1. The force of mortality at age x is given by

$$\mu(x) = \frac{10}{103 - x}, \quad 0 \le x < 103.$$

Compute $E(T(81)^2)$.

- a. 7
- b. $\frac{22}{3}$
- c. $\frac{23}{3}$
- d. $\frac{20}{3}$
- e. 8
- Unanswered

The time is 8:58

2. Suppose

$$s(x) = \begin{cases} 1 & \text{for } 0 \le x \le 1 \\ 1 - \dfrac{e^x}{100} & \text{for } 1 \le x \le 4.632 \\ 0 & \text{for } 4.632 \le x \end{cases}$$

Compute $\mu(3.9)$.

- a. 1.01
- b. 0.98
- c. 0.92
- d. 1.05
- e. 0.95

- Unanswered

The time is 8:58

---

3. Suppose that $\mu_x = \frac{1}{104-x}, \quad 0 \le x \le 104$ and that the force of interest is $\delta = 0.04$. The insurance policy pays 12 units of benefit at the moment of death. Find the variance of the present value of the benefit for a person aged 47 for an 8-year pure endowment policy.

- a. 8.880
- b. 9.553
- c. 9.161
- d. 8.978
- e. 9.787
- Unanswered

The time is 8:58

---

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

(i) $\mu_{x+t} = \mu, \quad t \ge 0$
(ii) $\delta_t = \mu, \quad t \ge 0$
(iii) the death benefit, payable at the moment of death is 1 for the first 10 years and $\frac{1}{2}$ thereafter
(iv) the actuarial present value at issue of the insurance is 0.2766

Calculate μ.

- a. 0.018
- b. 0.043
- c. 0.006
- d. 0.087
- e. 0.091
- Unanswered

The time is 8:58

---

5. You are given:

(i) $s(x) = 1 - \frac{x}{94}, \quad 0 \le x \le 94$
(ii) $\delta = 0.06$

Calculate $\bar{a}_{35}$.

- a. 11.37
- b. 11.28
- c. 10.62
- d. 12.10
- e. 11.45
- Unanswered

The time is 8:58

---

6. You are given:

(i) $\ddot{a}_x = 10$
(ii) $v = 0.94$

Calculate A_x.

- a. 0.33
- b. 0.42
- c. 0.46
- d. 0.34
- e. 0.40
- Unanswered

The time is 8:58

---

7. Your age is 33 and you want to buy a 4-year term life policy with a benefit of 50,000 payable at the end of year of death. Suppose that $i = 0.04$ and
$p_{33} = 0.96, \quad p_{34} = 0.94, \quad p_{35} = 0.91, \; p_{36} = 0.88.$

Find the standard deviation of the loss function.

- a. 22,015
- b. 21,861
- c. 21,720
- d. 22,045
- e. 21,680
- Unanswered

The time is 8:58

---

8. The distribution of future life time of (x) is as follows:

(i) With probabiliy 0.53, the future lifetime of (x) follows the illustrative life table at 6 % with UDD over each year of age.
Click here to see the table in a different window

(ii) With probabiliy 0.47, the future lifetime of (x) follows a constant force of mortality $\mu = 0.02$ and $i = .06$.

A fully continuous life insurance of 1000 issued to (58). Find the benefit premium for this insurance.

- a. 25.82
- b. 19.68
- c. 19.73
- d. 18.09
- e. 16.12
- Unanswered

The time is 8:58

---

9. On January 1, 2002, Pat age 40 purchases a 5-payment, 10-year term insurance of 100,000. Your are given:

(i) Death Benefits are payable at the moment of death.

(ii) Contract premiums of 4,000 are payable annually at the beginning of each year for 5 years.
(iii) $i = 0.05$.
(iv) L is the loss function at time of issue.

Calculate the value of L if Pat dies on June 30, 2003.

