Solution to analysis in Home Assignment 1

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1-4-2021

Analysis

In this report, i have analysed the questions related to home assignment 1. I have discussed my solutions with Hariharan Gopinath. Hereby, i consent that the results produced are my own results.

1 Transformation of Gaussian random variables

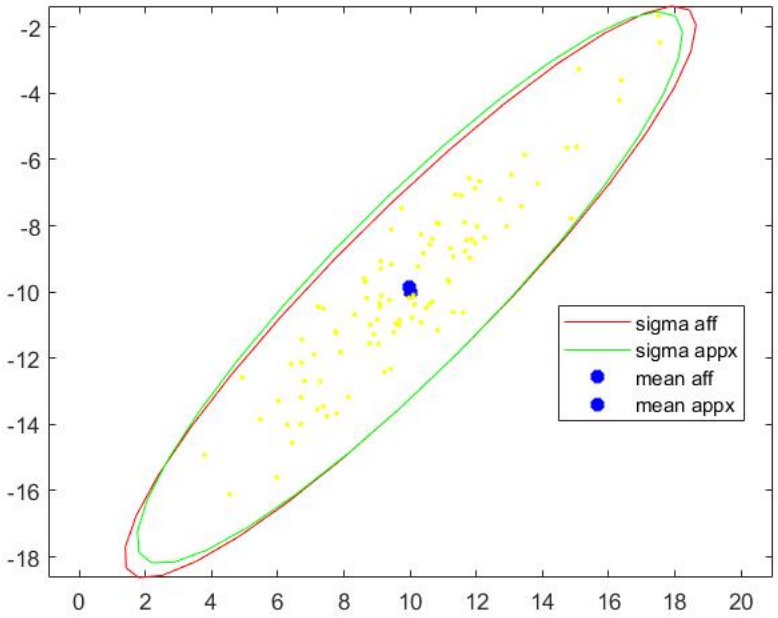

Figure 1: No. of samples =100

