Introduction to Pattern Recognition Homework 1

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1. **Suppose we have three colored boxes R (red), B (blue), and G (green). Box R contains 3 apples 4 oranges, and 3 guavas, box B contains 12 apples, 4 oranges, and 4 guavas. If a box is chosen at random with probabilities $p(R) = 0.2, p(B) = 0.4, p(G) = 0.4$ and a piece of fruit is removed from the box (with equal probability of selecting any of the items in the box), then what is the probability of selecting guava? If we observe that the selected fruit is in fact an apple, what is the probability that it came from the blue box?**

   For the second question, let a be the event of choosing an apple, and let b be the event of the fruit coming from the blue box. We are trying to find the probability that the apple comes from the blue box, or $p(a|b)$. However, we can use **Baye's Theorem** to calculate the probability. This theorem says

$$p(a|b) = \frac{p(b|a)p(a)}{p(b)}$$

2. **Using the definition**

$$\mathrm{var}[f] = E[(f(x) - E[f(x)])^2]$$

   show that $\mathbf{var}[f(x)]$ satisfies

$$\mathrm{var}[f(x)] = E[f(x)^2] - E[f(x)]^2$$