

EA-1 SEMINAR

SECTION 14

INTERESTING PROBLEMS

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Data for Question 25

Type of plan: Defined benefit pension plan funded partially with whole life insurance policies.

The cash value at age 65 and later is equal to the full net level premium reserve. The cash value prior to age 65 is equal to the net level premium reserve minus an amount equal to the amortization of an expense charge from issue to age 65 (using interest and mortality).

Net level premium per \$1,000 of face amount at issue: \$16.61529

Cash value at age 60: \$423.19

Selected commutation functions:

<u>x</u>	<u>D_x</u>	<u>N_x</u>	<u>1000A_x</u>
60	1,293,434	16,084,767	637.79502
62	1,165,483	13,562,294	661.06886
65	979,881	10,253,150	695.23305

Question 25

In what range is the cash value at age 62 per \$1,000 of face amount?

- (A) Less than \$458.00
- (B) \$458.00 but less than \$462.60
- (C) \$462.60 but less than \$467.20
- (D) \$467.20 but less than \$471.80
- (E) \$471.80 or more

Data for Question 3

Effective date of contract: 1/1/92.

Duration of contract: 10 years.

Terms of contract: Upon the death of the insured, the contract will pay \$1,000 at the end of the year of the insured's death and \$1,000 at the end of each succeeding year for the duration of the contract.

Interest rate: 7% per year, compounded annually.

Age of insured at issue: 50.

Selected commutation functions:

<u>x</u>	<u>D_x</u>	<u>N_x</u>
50	31,750	383,495
51	29,506	351,745
60	14,759	151,622
61	13,598	136,863

Question 3

In what range is the present value of the contract as of 1/1/92?

- (A) Less than \$200
- (B) \$200 but less than \$225
- (C) \$225 but less than \$250
- (D) \$250 but less than \$275
- (E) \$275 or more

Data for Question 11

Terms of a whole life insurance policy:

Issue date: 1/1/93.

Death benefit: \$1,000.

Date of first premium: 1/1/93.

Frequency of premiums: Annual.

Interest rate: 7% per year, compounded annually.

Age of insured at issue: 40.

Selected values:

$$q_{40} = 0.0021 \quad q_{41} = 0.0023 \quad \ddot{a}_{40} = 13.37$$

Question 11

In what range is the net level premium reserve for the policy at the end of the second year?

- [A] Less than \$15
- [B] \$15 but less than \$16
- [C] \$16 but less than \$17
- [D] \$17 but less than \$18
- [E] \$18 or more

Data for Question 21

1995

Amount of a loan: \$100,000.

Frequency of payments: Annual, at the end of each year.

Term of loan: 15 years.

Amount of payments: Level.

Interest rate: 7% per year, compounded annually.

The borrower, aged 40, purchases a special 15-year term insurance policy:

Death benefit: Balance of loan at the end of year of death, including the loan payment then due.

Premiums: Level annual premiums, payable at the beginning of each year.

Interest rate: 7% per year, compounded annually.

Selected values:

$$\ddot{a}_{40:\overline{15}|} = 9.5650$$

$${}_{15}E_{40} = 0.3384$$

Question 21

In what range is the annual premium for the term insurance policy?

- [A] Less than \$200
- [B] \$200 but less than \$210
- [C] \$210 but less than \$220
- [D] \$220 but less than \$230
- [E] \$230 or more

Data For Question 23 (3 Points)

For a study of four automobile engines, you are given:

- (i) The engines are subject to a uniform survival distribution over the interval $[0, \omega]$.
- (ii) Failures occurred at times 4, 5 and 7; the remaining engine was operational at time r .
- (iii) The observation period was from time 3 to time r .
- (iv) The maximum likelihood estimate of ω is 13.67.

Question 23

In what range is r ?

- [A] Less than 11.3
- [B] 11.3 but less than 11.8
- [C] 11.8 but less than 12.3
- [D] 12.3 but less than 12.8
- [E] 12.8 or more

Data for Question 26 (2 points)

You are given the following data from a clinical study:

<u>Time</u>	<u>Event</u>
0.0	20 new entrants
1.1	1 death
1.5	9 terminations
2.3	1 death
3.0	1 new entrant
3.2	1 death
4.7	1 termination
6.0	2 deaths

Y = Product Limit estimate of $S(6)$, i.e., the probability of surviving to time $t = 6$.

Question 26

In what range is Y ?

- (A) Less than 0.555
- (B) 0.555 but less than 0.563
- (C) 0.563 but less than 0.571
- (D) 0.571 but less than 0.579
- (E) 0.579 or more

2008

Data for Question 27 (5 points)

On 1/1/2008, Smith sets up an investment under an immunization strategy to meet the obligation shown:

Obligation	A single payment of \$10,000 on 1/1/2013
Available investments	2-year and 10-year zero-coupon bonds
Yield to maturity:	5.0%, compounded annually (for both investments)

Assume that the convexity of the assets is greater than the convexity of the obligation.

X = the amount invested in 2-year zero coupon bonds.

Question 27

In what range is X ?

- (A) Less than \$2,800
- (B) \$2,800 but less than \$3,800
- (C) \$3,800 but less than \$4,800
- (D) \$4,800 but less than \$5,800
- (E) \$5,800 or more

THIS PAGE WAS INTENTIONALLY LEFT BLANK