Fundamentals of Data Analysis: Assignment #4

Deadline: 11/04/2003 (Tuesday)

Please post to the mailbox next to the IS management office (2nd floor of IS building)

1. **A manufacturer made 1500 pieces of product, where 500 were made by machine S1 and the others (1000 pieces) were made by machine S2. The probability yielding defective pieces was 2% for machine S1, and 3% for machine S2. Assume that when you pick up one piece, it is a defective one. Calculate the probability that this piece was made by machine S1.**

   Hint: Use "Bayes theorem"

2. **Prove that the variance of Bernoulli distribution is given by "*pq*", from the definition of variance. Bernoulli distribution is the distribution of the number of head when you toss a coin once (i.e., 0 or 1), where the head and tail probabilities are given by *p* and *q*, respectively.**

3. **Prove that the variance of binomial distribution is given by "npq". Binomial distribution is the distribution of the number of heads (m) out of n tosses of a coin, whose head and tail probabilities are given by p and q, respectively.**

   Hint: $\mathrm{Var}(X) = E[X^2] - (E[X])^2$

4. **Let X be a variable giving the trial index of the first success of Bernoulli trials, whose success probability is given by p.**

a. Show the probability distribution P(X = m).

b. Calculate the conditional probability P(X = n + m | X > n), that is, the probability that one gets the first success at the (n+m)th trial under the condition that he/she has already failed n times, and compare the result to the equation you have got in question a.

5. **Please feel free to write your comments and requests on this lecture (if any).**