1. Suppose that $\mu_x = \frac{1}{105-x}, \quad 0 \le x \le 105$ and that the force of interest is $\delta = 0.04$. An insurance pays 8 units at the time of death. Find the variance of the present value of the benefit for an 14-year endowment policy issued to an individual aged 43.

- a. 0.7005
- b. 0.6565
- c. 0.5615
- d. 0.5465
- e. 0.6435
- Unanswered

The time is 9:27

2. Suppose that $\mu = 0.369$ and that the force of interest is $\delta = 0.47$. For an individual of age (x), compute $\left(I\ \overline{A}\right)^{1}_{x:\overline{6}|}$.

- a. 0.7864
- b. 0.7296
- c. 0.7354
- d. 0.7998
- e. 0.7523
- Unanswered

The time is 9:27

3. Suppose that $\delta = 0.08$ and

$$l_x = \begin{cases} 1000 - 6x & \text{for } 0 \le x \le 50 \\ 1400 - 14x & \text{for } 50 \le x \le 100 \end{cases}$$

Compute $\text{Var}\left(v^{T(34)}\right)$

- a. 0.026808
- b. 0.027641
- c. 0.035572
- d. 0.025575
- e. 0.044371
- Unanswered

The time is 9:27

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

(i) $\mu_{x+t} = \mu, \quad t \geq 0$
(ii) $\delta_t = \mu, \quad t \geq 0$
(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 0.2939
(iv) Z is the present-value random variable at issue of the death benefit

Calculate $V(Z)$.

- a. 0.0756
- b. 0.0598
- c. 0.1385
- d. 0.1365
- e. 0.1595
- Unanswered

The time is 9:27

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5. You are given:

(i) $q_x = 0.11$
(ii) $q_{x+1} = 0.16$
(iii) $i = 0.1$
(iv) Deaths are uniformly distributed over each year of a age.

Calculate ${}^2\bar{A}^{1}_{x:\overline{2}|}$.

- a. 0.306
- b. 0.151
- c. 0.274
- d. 0.207
- e. 0.279
- Unanswered

The time is 9:27

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6. You are given:

(i) $s(x) = 1 - \frac{x}{88}, \quad 0 \le x \le 88$
(ii) $\delta = 0.06$

Calculate $\bar{a}_{31}$.

- a. 12.36
- b. 11.95
- c. 11.70
- d. 10.84
- e. 12.93
- Unanswered

The time is 9:27

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7. You are given:

(i) ${}_1E_x = 0.9$
(ii) $A^{\,1}_{x:\overline{1}|} = 0.03$

Calculate v.

- a. 0.87
- b. 0.92
- c. 0.95
- d. 0.94
- e. 0.93
- Unanswered

The time is 9:27

---

8. An insurance company has agreed to make payments to a worker age x who was injured at work.

(i) The payments are 160,000 per year starting immediately and continuing for the remainder of the worker's life.
(ii) Afrer the first 560,000 is paid by the insurance company, the remainder will be paid by a reinsurance company.
(iii) $_tp_x = \begin{cases} (0.6)^t & \text{for } 0 \le t \le 6.5 \\ 0 & \text{for } 6.5 < t \end{cases}$
(iv) $i = 0.05$

Calculate the actuarial present value of the payments to be made by the reinsurer.

- a. 53,903
- b. 37,893
- c. 38,207
- d. 55,195
- e. 47,305
- Unanswered

The time is 9:27

---

9. For a special fully discrete 3-year term insurance on (x).
Your are given:

(i) 0.95 is the lowest premium such that 0% chance of loss in year 1
(ii) $p_x = 0.75$
(iii) $p_{x+1} = 0.8$

(iv) $p_{x+2} = 0.85$
(v) Z is the random variable at issue of future benefits.

Calculate $E(Z)$.