- a. 87,285
- b. 87,241
- c. 87,498
- d. 87,163
- e. 85,133
- Unanswered

The time is 8:58

---

10. Use the illustrative life table at 6%.
Click here to see the table in a different window to compute

$$\ddot{a}_{43:\overline{23}|}$$

- a. 11.14
- b. 11.27
- c. 13.69
- d. 11.09
- e. 12.39
- Unanswered

The time is 8:58

---

11. You are given $e_x = 29.3$ and $e_{x+1} = 28.8$, compute p_x

- a. 0.90

- b. 0.98
- c. 0.92
- d. 0.91
- e. 0.93
- Unanswered

The time is 8:58

---

12. For a special fully discrete whole life insurance of 1 is issued to (26), you are given:

(i) Premiums are paid annually to age 67.
(ii) Level benefit premiums are payable for life at the beginning of each year.
(iii) The net premium during the first 11 years is P followed by a different level annual premium for the next 32 years.
(iv) $A_{37} = 0.31$
(v) $P = 0.01$
(vi) $d = 0.06$

Calculate the reserve at the end of year 11.

- a. 0.025
- b. 0.345
- c. 0.195
- d. 0.015
- e. 0.305
- Unanswered

The time is 8:58

---

13. Lottery Life ussues a special fully discrete whole life insurance on (25).
you are given:

(i) At the end of year of death there is a random drawing. With probability 0.2, the death benefit is 1000. With probability 0.8, the death benefit is *0*.
(ii) At the start of each year, including the first, while (25) is alive, there is a random drawing. With probability 0.8, the level premium π is paid.With probability 0.2, no premium is paid.
(iii) The random drawings are independent.
(iv) Mortality follows Illustrative Life Table at 6%
Click here to see the table in a different window

(v) π is determined using the equivalence principal.

Calculate the benefit reserve at the end of year 10.

- a. 10.249
- b. 6.339
- c. 11.259
- d. 7.999
- e. 13.679
- Unanswered

The time is 8:58

---

14. You are given:

(i) The present value random variable for a continuous whole life annuity of 1 per year on (40) is denoted by Y.
(ii) Mortality follows De Moivre's Law with $w = 120$
(iii) $\delta = 0.044$

Calculate the 80^{th} percentile of the distribution of Y.

- a. 21.367
- b. 19.853
- c. 20.862
- d. 19.384
- e. 22.882
- Unanswered

The time is 8:58

---

15. You are given:

(i) ${}_kV^A$ is the benefit reserve at the end of year k for a type A insurance, which is fully discrete 10-payment whole life insurance of 4000 on (x).
(ii) ${}_kV^B$ is the benefit reserve at the end of year k for a type B insurance, which is fully discrete whole life insurance of 4000 on (x).

(iii) $q_{x+10} = 0.004$
(iv) ${}_{10}V^A - {}_{10}V^B = 101.3$
(v) $i = 0.07$
(vi) The annual benefit premium for type B insurance is 8.26

Calculate ${}_{11}V^A - {}_{11}V^B$

- a. 104
- b. 99
- c. 100
- d. 101
- e. 102
- Unanswered

The time is 8:58

---

16. For two independent lives (69) and (77).
You are given

(i) The survival function of (69) follows De Moivre's law with $\omega = 85$.
(ii) The survival function of (77) follows De Moivre's law with $\omega = 91$.

Calculate the probability that (69) dies after (6) years but after (77) dies.

- a. 0.518
- b. 0.482
- c. 0.471
- d. 0.529
- e. 0.556
- Unanswered

The time is 8:58

---

17. Suppose that people arrive at a desert island from either island A or island B.
The number of people arriving each day from island A is given by a Poisson distribution with parameter $\lambda_A = 2$.
The number of people arriving each day from island B is given by a Poisson distribution

with parameter $\lambda_B = 2$.
What is the variance in the number of people that arrive in 6 days?

- a. 24
- b. 4
- c. 8
- d. 12
- e. 16
- Unanswered

The time is 8:58

---

18. For a claim process, you are given:

(i) The number of claims $\{N(t),\ t \geq 0\}$ is nonhomogeneous Poisson process with intensity function

$$\lambda(t) = \begin{cases} 1, & 0 \leq t < 1 \\ 4, & 1 \leq t < 2 \\ 5, & 2 \leq t \end{cases}$$

(ii) Claims amounts Y_i are independently and identically distributed random variables that are also independent of $N(t)$.
(iii) Each claim Y_i amount is uniformly distributed on $[200,\ 500]$.
(iv) The random variable P is the number of claims amount less than 400 by time $t = 5$
(v) The random variable Q is the number of claims amount greater than 400 by time $t = 5$
(vi) R is the conditional expected value of P given that $Q = 10$

Calculate R.

