Math 150

Section 8.6 Bayes' Formula

Bayes' Formula (Special Case)

$$P(F \mid E) = \frac{P(F)P(E \mid F)}{P(F)P(E \mid F) + P(F')P(E \mid F')}$$

Bayes' Formula (For three pairwise disjoint events)

Suppose F_1, F_2, and F_3 are pairwise disjoint events (meaning that any two of them are disjoint) whose union is the sample space. Then for an event E,

$$P(F_1 \mid E) = \frac{P(F_1)P(E \mid F_1)}{P(F_1)P(E \mid F_1) + P(F_2)P(E \mid F_2) + P(F_3)P(E \mid F_3)}$$

$$P(F_2 \mid E) = \frac{P(F_2)P(E \mid F_2)}{P(F_1)P(E \mid F_1) + P(F_2)P(E \mid F_2) + P(F_3)P(E \mid F_3)}$$

$$P(F_3 \mid E) = \frac{P(F_3)P(E \mid F_3)}{P(F_1)P(E \mid F_1) + P(F_2)P(E \mid F_2) + P(F_3)P(E \mid F_3)}$$

Examples

Example 1 For a fixed length of time, the probability of worker error on a certain production line is .1, the probability that an accident will occur when there is worker error is .3, and the probability that an accident will occur when there is no worker error is .2. Find the probability of no worker error if there is an accident.

Example 2

Age Group	% in sample	Probability of high cholesterol
18-39	46.3	.315
40-64	34.9	.504
65+	18.8	.405

Find the probability of a person being 65+, given that the person does not have high cholesterol.