

# EXAM P QUESTIONS OF THE WEEK

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## Week of March 3/08

An insurer has two lines of business: auto insurance and home fire insurance.

People with a home fire insurance policy can add flood insurance coverage, but only if the policy already has fire coverage. You are given the following information about the insurer's customers:

- 80% of all customers have an auto insurance policy
- 40% of all customers have a fire insurance policy
- 25% of customers with an auto insurance policy also have a fire insurance policy
- 50% of customers with a fire insurance policy also have flood insurance
- 50% of customers with flood insurance coverage also have auto insurance

Of the insurer's customers that have fire insurance, find the fraction that have neither auto insurance nor flood insurance coverage.

**The solution can be found below.**

## Week of March 3/08 - Solution

We use the following notation:

$A$  - customer has an auto policy

$F$  - customer has a fire insurance policy

$L$  - customer has flood insurance coverage

We are given:  $P(A) = .8$  ,  $P(F) = .4$  ,  $P(F|A) = .25$  ,  $P(L|F) = .5$  ,  $P(A|L) = .5$

We also know that  $L \cap F = L$  , so from  $.5 = P(L|F) = \frac{P(L \cap F)}{P(F)} = \frac{P(L)}{P(F)} = \frac{P(L)}{.4}$

we get  $P(L) = .2$  .

We wish to find  $P(A' \cap L' | F) = \frac{P(A' \cap L' \cap F)}{P(F)}$  .

$$\begin{aligned} P(A' \cap L' \cap F) &= P(F) - P[(A \cup L) \cap F] = P(F) - P[(A \cap F) \cup (L \cap F)] \\ &= P(F) - P[(A \cap F) \cup L] = P(F) - [P(A \cap F) + P(L) - P(A \cap F \cap L)] \\ &= P(F) - [P(A \cap F) + P(L) - P(A \cap L)] \end{aligned}$$

From the given information we have  $.25 = P(F|A) = \frac{P(F \cap A)}{P(A)} = \frac{P(F \cap A)}{.8}$  ,

so that  $P(F \cap A) = .2$  , and

$.5 = P(A|L) = \frac{P(A \cap L)}{P(L)} = \frac{P(A \cap L)}{.2}$  so that  $P(A \cap L) = .1$  .

$$\begin{aligned} \text{Then, } P(A' \cap L' | F) &= \frac{P(A' \cap L' \cap F)}{P(F)} = \frac{P(F) - [P(A \cap F) + P(L) - P(A \cap L)]}{P(F)} \\ &= \frac{.4 - [.2 + .2 - .1]}{.4} = .25 \text{ .} \end{aligned}$$

