# 10.1 Make-up work

1. What is a mixture model?
   → Mixture model is a parametric density estimation function that consists of a weighted product of k Gaussians. They are useful for clustering data points to find the underlying model and generating new data points potentially indistinguishable from the “real” ones.

2. What is a latent variable and what does it mean in the context of mixture models?
   → Latent variables are variables that underlie a model but are unobserved. For example, we can get sequences of coin drops but we might not know to which individual coins the sequences belong. Latent variable in this case refers to the cluster/Gaussian distribution that a data point belongs do.

3. Why does a mixture of gaussians sometimes fit an entire cluster to a single datapoint?
   → When we have a single data point and use the EM algorithm, after the first E and M steps, the Gaussian mixture will have the mean at that single data point, and as we perform more and more E and Ms, the standard deviations of the Gaussians will converge to zero so as to maximize the likelihood of the data point.

4. Why shouldn’t we initialize the unknown parameters in an EM model to have the same values?
   → Because they will have exactly the same updates during the M step because the likelihood value calculated during the E step is equal due to equal distance of Gaussian distributions’ means to the data point.