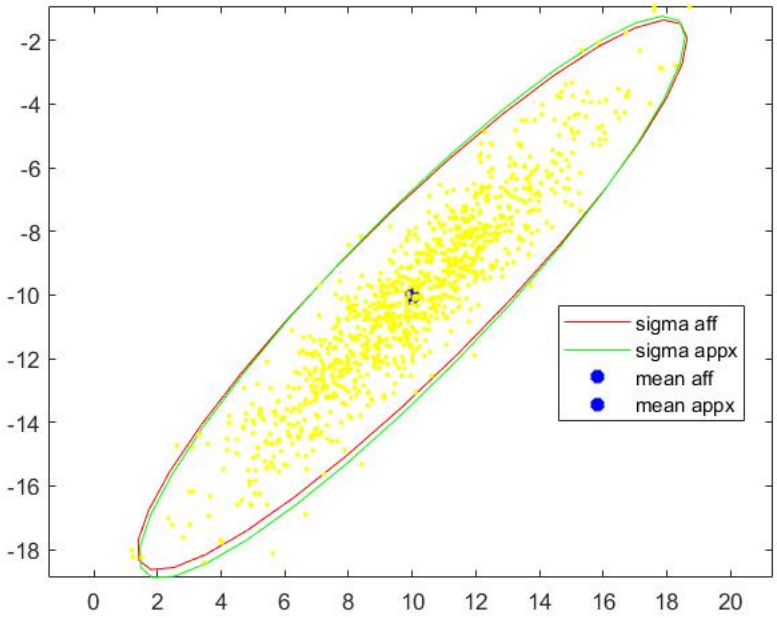

Figure 2: No. of samples =1000

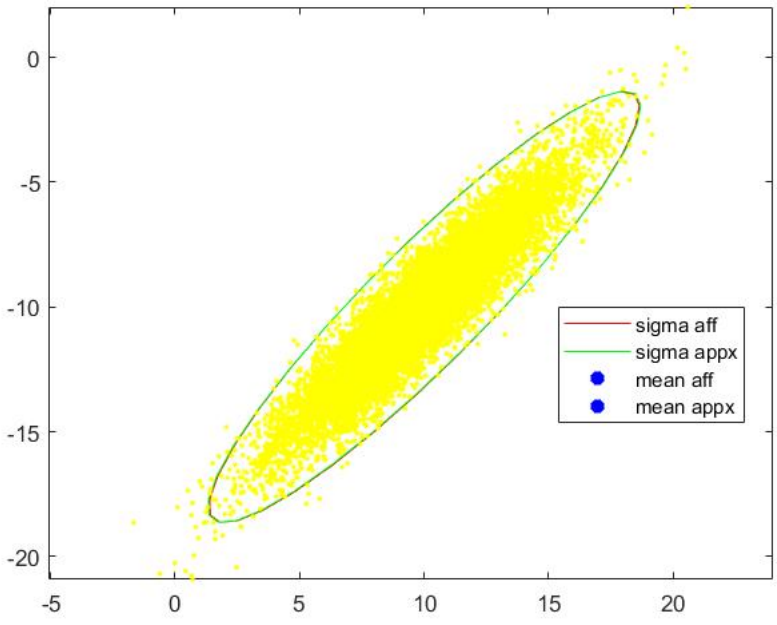

Figure 3: No. of samples =10000

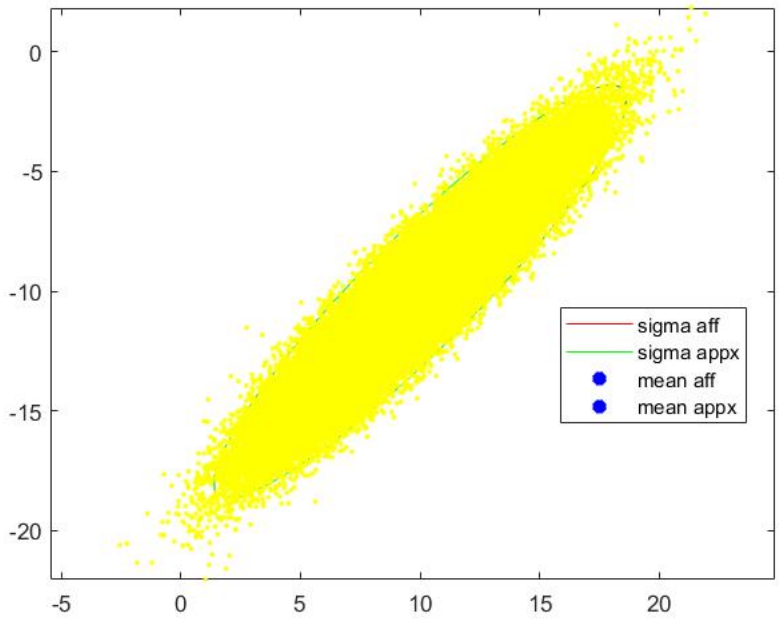

Figure 4: No. of samples =100000

From the above images we can infer that as the sample number increases, the ellipse fit matches precisely. Also as the sample number increases, the number of samples outside the 3 sigma curves increases.

