Module 5 Section 5 Exercises:

1. For a UL insurance policy, you are given

Year	Premium	Expense Charged	Cost of Insurance	Credited Interest Rate
1	1000	50	500	.04
2	1200	40	525	.05
3	1000	30	550	.04
4	500	30	600	.05

Determine AV_4, the account value at the end of year 4.

2. For a UL insurance policy, you are given:

Year	Premium	Expense Charged	Cost of Insurance	Credited Interest Rate
1	1000	50	500	.04
2	1000	50	500	.04
3	1000	50	500	.04
⋮	⋮	⋮	⋮	⋮
20	1000	50	500	.04

Determine AV_{20}, the account value at the end of year 20.

3. Ron and Don, twins, purchase identical UL insurance policies with credited interest rate equal to 5%. Ron pays 100 more in premium each year than Don. For Ron, $AV_{20} = 30000$. Determine AV_{20} for Don.

4. Ron and Don, twins, purchase identical UL insurance policies with credited interest rate equal to 5%. Ron pays 1000 more than Don in premium for the first year, but Don pays 50 more in premium than Ron for every other year. For Don, $AV_{20} = 30000$. Determine AV_{20} for Ron.

5. For a universal life policy with face amount of 1000 issued to (45), you are given

   (i) actuarial assumptions follow the illustrative life table and $AV_{10} = 85$

   (ii) after age 55, there is a no lapse guarantee providing fully discrete term life insurance of 1000 to age 65

   Determine the reserve for the no lapse guarantee at the end of year 10

6. For a universal life policy with face amount of 1000 issued to (40), you are given

   (i) actuarial assumptions follow the illustrative life table

   (ii) after age 50, there is a no lapse guarantee providing fully discrete whole life insurance of 1000

   (iii) $AV_{10} = 240$ and $AV_{20} = 380$

   Determine

   (a) the reserve at $t = 10$ for the no lapse guarantee

   (b) the reserve at $t = 20$ for the no lapse guarantee

7. For a universal life policy with face amount of 100,000 issued to (43), you are given

   (i) actuarial assumptions follow the illustrative life table

   (ii) a no lapse guarantee begins once the account value exceeds 30,000

   (iii) the no laps guarantee provides fully discrete whole life insurance of 100,000

   (iv) each year, the premium less expenses charged less cost of insurance is 1500

   (v) the credited interest rate is 3%

   Determine

   (a) the first year in which the no lapse guarantee is activated

   (b) the reserve for the no lapse guarantee at the end of the 20th year

8. For a universal life policy, you are given that the face value is 10,000 and the account value at the end of the 8th year is 1300.

   (a) Determine the net amount at risk and total death benefit for policy year 8 if the policy is Type A.

   (b) Determine the net amount at risk and total death benefit for policy year 8 if the policy is Type B.

9. For a universal life insurance policy, you are given

Policy Year	EOY Account Value	Face Amount	Death Expense Fee	Surrender Charge	$q_{x+t-1}^{(d)}$	$q_{x+t-1}^{(w)}$
⋮	⋮	⋮	⋮	⋮	⋮	⋮
5	8000	100,000	200	800	.01	.05
⋮	⋮	⋮	⋮	⋮	⋮	⋮

(a) If the policy is Type A, determine the additional death benefit for policy year 5

(b) If the policy is Type A, determine the expected death benefit for policy year 5

(c) If the policy is Type A, determine the expected lapse benefit for policy year 5

(d) Redo parts (a) – (c) if the policy is Type B.

10. For a Type B universal life insurance policy, you are given

(i) the face amount is 100,000

(ii) $AV_n = 70000$

(iii) the premium for year $n + 1$ is 2500

(iv) the expense charged for year $n + 1$ is 100

(v) the credited interest rate for year $n + 1$ is 5%

(vi) the COI rate per 1000 for year $n + 1$ is 7

(vii) the interest rate used for COI calculations for year $n + 1$ is 4%

Determine

(a) the COI, the cost of insurance for policy year $n + 1$, paid at time n.

(b) AV_{n+1}

(c) the TDB, the total death benefit for policy year $n + 1$

11. Repeat the previous exercise given

(a) a corridor factor of 2.0 for policy year $n + 1$

(b) a corridor factor of 2.5 for policy year $n + 1$

12. For a Type A universal life insurance policy, you are given
(same setup as #10, except this policy is Type A instead of Type B)

(i) the face amount is 100,000

(ii) $AV_n = 70000$

(iii) the premium for year $n + 1$ is 2500

(iv) the expense charged for year $n + 1$ is 100

(v) the credited interest rate for year $n + 1$ is 5%

(vi) the COI rate per 1000 for year $n + 1$ is 7

(vii) the interest rate used for COI calculations for year $n + 1$ is 4%

Determine

(a) an expression for the COI, the cost of insurance for policy year $n + 1$, paid at time n. (For a Type A policy, we first write the COI as an expression since it depends on AV_{n+1}, which we don't know a priori.)

(b) AV_{n+1}

(c) the value of COI now that, from part (b), we know AV_{n+1}

(d) the TDB, the total death benefit for policy year $n + 1$

13. Repeat the previous exercise given

(a) a corridor factor of 1.25 for policy year $n + 1$

(b) a corridor factor of 2.25 for policy year $n + 1$