Module 5 Section 2 Exercises:

1. For a fully discrete whole life insurance of 1000 on (x), you are given:

   (i)   Death is the only decrement

   (ii)   The annual gross premium is 100

   (iii)   First year expenses are 60% of gross premium, payable at BOY

   (iv) $i = .10$

   (v) $q_x = .03$

   (vi)   The asset share at time 0 is 0.

   Determine the asset share at the end of the first year.

2. For a fully discrete whole life insurance of 1000 on (x), you are given:

   (i)   Death is the only decrement

   (ii)   The annual gross premium is 100

   (iii)   First year expenses are 60% of gross premium, payable at BOY

   (iv) $i = .10$

   (v) $q_x = .03$

   (vi)   Reserves are set as full preliminary term reserves.

   Determine

   (a) EDB_1, the expected death benefit paid at the end of the first policy year

   (b) Pr_1, the profit emerging at the end of the first policy year.

3. The policy in the previous problem was sold to 500 *x*-year olds. The values for interest, mortality, and expenses in the previous problem were anticipated values when the policies were sold. You are given:

(i)   The actual total expense for all 500 policies was 25000.

(ii)   The actual interest rate earned during the first year was 8%.

(iii)   Of the 500 insured, 15 died during the first year.

Determine each of the following:

(a)   the total gain on all policies for year 1.

(b)   the total gain on all policies from interest, assuming the gains from mortality and expense have not been calculated.

(c)   the total gain on all policies from mortality, assuming the gains from interest and expense have not been calculated.

(d)   the total gain on all policies from mortality, assuming the gain from interest has been calculated but the gain from expense has not been calculated.

(e)   the total gain on all policies from expense, assuming the gains from mortality and interest have already been calculated.

4. For a fully discrete whole life insurance on (x), you are given:

(i)   The death benefit is 10,000. There is a settlement expense of 100.

(ii)   The withdrawal benefit for year 11, paid at EOY, is 1500. The surrender charge for year 11 is 50.

(iii)   The annual gross premium is 300

(iv)   Expenses paid at the beginning of year 11 are 5% of gross premium

(v) $v = 0.9$

(vi) $q^{(d)}_{x+10} = .02$ and $q^{(w)}_{x+10} = .10$

(vii)   The asset share at time 11 is 230.

Determine the asset share at time 10.

5. For a whole life insurance on (x), you are given:

   (i)   The death benefit is paid at the moment of death.

   (ii)   The withdrawal benefit is paid at the end of the quarter of death.

   (iii)   There are both settlement and surrender expenses.

   (iv)   Premiums are paid at the beginning of each month.

   (v)   "Premium-type" expenses are paid immediately after each premium is paid.

   (vi)   Reserves are gross premium reserves

   Determine the profit at the end of the tenth year for a policy in force (insured and alive) at the beginning of the tenth year.

6. For a fully discrete whole life insurance on (x), you are given:

   (i)   The death benefit is 10,000. There is a settlement expense of 100.

   (ii)   The withdrawal benefit for year 11, paid at EOY, is 1500. The surrender charge for year 11 is 50.

   (iii)   The annual gross premium is 300

   (iv)   Expenses during year 11 are 5% of gross premium

   (v) $i = 10\%$

   (vi) $q_{x+10}^{(d)} = .02$ and $q_{x+10}^{(w)} = .10$

   (vii)   Reserves are set as follows: $_{10}V = 1500$ and $_{11}V = 1750$

   Determine

   (a) EDB_{11}, the expected cost of death benefits paid at the end of year 11 for a policy in force at the beginning of the year.

   (b) ECV_{11}, the expected cost of cash values paid at the end of year 11 for a policy in force at the beginning of the year. This is also denoted by ESB_{11}.

   (c) Pr_{11}, the surplus emerging at the end of year 11 for a policy in force at the beginning of the year.

7. The values for interest, mortality, withdrawal, and expenses in the previous problem were expected values at the beginning of year 11. You are given the following actual values that were determined at the end of year 11:

(i)   The settlement expense is 90.

(ii)   The surrender charge is 60.

(iii)   Expenses paid at the beginning of the year were 20.

(iv) $i = 8\%$

(v) $q^{(d)}_{x+10} = .015$ and $q^{(w)}_{x+10} = .12$

Determine each of the following:

(a)   the total gain for year 11.

(b)   the gain from interest for year 11, assuming the gains from mortality, withdrawal, and expense have not been calculated.

(c)   the total gain from mortality and expense for year 11, assuming the gains from interest and withdrawal have not been calculated.

(d)   the total gain from interest and withdrawal for year 11, assuming the gains from mortality and expense have been calculated.