

# Homework 4

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## 1c

The reason is the GMM using soft assignments conveys some ambiguity about the identity of certain pixels which gets conveyed into the reconstruction of the image. Also, since the K-means already found a good enough solution, the GMM model had to do much better to achieve better results.

## 1d

The log-likelihood and the free energy after each E-step are exactly the same. The reason is that, by using the second part of Jensen's inequality, the arbitrary distribution  $Q(z^{(i)})$  was set to the posterior probabilities of the gaussians. This makes the free-energy bounded tightly above by the log-likelihood for any set of parameters, hence the observed plots in the two cases. For each M-step, using the same posterior probabilities and the new parameters, the free-energy and the log-likelihood are exactly same for similar reasons as explained above.