- a. 0.454
- b. 0.442
- c. 0.450
- d. 0.458
- e. 0.443
- Unanswered

The time is 9:27

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10. For a fully continuous 21-year deferred life annuity of 1 issued to (35), You are given:

(i) Mortality follows de Moivre's law with $w = 89$
(ii) $i = 0$
(iii)Premium are paid continuously for 21 years.

Calculate the net premium reserve at the end of *8* years for this annuity.

- a. 5.533
- b. 5.183
- c. 5.403
- d. 5.343
- e. 5.413
- Unanswered

The time is 9:27

---

11. Let ${}_kL$ denote the prospective-loss-at-time- k random variable for a fully discrete whole life insurance of 500 issued to (x).
you are given:

(i) $A_x = 0.124$
(ii) $A_{x+n} = 0.384$

(iii) ${}^{2}A_{x+n} = 0.192$

Calculate Var$({}_{n}L)$.

- a. 13,907
- b. 13,857
- c. 14,827
- d. 14,362
- e. 14,512
- Unanswered

The time is 9:27

---

12. Let ${}_{k}L$ denote the prospective-loss-at-time- k random variable for a fully discrete whole life insurance of 500 issued to (x).
you are given:

(i) $A_x = 0.126$
(ii) $A_{x+n} = 0.404$
(iii) ${}^{2}A_{x+n} = 0.202$

An insurer has 150 policies at this type. Assume that the losses of the 150 policies are independent. Use the approximation that the agregate loss is normally distributed.

Calculate the agregate amount that the inurer must have a time n so that the probability of meeting its obligations for these policies is .95.

- a. 27,266
- b. 27,126
- c. 25,086
- d. 27,476
- e. 26,126
- Unanswered

The time is 9:27

---

13. A fully discrete 3-year endowment insurance of 17 is issued to (x).

You are given:

(i) $i = 0.18$.
(ii) The reserve at the end of the first year is 3.74
(iii) The reserve at the end of the second year is 8.84

Calculate the benefit premium.

- a. 4.86
- b. 5.37
- c. 6.39
- d. 4.72
- e. 5.57
- Unanswered

The time is 9:27

---

14. A fully discrete 3-year endowment insurance of 16 is issued to (x).
You are given:

(i) $i = 0.18$.
(ii) The reserve at the end of the first year is 3.52
(iii) The reserve at the end of the second year is 8.32

Calculate q_{x+1}

- a. 0.183
- b. 0.333
- c. 0.263
- d. 0.213
- e. 0.223
- Unanswered

The time is 9:27

---

15. A special fully discrete 2-year insurance of 1 (x).
You are given:

(i) $q_x = 0.093, \quad q_{x+1} = 0.186$
(ii) $v = 0.88$
(iii) ${}_1L$ is the prospective loss random variable at time 1 using the premium determined by the equivalence principle.

Calculate the $\text{Var}[{}_1L|K(x) > 0]$

- a. 0.18848
- b. 0.15742
- c. 0.02557
- d. 0.11725
- e. 0.01961
- Unanswered

The time is 9:27

---

16. The random variables $T(x)$ and $T(y)$ are independent. You are given the following mortality table:

k	q_{x+k}	q_{y+k}
0	0.07	0.09
1	0.08	0.12
2	0.09	0.20

Calculate ${}_{1|}q_{xy}$

- a. 0.143
- b. 0.161
- c. 0.189
- d. 0.144
- e. 0.172
- Unanswered

The time is 9:27

---

17. You are pricing a special 3-year life annuity-due on two lives each age x, with independent future lifetimes. The annuity pays 12,000 if both persons are alive and 3,000 if

exactely one person is alive.
You are given:

(i) $q_{xx} = 0.035$
(ii) $q_{x+1:x+1} = 0.009$
(iii) $i = 0.05$

Calculate the APV of this annuity.

- a. 34,000
- b. 33,900
- c. 33,700
- d. 33,300
- e. 33,500
- Unanswered

The time is 9:27

---

18. For two independent lives (42) and (58), you are given

(i) The mortality of (42) follows a constant mortality rate $\mu_1 = 0.038$
(ii) The mortality of (42) follows the constant mortality law with $\mu_2 = 0.060$

Calculate $\mathring{e}_{42:58}$.