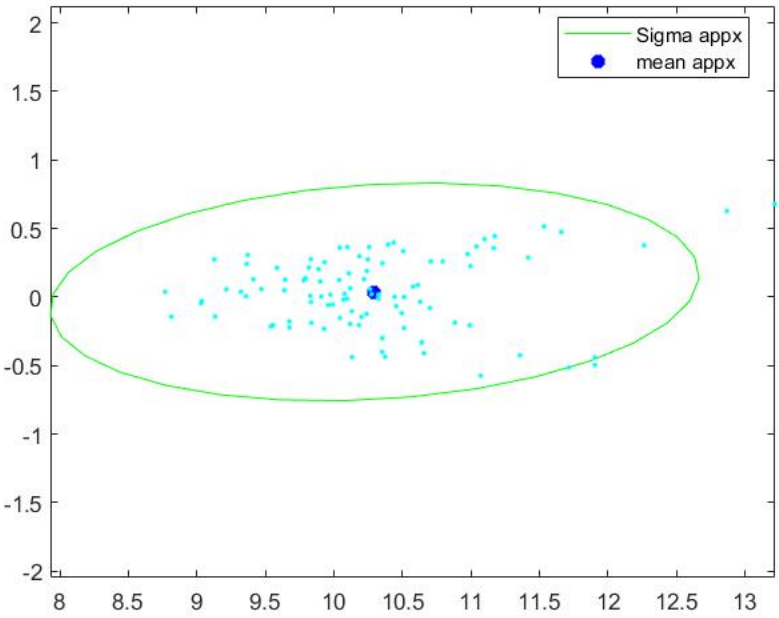

Figure 5: No. of samples =100

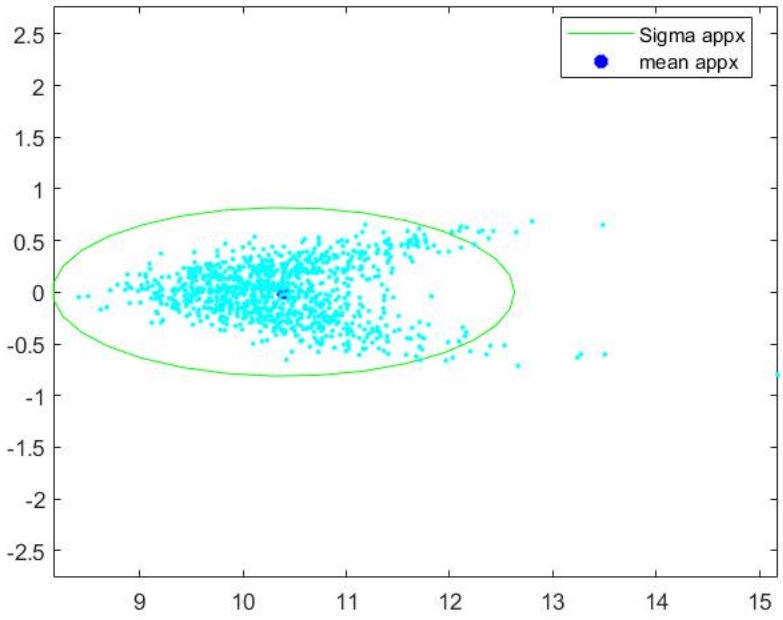

Figure 6: No. of samples =1000

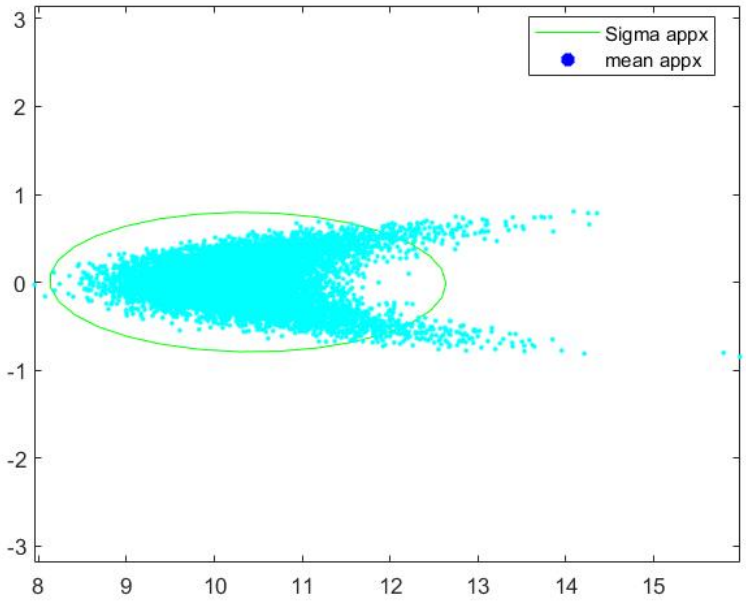

Figure 7: No. of samples =10000

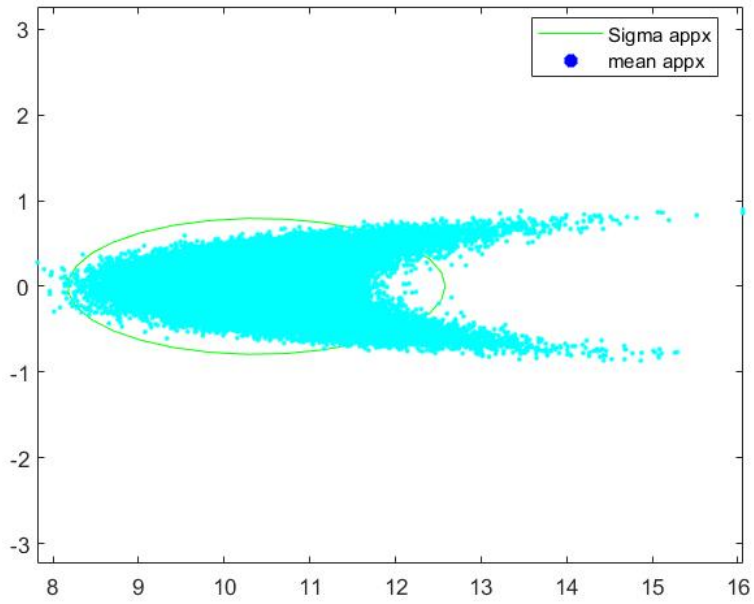

Figure 8: No. of samples =100000

The above images infer that as the number of samples increases, the samples outside the 3 sigma curve also increases. But most of the sample points lie within the ellipse.

