Bayes Exercise 2

Solve the simple perceptual task facing a monkey in the jungle using a Bayesian approach. Spell out which terms are posteriors, priors, likelihoods, what terms are being discounted and what terms explains away what? You can assume Gaussian distributions throughout.

1. Out in the jungle, 15% of the juju-fruits are ripe. Ripe juju-fruits are orange, on average reflecting light with a wavelength of about 600 nm with some variation (standard deviation of 50 nm). Unripe juju-fruits are green with a wave length of 500 nm (standard deviation 50 nm). What is the probability of a juju-fruit reflecting light with a wavelength between 540-550 nm being ripe?

2. Only 10% of the fruits in the jungle are juju-fruits. 50% are mongo berries. 80% of the mongo berries are ripe. When ripe, mongo berries reflect light with a wavelength of 580 nm (standard deviation 20). When unripe, they reflect light with a wavelength of 520 nm (standard deviation 20). The remaining fruits are all chakavas. Only 10% of the chakavas are ripe. When they are ripe, they reflect light with a wavelength of 400 nm (standard deviation 100). When they are unripe, they reflect light with a wavelength of 550 nm (standard deviation 100). What's the probability that a random fruit reflecting light with a wavelength between 540-550 nm is ripe? How does this result change if you see a monkey enjoying eating the fruit?

3. Simulate fruit picking by drawing a random sample of 1000 fruits using Matlab's random number generator. The probability for *each* fruit being a juju, mongo or chakava; ripe or unripe should be as described in Problem 2. Each fruit should reflect light with specific wavelength. Assume that monkey's can identify the wavelength reflected by a fruit with an accuracy of +/- 5 nm. Simulate a fruit-picking monkey. How good is the monkey at separating ripe from unripe fruit? You can assume that the monkey's visual system has all the information described in Problem 2 and that the monkey uses the maximum posterior decision rule.