

EXAM MLC QUESTIONS OF THE WEEK

S. Broverman, 2008

Week of January 7/08

Actuary Smith has mortality models for smokers and non-smokers. According to Actuary Smith's models, non-smokers have constant force of mortality μ^S at all ages and smokers have constant force of mortality μ^{NS} at all ages.

Actuary Jones has mortality models for smokers and non-smokers. According to Actuary Jones's models, non-smoker mortality follows DeMoivre's Law with upper age limit ω , and smokers have a force of mortality which is constant multiple c of that of non-smokers.

At all ages, the ratio $\frac{e_x^{NS}}{e_x^{oS}}$ is the same for the models of Smith and Jones.

Find an expression for c in terms of Smith's μ^{NS} and μ^S .

- A) $\frac{2\mu^{NS}}{\mu^S}$ B) $\frac{2\mu^S}{\mu^{NS}}$ C) $\frac{2\mu^{NS}}{\mu^S} - 1$ D) $\frac{2\mu^S}{\mu^{NS}} - 1$ E) $\frac{\mu^S}{\mu^{NS}} + 1$

The solution can be found below.

Week of January 7/08 - Solution

For Smith's model, ${}^{\circ}e_x^{NS} = \frac{1}{\mu^{NS}}$ and ${}^{\circ}e_x^S = \frac{1}{\mu^S}$, so $\frac{{}^{\circ}e_x^{NS}}{e_x^{\circ S}} = \frac{\mu^S}{\mu^{NS}}$.

For Jones's model, $\mu^{NS}(x) = \frac{1}{\omega-x}$ and $\mu^S(x) = \frac{c}{\omega-x}$, so for Jones's model, smoker mortality follows a Generalized DeMoivre Law with upper age limit ω and parameter c .

For the Jones model, complete expectation for non-smokers is ${}^{\circ}e_x^{NS} = \frac{\omega-x}{2}$ and for smokers it is ${}^{\circ}e_x^S = \frac{\omega-x}{c+1}$. For Jones's model, $\frac{{}^{\circ}e_x^{NS}}{e_x^{\circ S}} = \frac{c+1}{2}$.

Therefore, $\frac{c+1}{2} = \frac{\mu^S}{\mu^{NS}}$, and $c = \frac{2\mu^S}{\mu^{NS}} - 1$. Answer: D