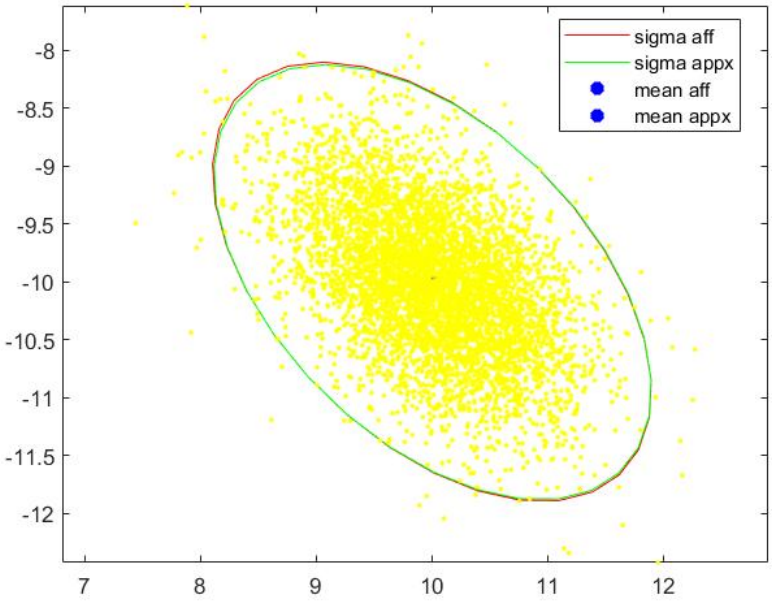

Figure 9: Approximate and affine Gaussian transform

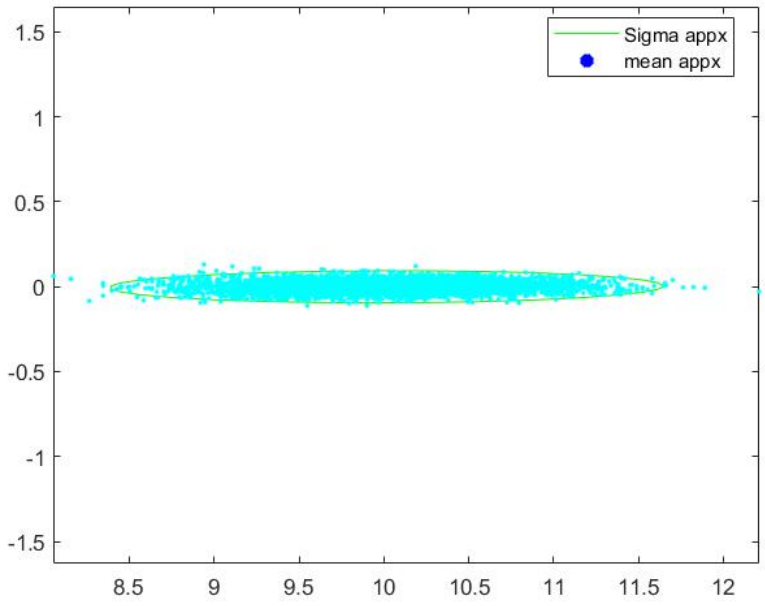

Figure 10: Approximate and affine Gaussian transform

Comparing the above two plots with task 1 a and task 1 b, it is inferred that, as the new value of variance is less most of the sample points are found to converge within the 3 sigma circle.

