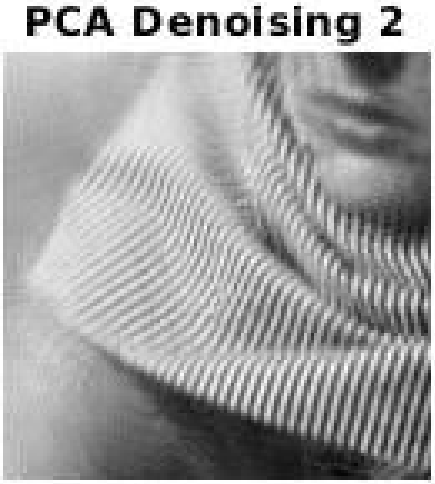


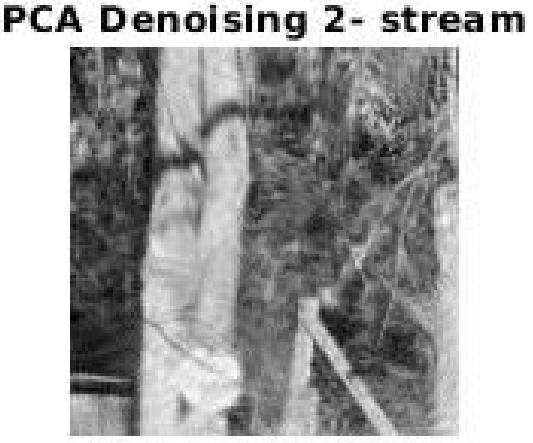
a) Final image:-



Rmse of barbara:- 0.1297
Rmse of stream:- 0.1185

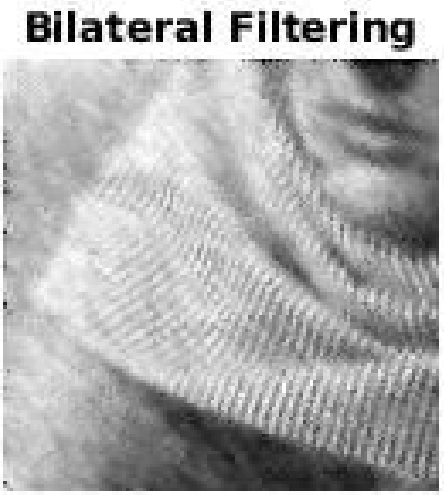
b) Final image:-





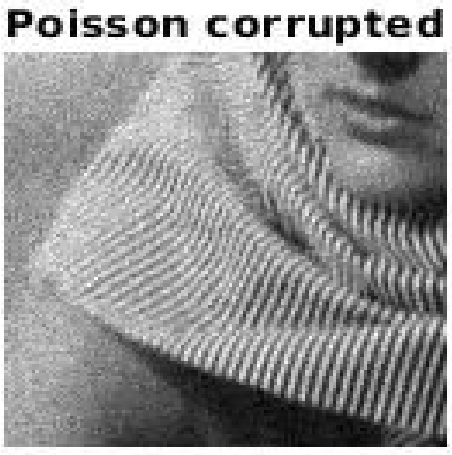
Rmse of barbara:- 0.0528
Rmse of stream:- 0.0742

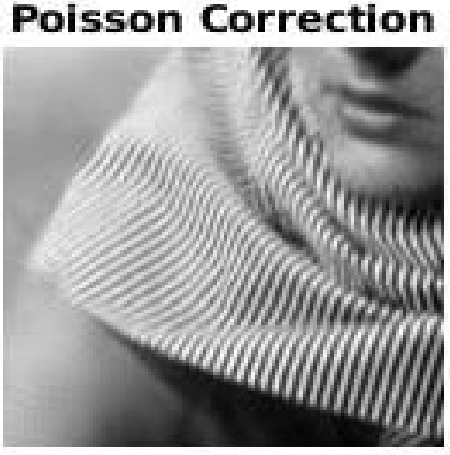
c) Final image:-



We can see that PCA based approach performs better than bilateral filtering. Generally bilateral filtering tries smooth the image preserving the edges, but in this case as the discontinuities are large. Bilateral filtering tries to find similar patches and averages the pixel values within one patch based on distance. This distance is calculated based on spatial and intensity distance. Here it is unable to determine the difference between a discontinuity (noise) and an edge, and thus we are able to see a sufficient amount of noise in the image.
PCA based approach on the other hand performs a dimensional reductionality and tries to separate the image and noise based on statistical methods.

d) Final image:-

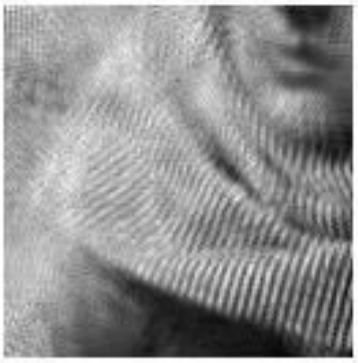




Rmse of image is: 0.0369
For im = im/20:

Poisson corrupted(im/20)

Poisson Correction(im/20)



Rmse of image: 0.9519

When the image is divided by 20, this gives us an image of much lower exposure. This can be seen in the image - it has a dark overlay and grainy look.

If we compare the results purely on basis of RMSE values for im has a better performance but the reason is that the noise added in case 2 is more prominent than case 1 (noise added to im/20 instead of just adding to im).

e) Final image:-

Clamping intensity values

Rmse of the image:- 0.1293

This approach is correct because the intensity values for the image cannot be outside [0,255] range. Adding noise to the image makes the intensity value go out of the range, so clamping the intensities gives us a better result.