

Module 5 Section 4 Exercises:

1. For the profit signature, $\pi = (-300, 280, 48)$, determine

- (a) the IRR
- (b) the NPV and DPP using a hurdle rate of 6%

2. For a fully discrete 2-year term insurance on (x) , you are given:

- (i) $q_x = 0.2$
- (ii) The profit vector is $Pr = (-300, 280, 60)$

Determine

- (a) π_2
- (b) the surplus emerging at the end of the 2nd year for a policy in force at time 1
- (c) the profit emerging at the end of the 2nd year for a policy in force at issue

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

- (i) Mortality follows a constant force model with $\mu = -\ln(0.9)$
- (ii) The profit vector is $Pr = (-2500, 1900, 250, 360, 470, 580, 690, \dots)$
- (iii) Profits are discounted using $d = 10\%$

Determine

- (a) pre-contract expenses
- (b) the surplus emerging at the end of the 5th year for a policy in force at issue
- (c) NPV(5)

4. For a fully discrete 10-year term insurance on (x) , you are given:
- (i) the profit signature is $\pi = (-700, 120, 125, 130, 130, 130, 130, 130, 125, 120, 110)$
 - (ii) the risk discount rate is 8%
 - (iii) annual premiums are 1250
 - (iv) $\ddot{a}_{x:\overline{10}|} = 8$ using policy mortality and an 8% annual effective interest rate

Determine

- (a) the IRR
 - (b) the NPV
 - (c) the profit margin
 - (d) the discounted payback period
5. For a fully discrete 3-year term insurance on (x) , you are given:
- (i) the profit vector is $Pr = (-1000, 750, 200, 200)$
 - (ii) the net present value is 17.49, using a hurdle rate of 5%
 - (iii) mortality follows a constant force model

Determine q_x .

6. For a fully discrete 3-year term insurance on (x) , you are given:
- (i) the profit vector is $Pr = (-1000, 750, 200, 200)$
 - (ii) the internal rate of return is 6%
 - (iii) mortality follows a constant force model

Determine q_x .

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

(i)

t	Pr_t	π_t
0	- 230	- 230
1	70	X
2	Y	77
3	96	88
4	116	99
5	72	55

(ii) the annual premium is 285

(iii) the hurdle rate is 10%

(iv) $p_x = 0.9625$

Determine

(a) X

(b) Y

(c) the value of ${}_3p_x$

(d) the value of q_{x+2}

(e) NPV(3)

(f) the discounted payback period

(g) profit margin