2 Vacation in Turkey

The joint distribution at Antalya and Izmir is shown below.

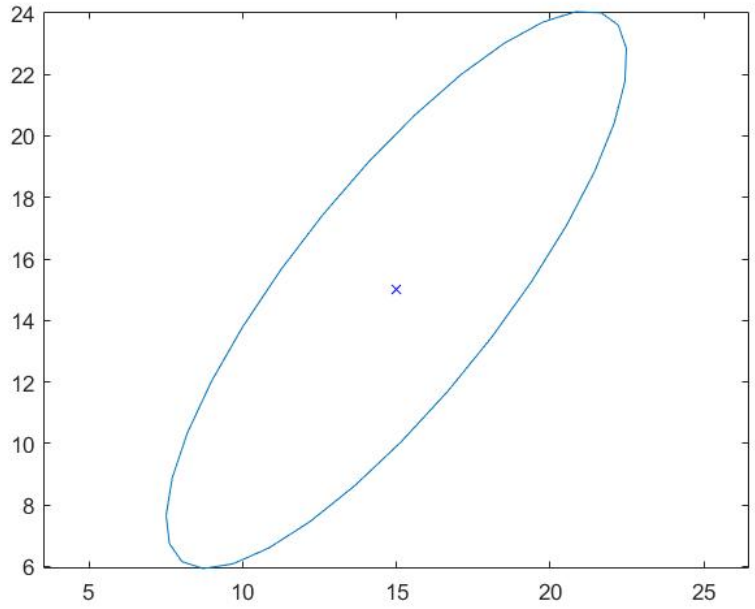

Figure 11: 3 sigma ellipsoid for lake temperature of Antalya

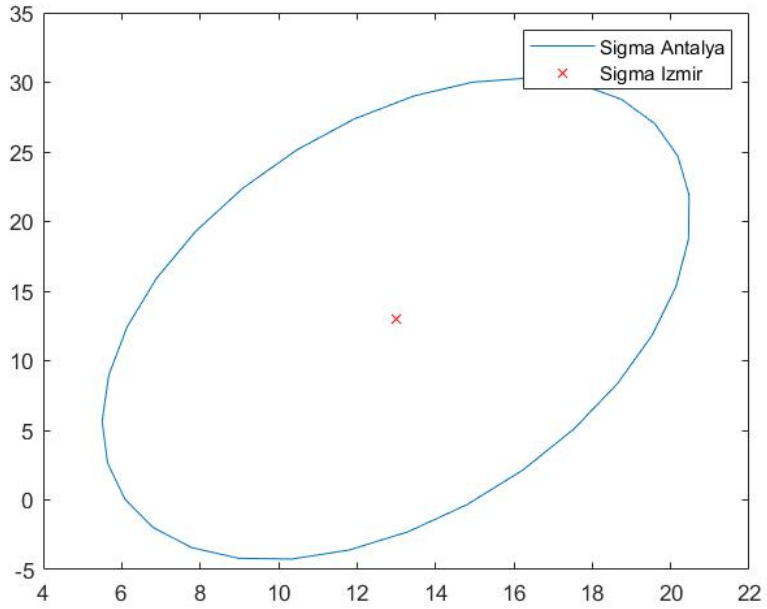

Figure 12: 3 sigma ellipsoid for lake temperature of Izmir

Comparing the above two plots, The variance values are higher in case of Izmir than in Antalya. This is because the extreme sample points are far away from the mean in case of Izmir.

