

Show all work for full credit, and use correct notation. Simplify answers completely. See other side of each page for additional problems.

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) Expenses are 60% of gross premium for the first year, 10% thereafter, payable at BOY
- (iv) $i = 0.05$
- (v) $q_x = 0.030$ and $q_{x+1} = 0.035$

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

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

- (i) The death benefit is 10,000.
- (ii) The withdrawal benefit for year 5, paid at EOY, is 450.
- (iii) The annual gross premium is 300
- (iv) Expenses during year 5 are 10% of gross premium
- (v) $i = 6\%$
- (vi) $q_{x+4}^{(d)} = .02$ and $q_{x+4}^{(w)} = .10$
- (vii) Reserves are set as follows: ${}_4V = 400$ and ${}_5V = 500$

Determine Pr_5 , the profit emerging at the end of year 5 per policy in force at the beginning of the year.

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

(i) The death benefit is 10,000.

(ii) The withdrawal benefit for year 10, paid at EOY, is W .

(iii) The annual gross premium is π .

(iv) Expenses during year 10 total e , payable at the beginning of the year.

(v) $q_{x+9}^{(w)} = 0.10$

(vi) $q_{x+9}^{(d)} = 0.020$ is the actual value, and $q_{x+9}^{(d)} = 0.015$ is the expected value.

(vii) ${}_{10}V = 1500$

Determine the gain/loss due to mortality for year 10 per policy in force at the beginning of the year.

4. For a fully discrete 5-year term insurance on (x) , you are given:

- (i) The annual gross premium is 1200.
- (ii) The profit vector is $Pr = (-900, 265, 265, 265, 265)$.
- (iii) Mortality follows a constant force model with $\mu = -\ln(0.9)$.
- (iv) The hurdle rate is $i = 0.05$.

Determine

- (a) (10 points) $NPV(3)$
- (b) (10 points) The profit margin for this policy.