- a. 10.20
- b. 11.50
- c. 11.68
- d. 11.25
- e. 10.78
- Unanswered

The time is 9:27

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19. Your local grocery store is open 12-hours a day. Custmors arrive to the store from $t = 0$ (7:00 a.m.) to $t = 12$ (7:00 p.m.) according to a nonhomogeneous Poisson process with intensity function

$$\lambda(t) = t(12 - t)$$

What is the probability that there will be fewer than *4* customers who arrived in the first 30 minutes after 7:00 a.m.?

- a. 0.061
- b. 0.321
- c. 0.939
- d. 0.679
- e. 0.709
- Unanswered

The time is 9:27

---

20. Workers's compensation claims are reported according to a Poisson process with mean 100 per month. Then number of claims reported and the number of claim amounts are independently distributed. The number of claims exceeding 30,000 is *2*% of the total claims. Calculate the number of complete months of data that must be gathered to have at least 56% chance of observing at least *4* claims each exceeding 30,000.

- a. 1
- b. 4
- c. 3
- d. 5
- e. 2
- Unanswered

The time is 9:27

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

$$Q = \begin{pmatrix} 0.73 & 0.27 \\ 0.25 & 0.75 \end{pmatrix}$$

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 20,000 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
   $i = 0.04$ in year one
   $i = 0.05$ in year two
   $i = 0.06$ in year three

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

- a. 20,235
- b. 20,531
- c. 20,415
- d. 20,586
- e. 20,250
- Unanswered

The time is 9:27

---

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

x	$q_x^{(1)}$	$q_x^{(2)}$	$q_x^{(3)}$	$p_x^{(\tau)}$	$l_x^{(\tau)}$	$d_x^{(1)}$	$d_x^{(2}$	$d_x^{(3)}$	$d_x^{(\tau)}$
37	0.07	0.06	0.16	0.71	1000.00	70.00	60.00	160.00	290.00
38	0.15	0.08	0.10	0.67	710.00	106.50	56.80	71.00	234.30
39	0.17	0.02	0.04	0.77	475.70	80.87	9.51	19.03	109.41
40	0.09	0.02	0.03	0.86	366.29	32.97	7.33	10.99	51.29
41	0.14	0.09	0.14	0.63	315.01	44.10	28.35	44.10	116.55
42	0.11	0.15	0.05	0.69	198.46	21.83	29.77	9.92	61.52

Compute ${}_3q_{37}^{(\tau)}$

- a. 0.574
- b. 0.634
- c. 0.718
- d. 0.535
- e. 0.712
- Unanswered

The time is 9:27

---

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

(i) $\mu_x^{(1)}(t) = 0.01, \quad t \geq 0$
(ii) $\mu_x^{(2)}(t) = 0.02 \quad t \geq 0$
(iii) $\mu_x^{(3)}(t) = 0.04 \quad t \geq 0$

Where the index (1) indicates death, the index (2) indicates withdrawal for disability and the index (3) indicates withdrawal for all other causes.
Find the probability that (x) will withdraw for all other causes.

- a. 0.286
- b. 0.143
- c. 0.571
- d. 0.487
- e. 0.656
- Unanswered

The time is 9:27

---

24. For special whole life insurance, you are given:

(i) Benefits are payable at the the moment of death.
(ii)The benefit for accidental death (Cause (1)) is 0 for all years.
(iii) The benefit for non-accidental death (Cause (2)) for the first *2* years is return of the single benefit premium P without interest.
(iv) The benefit for non-accidental death after the first *2* years is 35,000
(v) $\mu^{(1}(t) = 0.053, \quad t \geq 0$
(vi) $\mu^{(2)}(t) = 0.038, \quad t \geq 0$
(vii) $\delta = 0.08$

Calculate P.