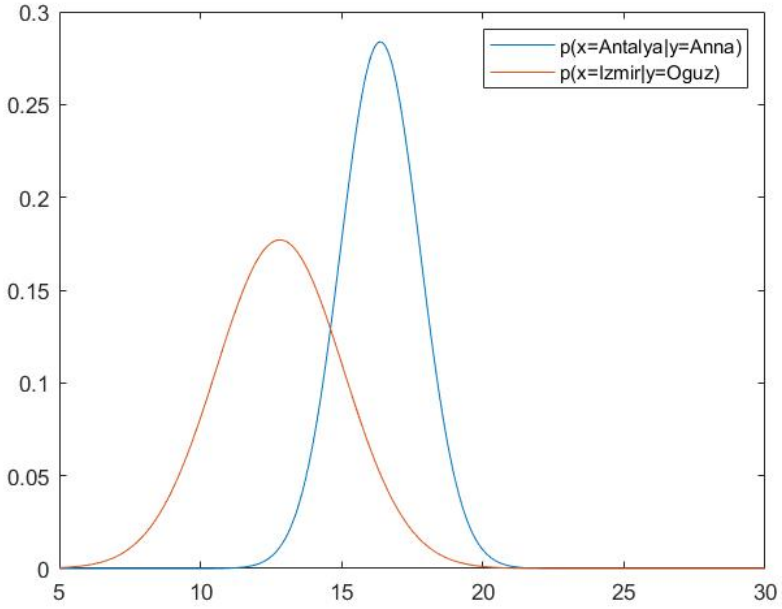

Figure 13: Posterior densities of both the lakes provided the friend's forecast

From the above posterior mean graphs, we can see that the values of mean are found to be close to the actual values of mean. Hence the variance is found to be less. From the posterior distribution graphs, The temperature in Antalya is found to be 16 degree Celsius.whereas in Izmir its found to be 13 degree Celsius. As the temperature is within the required limits, it is advisable to enjoy the summer at Antalya.

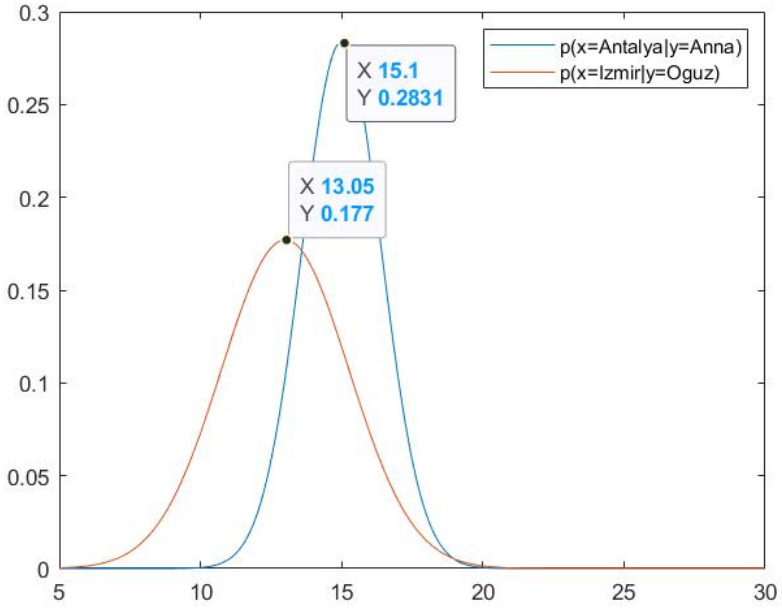

Figure 14: posterior densities

By comparing the mean values with the previous mean values are reduced from above 16 to 15.1 degrees in case of Antalya where the mean is 15 degree Celsius and in case of Izmir it has been found to be increasing slightly where the mean is 13 degree Celsius.