- a. 13.3
- b. 13.8
- c. 11.0
- d. 10.7

- e. 17.1
- Unanswered

The time is 8:58

---

19. Let Q be a transition probabilty matrix for a homogeneous Markov chain.

$$Q = \begin{pmatrix} 0.09 & 0.91 \\ 0.31 & 0.69 \end{pmatrix}$$

This matrix describes the probabilites of transition between two States S_0 and S_1 of a certain individual.
If a person is in S_1 now and purchases an insurance whose premiums for the first and future years are equal to 300 if the indvidual is in S_0 in that year and 600 if the individual is in State S_1 in the same year.
Premium are payable at the beginning of each year and the interest rate is $i = 0.06$ all years.
Find the actuarial present value of future premiums for this policyholder for the first 4 years.

- a. 2030
- b. 2086
- c. 2059
- d. 2005
- e. 1987
- Unanswered

The time is 8:58

---

20. Let Q be a transition probabilty matrix for a homogeneous Markov chain.

$$Q = \begin{pmatrix} 0.74 & 0.26 \\ 0.32 & 0.68 \end{pmatrix}$$

This matrix describes the probabilites of transition between two States S_0 and S_1 of a certain person. Each period represents a year.
This person purchases a 4-year Long-Term care insurance policy. You are given:

1. The person begins the insurance in S_0
2. Benefits of 10,000 are paid at the beginning of the year if the person is in S_1.
3. Premiums of P are will be paid at the beginning of the year if a person is in S_0

4. The interest rate is
   $i = 0.05$ in year one
   $i = 0.06$ in year two
   $i = 0.07$ in year three

Find P.

- a. 3,331
- b. 3,273
- c. 3,359
- d. 3,383
- e. 3,325
- Unanswered

The time is 8:58

---

21. Let Q be a transition probabilty matrix for a homogeneous Markov chain.

$$Q = \begin{pmatrix} 0.73 & 0.27 \\ 0.28 & 0.72 \end{pmatrix}$$

This matrix describes the probabilites of transition between two States S_0 and S_1 of a certain person. Each period represents a year.
This person, in S_0 now, purchases a 4-year Long-Term care insurance policy. You are given:

1. The person is in S_1 in the second time period.
2. Benefits of 30,000 are paid at the beginning of the year if the person is in S_1.
3. Premiums are will be paid at the beginning of the year if a person is in S_0
4. The interest rate is
   $i = 0.05$ in year one
   $i = 0.06$ in year two
   $i = 0.07$ in year three

Find the benefit reserve in the beginning of the second time period.

- a. 28,085
- b. 27,981
- c. 28,249
- d. 27,959
- e. 28,211
- Unanswered

The time is 8:58

---

22. For a double decrement model you are given the following about a person age (x)

(i) $\mu_x^{(1)}(t) = 0.03, \quad t \geq 0$

(ii) $\mu_x^{(2)}(t) = 0.04 \quad t \geq 0$

Where the index (1) indicates death through accidental causes and the index (2) indicates death through non-accidental causes.
Find the probability that (x) will die due to non-accidental causes.

- a. 0.429
- b. 0.523
- c. 0.571
- d. 0.629
- e. 0.613
- Unanswered

The time is 8:58

---

23. For a triple-decrement model, you are given the following information:

x	$q'^{(1)}_x$	$q'^{(2)}_x$	$q'^{(3)}_x$
37	0.16	0.17	0.07
38	0.08	0.07	0.12
39	0.11	0.08	0.02
40	0.07	0.13	0.07
41	0.06	0.14	0.07
42	0.13	0.08	0.17

Calculate ${}_3p_{38}^{(\tau)}$.

- a. 0.541
- b. 0.428
- c. 0.361
- d. 0.388
- e. 0.455
- Unanswered

The time is 8:58

---

24. A special whole life insurance of 190,000 issued to (x). You are given:

(i) Benefits are payable at the the moment of death.
(ii) If death occurs by accident during the first 28 years, the death benefit is doubled,
(iii) $\mu_x^{(\tau)}(t) = 0.040, \quad t \geq 0$
(iv) The force of mortality due to accidental death is $\mu_x^{(1)}(t) = 0.005, \quad t \geq 0$
(v) $\delta = 0.05$

Calculate the APV of this insurance.