- a. 5,800
- b. 5,900
- c. 5,600
- d. 6,300
- e. 6,000
- Unanswered

The time is 9:27

---

25. Harold has been disabled and will begin receiving disabilty payments.
You are given:

(i) $v = 0.93$
(ii)The benefit for accidental death (Cause (1)) is 0 for all years.
(iii) $\mu_{67}^{(1}(t) = .1(6-t), \quad t \le 6$
(iv) $\mu_{67}^{(2)}(t) = .1t, \quad t \le 6$
(v) Payments of 20,000 begin today, his 67th birthday.
(vi) On every birthdays up to and including his 73th birthday, he will receive 20,000 as long as he has not recovered or died.

Calculate the APV of Harold's disability payments.

- a. 40,127
- b. 37,318
- c. 37,647
- d. 40,285
- e. 40,481
- Unanswered

The time is 9:27

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26. For a whole life insurance of 1 on (x) with benefits payable at the moment of death, you are given:

(i)

$$\delta(t) = \begin{cases} 0.01 & t < 10 \\ 0.02 & t \geq 10 \end{cases}$$

(ii)

$$\mu_x(t) = \begin{cases} 0.03 & t < 4 \\ 0.04 & t \geq 4 \end{cases}$$

Calculate the actuarial present value of this insurance.

- a. 0.71
- b. 0.77
- c. 0.76
- d. 0.66
- e. 0.63
- Unanswered

The time is 9:27

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27. A population has 10% who are smokers with a constant force of mortality 0.2 and 90% who are non-smokers with a constant force of mortality 0.1
Calculate the 72th percentile of the distribution of the future lifetime of an individual selected at random from this population.

- a. 12.01
- b. 12.83
- c. 12.81
- d. 12.91
- e. 12.55
- Unanswered

The time is 9:27

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28. You are given:

(i) $T(x)$ and $T(y)$ are independent.

$$Z = \begin{cases} v^{T(y)}, & T(x) \le T(y) \\ 0, & T(x) > T(y) \end{cases}$$

(ii) The survival function of (x) follows De Moivre's Law with $\omega = 104$.
(iii) The survival function of (y) is subject to a constant force of mortality
$\mu_y(t) = \mu, \quad t \ge 0$
(iv) $n < 104 - x$

Deternine the probabilty that (x) dies within n years and predeceases (y).

- a. $\frac{1-e^{-\mu n}}{104-x}$
- b. $\frac{1-e^{-\mu n}}{\mu(104-x)}$
- c. $\frac{e^{-\mu n}}{\mu(104-x)}$
- d. $\frac{e^{-\mu n}}{104-x}$
- e. $\frac{1+e^{-\mu n}}{104-x}$
- Unanswered

The time is 9:27

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29. For two indpendent lives (40) and (53) you are given:

(i) $\delta = 0.03$
(ii) Mortality for both lives follows De Moivre's law with $\omega = 96$

Compute $\overline{A}_{40:53}$

- a. 0.60702
- b. 0.62939
- c. 0.62631
- d. 0.65208
- e. 0.60692

Unanswered

The time is 9:27

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30. For a special 4-year term insurance, you are given:

(i) Insureds may be in one of three states at the beginning of each year: active, disabled, or dead. All insureds are initially active. The annual transition probabilities are as follows:

	Active	Disabled	Dead
Active	0.78	0.10	0.12
Disbaled	0.12	0.64	0.24
Dead	0	0	1

(ii) A 200,000 benefit is payable at the end of the year in which the insured is disabled at the beginning of the year.
(iii) Premiums are paid at the beginning of each year when active. Insureds do not pay any annual premiums when they are disabled.
(iv) $d = 0.10$

Calculate the level annual benefit premium for this insurance.

a. 32,188.58
b. 22,211.00
c. 22,169.66
d. 22,210.37
e. 22,121.05
Unanswered

The time is 9:27

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