CHEM/PHY 598

Info: You can work in groups, but all solutions must be written up independently. Many of the written problems –which are not assigned directly from the class textbook– are taken from a variety of other textbooks/papers. If any question requires a computational component, provide your written answer on one sheet, then the printout of your Mathematica notebook only for that problem on separate sheets following your write-up for that problem. Then repeat for each problem. i.e. do **not** staple a Mathematica notebook printout for all problems at the end of your problem set. **Only codes that are commented *at every step* and *whose logic can be easily followed* will be graded**.

DUE: Tuesday February 25th. To be handed in within the first five minutes of class.

Problem 1: EM algorithm

Implement the EM algorithm for the simple case of a mixture of two Gaussians in 1D with identical standard deviation. In other words, begin by generating synthetic data according to this model: $\pi_1 e^{-\frac{(x-\mu_1)^2}{2\sigma^2}} + (1 - \pi_1)e^{-\frac{(x-\mu_2)^2}{2\sigma^2}}$ where you have pre-specified by hand the parameters $\pi_1, \mu_1, \mu_2, \sigma$.

Then, implement an EM in order to learn the parameters $\pi_1, \mu_1, \mu_2, \sigma$. Compare your parameter estimates from EM to the theoretical values you used to generate your data.