- a. 94,151
- b. 93,533
- c. 93,207
- d. 93,494
- e. 94,801
- Unanswered

The time is 8:58

---

25. A non-homogenous Markov model has:

(i) Three states: 0, 1, and 2
(ii) Annual transition matrix Q_n are as follows:

$$Q_n = \begin{pmatrix} 0.83 & 0.17 & 0 \\ 0.08 & 0.72 & 0.20 \\ 0 & 0 & 1 \end{pmatrix} \qquad \text{for} \quad n = 0,\ 1,\ 2$$

$$Q_n = \begin{pmatrix} 0.95 & 0.05 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \end{pmatrix} \qquad \text{for} \quad n = 3,\ 4,\ 5,\ 6\ldots$$

An individual starts out in state 0, what is the probabilty that this individual will ever be in state 2?

- a. 0.258
- b. 0.157
- c. 0.164
- d. 0.260
- e. 0.087
- Unanswered

The time is 8:58

---

26. For a semi-continuous 20-year endowment insurance of 1000 on (x), you are given:

(i) Expenses are paid at the beginning of the year and are as follows:

Year	% of Premium Expenses	Per 1000 expenses	Per Policy expenses
1	34 %	2.00	22
Renewal	6 %	.41	4

(ii) $\ddot{a}_{x:\overline{20}|} = 12.575$

Calculate the level annual policy fee to be paid each year.

- a. 5.92

- b. 6.67
- c. 6.46
- d. 5.71
- e. 5.13
- Unanswered

The time is 8:58

---

27. For a special fully continuous whole life insurance on (x), you ae given

(i) $\delta = 0.04$
(ii) $\mu_x(t) = 0.02, \quad t \geq 0$
(iii) $b_t = 800e^{0.008\,t}, \quad t \geq 0$
(iii) $\pi_t = 10e^{0.02\,t}, \quad t \geq 0$

Calculate, the benefit reserve at $t = 7$.

- a. 38
- b. 31
- c. 33
- d. 45
- e. 32
- Unanswered

The time is 8:58

---

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

(i) $\delta = 0.06$
(ii) $\bar{a}_x = 12$
(iii) $\text{Var}\left(v^T\right) = 0.11$
(iv) ${}_0L_e = {}_0L + E$ is the expense augmented loss variable, where

$$
\begin{aligned}
{}_0L &= v^T - \overline{P}(\overline{A}_x)\overline{a}_{\overline{T|}} \\
E &= c_0 + (g - e)\overline{a}_{\overline{T|}} \\
c_0 &= \text{initial expense} \\
g &= 0.0032 \quad \text{is the annual rate of continuous maintenance expense} \\
e &= 0.0064 \quad \text{is the annual expense loading premium}
\end{aligned}
$$

Calculate Var$({}_0L_e)$

- a. 0.241
- b. 0.229
- c. 0.376
- d. 0.066
- e. 0.398
- Unanswered

The time is 8:58

---

29. For two indpendent lives (33) and (45) you are given:

(i) $\delta = 0.03$
(ii) Mortality for both lives follows De Moivre's law with $\omega = 106$

Compute $\overline{A}_{33:45}$

- a. 0.60881
- b. 0.52767
- c. 0.56967
- d. 0.54206
- e. 0.57996
- Unanswered

The time is 8:58

---

30. The force of mortality is $\frac{1}{2}$ times the force of mortality given by the Illustrative life table.

Click here to see the table in a different window

Compute ${}_{59}p_{22}$

- a. 0.6934868
- b. 0.6124461
- c. 0.5804476
- d. 0.6947095
- e. 0.7046182
- Unanswered

The time is 8:58

Make sure that you answered all the problems before clicking below. Please report any bug to:
saabactuarial at yahoo.com
Copy and paste the problem where you think there is a bug and give reasons to support your claim. This will help us make this site better. Thanks.

Submit Your Work
