MATH 4/50056 | Actuarial Mathematics II | Spring 2015
MTWR 8:50 | Dr. Kracht

Name: KEY Quiz Score: /20

Quiz 1: Thursday, January 22, 2015

1. (3 pts) What is the difference between **net premium** and **gross premium**?

The net premium uses only benefit and premiums, while the gross premium also includes expenses.

2. (3 pts) Define (give a "formula in words"):

$L_0^n =$ PV of benefit outgo − PV of net premium income.

3. (14 pts) Sally, currently exact age 50, joined a defined benefit pension plan at exact age 40. Her current salary is \$100,000 per year. She will retire at exact age 65.

   You are given:

   - Sally's salary will increase at the rate of 3% each year on her future birthdays.
   - The annual retirement benefit is 1% of the final five-year average salary for each year of service.
   - Sally wants to supplement this annual retirement benefit with an annuity, so that the total annual benefit is \$50,000.
   - Retirement benefits will commence at exact age 65 and are payable at the beginning of each year of life.
   - $\ddot{a}_{65} = 9.8$

   Calculate the amount Sally needs at age 65 to purchase the annuity to receive her desired annual retirement benefit.

Sally's annual retirement benefit will be

$$\underbrace{\frac{100{,}000\left(1.03^{10}+1.03^{11}+1.03^{12}+1.03^{13}+1.03^{14}\right)}{5}}_{\text{final five-year avg salary}} \times (0.01) * (25)$$

(0.01): 1% for each of (25): 25 yrs service

$$= 5000\left(1.03^{10}+1.03^{11}+1.03^{12}+1.03^{13}+1.03^{14}\right)$$

$$\approx \$35{,}675.17$$

Shortfall: $50{,}000 - 35{,}675.17 \overset{\$1}{=} 14{,}324.83$

Amount Sally needs − PV of \$14,324.83 life annuity-due issued to a life aged 65:

$$14\,324.83\ \ddot{a}_{65} = (14\,324.83)(9.8) = \$140{,}383.31.$$