Review I

Econ 253 Spring 2002

1. Past experience has shown that for every 100,000 item produced by a plant in the morning shift, 200 are defective, and for every 100,000 items produced by the evening shift, 500 are defective. During a 24 hour period 1,000 items are produced by the morning shift and 600 by the evening shift.

   (a) Suppose from these 1,600 item produced in one 24 hour period one is picked at random. What is the probability that it is defective?

   (b) Suppose one item is picked at random and is found to be defective. What is the probability it was produced in the morning shift?

   Answer: Let M be the event that a randomly picked item is produced in the morning shift. Let E be the event that an item is produced in the evening shift and let D be the event that an item is defective. From the question we know that:

   $P(D|M) = \frac{200}{100{,}000} = 0.002$
   $P(D|E) = \frac{500}{100{,}000} = 0.005$
   $P(M) = \frac{1000}{1600} = 0.625$
   $P(E) = \frac{600}{1600} = 0.375$
   $P(D) =?$

   Part a: There are two possible ways that an item is defective: it is defective and produced in the morning shift, or it is defective and produced in the evening shift. Using the fact that those those two events are mutually exclusive and the formula for conditional probability we can write: $P(D) = P(DM + DE) = P(DM) + P(DE) = P(M)P(D|M) + P(E)P(D|E) = 0.00125 + 0.001875 = 0.003125$

   Part b: We look for $P(M|D) = \frac{P(DM)}{P(D)} = \frac{0.00125}{0.003125} = 0.4$.