# Practice problems for Conditional Probability.

**Problem 1**. If $R$ is the event that a convict committed armed robbery and $D$ is the event that the convict pushed dope, state in words what probabilities are expressed by,

(a) $P(R|D)$;

(b) $P(D'|R)$;

(c) $P(R'|D')$.

**Problem 2**. A town has 2 fire engines operating independently. The probability that a specific engine is available when needed is 0.96.

- What is the probability that neither is available when needed?
- What is the probability that a fire engine is available when needed?

**Problem 3**. The probability that a person visiting a given dentist will have an X-ray is 0.6; the probability that a person who has an X-ray will also have a cavity filled is 0.3; and the probability that a person who has had an X-ray and a cavity filled will also have a tooth extracted is 0.1. What is the probability that a person visiting this dentist will have an X-ray, a cavity filled, and a tooth extracted?

# Practice problems for Bayes Rule.

**Problem 4**. In a certain region of the country it is known from past experience that the probability of selecting an adult over 40 years of age with cancer is 0.05. If the probability of a doctor correctly diagnosing a person with cancer as having the disease is 0.78 and the probability of incorrectly diagnosing a person without cancer as having the disease is 0.06,

(a) what is the probability that a person is diagnosed as having cancer?

(b) what is the probability that a person diagnosed as having cancer actually has the disease?

**Problem 5**. Pollution of the rivers in the United States has been a problem for many years. Consider the following events:

- $A = \{\text{The river is polluted.}\}$
- $B = \{\text{A sample of water tested detects pollution.}\}$
- $C = \{\text{Fishing permitted.}\}$

Assume: $\text{P(A)} = 0.3$, $\text{P}(B|A) = 0.75$,
$\text{P}(B|A') = 0.20$, $\text{P}(C|A \cap B) = 0.20$,
$\text{P}(C|A' \cap B) = 0.15$,
$\text{P}(C|A \cap B') = 0.80$,
$\text{P}(C|A' \cap B') = 0.90$.

(a) Find $\text{P}(A \cap B \cap C)$.

(b) Find $\text{P}(B' \cap C)$.

(c) Find P(C).

(d) Find the probability that the river is polluted, given that fishing is permitted and the sample tested did not detect pollution.