Solution #210

$$v^t = e^{-\delta t} = e^{-.045t}$$

$$\exp - \int_0^t \mu \, dt = e^{-\mu t}$$

$$f(\mu) = \frac{1}{1-.5} = 2$$

$$b_t = 50000$$

$$E[X] = E_Y[E_X[X|Y]]$$

Let Z be the policy benefit

$$E_Z[Z|\mu] = \int_0^{\infty} b_t \cdot {}_tp_x \cdot v^t \, dt$$

$$E_Z[Z|\mu] = \int_0^{\infty} 50000 \cdot e^{-\mu t} \cdot e^{-.045t} \, dt$$

$$= 50000 \int_0^{\infty} e^{-(\mu+.045)t} \, dt = \left[\frac{-50000 e^{-(\mu+.045)t}}{\mu+.045}\right]_0^{\infty}$$

$$= 50000 \left[\frac{0 + 1}{\mu+.045}\right] = \frac{50000}{\mu+.045}$$

$$E_\mu[E_Z[Z|\mu]] = E_\mu\left[\frac{50000}{\mu+.045}\right] = \int_{.5}^{1} f(\mu) \cdot \frac{50000}{\mu+.045}$$

$$= \int_{.5}^{1} 2 \cdot \frac{50000}{\mu+.045} = \left[100000 \ln(\mu+.045)\right]_{.5}^{1}$$

$$= 100000 [\ln(1.045) - \ln(.545)]$$

$$\approx 65098.64 \qquad \approx 65,100 \qquad \boxed{C}$$