3 MMSE and MAP estimates for Gaussian mixture posteriors

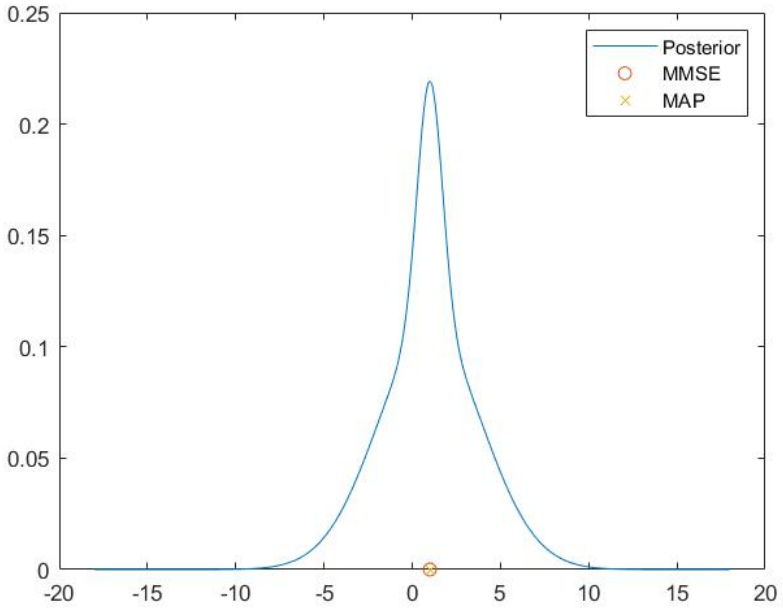

Figure 15: Posterior densities along with both MMSE and MAP estimates
B

The MAP and MMSE distribution are the same which inferrs that the expected value and the likelihood are the same.

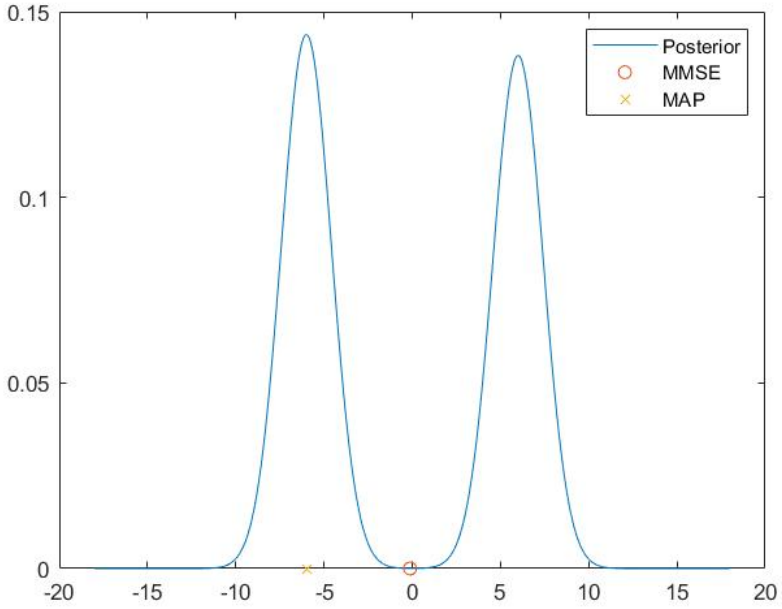

Figure 16: Posterior densities along with both MMSE and MAP estimates

Here the MAP and the MMSE values are at different points, where the MAP estimates the mode and the MMSE estimates the mean from the posterior density plot.

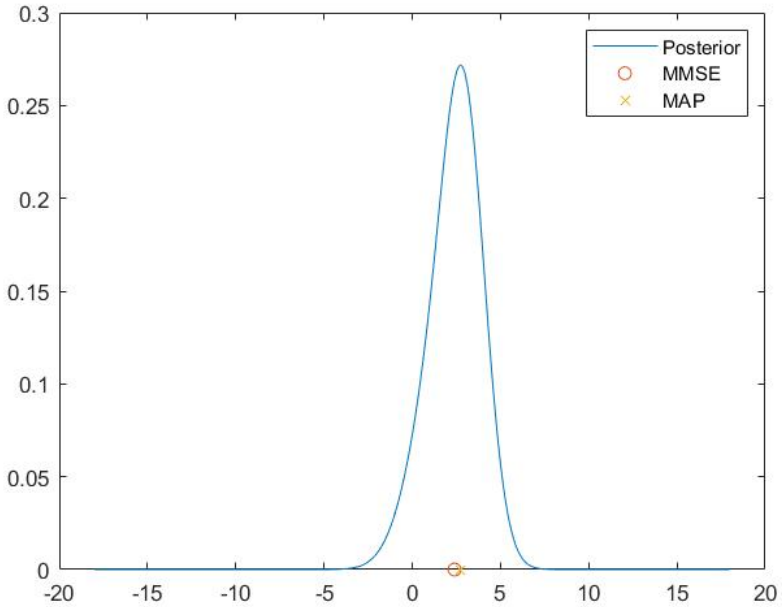

Figure 17: Posterior densities along with both MMSE and MAP estimates

The MAP and MMSE values are slightly different.