

Chapter 4 – Past Test and Quiz Problems – Portfolio of Policies

Jeff is (63). He wants to buy a life insurance policy from Wu Life Insurance Company. However, he is not sure which policy to buy. All calculations assume:

- i. Mortality follows the Standard Ultimate Life Table
- ii. $i = 0.05$
- iii. Deaths are uniformly distributed between integral ages.

First, he decides to consider a whole life insurance policy that pays a death benefit of 100,000 at the end of the year of death. Jeff asks Shina who is the chief actuary at Wu Life to do several things for him.

- a. (2 points) Write the present value random variable Z for this policy.

$$Z = 100,000v^{k_x+1} = 100,000\left(\frac{1}{1.05}\right)^{k_x+1}$$

- b. (1 point) Jeff estimates that the expected present value of this whole life policy is 33,000 to the nearest 1000. Calculate it to the nearest 1.

$$100,000A_{63} = 100,000(0.32785) = 32,785$$

- c. (4 points) Jeff decides to purchase the whole life insurance policy in Part b. With this sale, Wu Life now has 400 identical whole life policies sold to 400 independent lives. Wu decides to hold 13,500,000 to cover the future death benefit payments on these policies. Using the normal distribution, calculate the probability that the present value of the death benefits will be greater than the 13,500,000.

Solution:

$$E[Port] = 400(32,785) = 13,114,000$$

$$Var[Z] = 100,000^2 [^2 A_{63} - (A_{63})^2] = 100,000^2 [0.13421 - (0.32785)^2] = 267,243,775$$

$$Var[Port] = 400(267,243,775)$$

$$13,114,000 + Z\left(\sqrt{400(267,243,775)}\right) = 13,500,000$$

$$Z = 1.18$$

$$P(Z > 1.18) = 1 - 0.8810 = 0.1190$$