Exercise for October 20, 2007
May 2001 Course 1 Examination, Problem No. 6, also Study Note P-09-07, Problem No. 20

An insurance company issues life insurance policies in three separate categories: standard, preferred, and ultra-preferred. Of the company’s policyholders, 50% are standard, 40% are preferred, and 10% are ultra-preferred. Each standard policyholder has probability 0.010 of dying in the next year, each preferred policyholder has probability 0.005 of dying in the next year, and each ultra-preferred policyholder has probability 0.001 of dying in the next year. A policyholder dies in the next year. What is the probability that the deceased policyholder was ultra-preferred?

A. 0.0001  B. 0.0010  C. 0.0071  D. 0.0141  E. 0.2817

Solution.
Always start solving problems like that by labeling the events. Let $S$ be the event of a standard policy, $P$ be the event of a preferred policy, $U$ be the event of an ultra-preferred policy, and $D$ be the event that a policyholder dies. Then by using the Bayes’ Theorem we obtain:

$$
\Pr(U|D) = \frac{\Pr(D|U)\Pr(U)}{\Pr(D|S)\Pr(S)+\Pr(D|P)\Pr(P)+\Pr(D|U)\Pr(U)} = \frac{0.001 \cdot 0.10}{0.01 \cdot 0.50 + 0.005 \cdot 0.40 + 0.001 \cdot 0.10} = 0.0141.
$$

Answer D.

© Copyright 2004-2007 by Krzysztof Ostaszewski.
All rights reserved. Reproduction in whole or in part without express written permission from the author is strictly prohibited.
Exercises from the past actuarial examinations are copyrighted by the Society of Actuaries and/or Casualty Actuarial Society and are used here with permission.