MAP 4176 / 5178 Name:______________________________

Test 4 Date: February 6, 2019

Each problem is worth 10 points. Show all work for full credit, and use correct notation. Simplify answers completely. See other side for additional problems.

1. Using $d = 0.05$, determine the actuarial present value of a 1-year discrete endowment insurance of 10,000 issued to (50).

$APV = 10000A_{50:\overline{1}|} = 10000(vp_{50} + vq_{50}) = 10000v = 9{,}500$

2. Write an expression for the actuarial present value of a 20-year term insurance issued to (40) that pays 5000 if death occurs in the first year, 6000 if death occurs in the second year, and so on, such that each year's death benefit is 1000 more than the previous year's death benefit, for the duration of the policy.

$APV = 4000A^{\,1}_{40:\overline{20}|} + 1000(IA)^{\,1}_{40:\overline{20}|}$ (There are other correct answers.)

For Numbers 3 – 5, use the actuarial assumptions in the L-TAM Tables to determine the actuarial present value of the insurance product described:

3. a 10-year deferred, 10-year term insurance issued to (20), with a benefit of 10,000 paid at the end of the year of death if (20) dies between ages 30 and 40.

$$APV = 10000A^{\,1}_{20:\overline{20|}} - 10000A^{\,1}_{20:\overline{10|}}$$
$$= 10000\left(A_{20:\overline{20|}} - {}_{20}E_{20}\right) + 10000\left(A_{20:\overline{10|}} - {}_{10}E_{20}\right) = 18$$

or

$$APV = 10000\,{}_{10}E_{20}\left(A_{30} - {}_{10}E_{30}A_{40}\right) = 18.06$$

4. a whole-life insurance of 10,000 issued to (25) with death benefit paid at the end of the quarter of death, assuming a uniform distribution of deaths between integer ages Note that if $i = 0.05$, then $\frac{i}{i^{(4)}} = 1.01856$.

$$APV = 10000A_{25}^{(4)} = 10000\frac{i}{i^{(4)}}A_{25} = 626.11$$

5. a 10-year endowment insurance of 1,000,000 issued to (20) with death benefit payable at the end of the semiannual period of death, using the claims acceleration approach.

$$APV = 1{,}000{,}000A^{(2)}_{20:\overline{10|}} = 1{,}000{,}000\left(A^{(2)\,1}_{20:\overline{10|}} + {}_{10}E_{20}\right)$$
$$= 1{,}000{,}000\left((1.05^{0.25})A^{\,1}_{20:\overline{10|}} + {}_{10}E_{20}\right)$$
$$= 1{,}000{,}000\left((1.05^{0.25})\left(A_{20:\overline{10|}} - {}_{10}E_{20}\right) + {}_{10}E_{20}\right) = 614{,}356$$