MATH 120 Section 8.4 Bayes' Formula

In the preceding section, we calculated the conditional probability of a later event given an earlier event. Now we will find the probability of an earlier event given a later event.

<u>Bayes' Formula</u>

$$P(U_1|E) = \frac{P(U_1 \cap E)}{P(E)} = \frac{product\ of\ branch\ probabilites\ leading\ E\ through\ U_1}{sum\ of\ all\ branch\ products\ leading\ to\ E}$$

where $U_1, U_2, \ldots U_n$ are n mutually exclusive events whose union is the sample space S, and E is an arbitrary event in S such that $P(E) \neq 0$.

1. A manufacturer obtains clock-radios from three different subcontractors: 10% from A, 20% from B and 70% from C. The defective rates for these subcontractors are 2%, 4% and 3% respectively. If a defective clock-radio is returned by a customer,

a) What is the probability that it came from subcontractor A?

b) What is the probability that it came from subcontractor B?

c) What is the probability that it came from subcontractor C?

2. A new, simple test has been developed to detect a particular type of cancer. The test must be evaluated before it is put into use. A medical researcher selects a random sample of 3000 adults and finds (by other means) that 3% have this type of cancer. Each of the 3000 adults is given the test, and it is found that the test indicates cancer in 95% of those who have it and in 2% of those who do not. Based on these results,

   a) What is the probability of a randomly chosen person having cancer given the test indicates cancer?

   b) What is the probability of a randomly chosen person having cancer given that the test does not indicate cancer?