1. Suppose that the survival function is given by

$$s(x) = \frac{100 - x}{100}$$

Compute ${}_{17}q_{42}$

- a. $\frac{8}{29}$
- b. $\frac{17}{58}$
- c. $\frac{9}{29}$
- d. $\frac{15}{58}$
- e. $\frac{19}{58}$
- Unanswered

The time is 9:24

2. Suppose that $\mu_x = \frac{1}{107-x}, \quad 0 \le x \le 107$ and that the force of interest is $\delta = 0.05$. An insurance pays 17 units at the time of death. Find the variance of the present value of the benefit for an 12-year endowment policy issued to an individual aged 42.

- a. 2.7195
- b. 2.7155
- c. 2.6125
- d. 2.6955
- e. 2.7595
- Unanswered

The time is 9:24

3. Suppose that $\mu = 0.297$ and that the force of interest is $\delta = 0.411$.

For an individual of age (x), compute $\left(D\ \overline{A}\right)^{1}_{x:\overline{6}|}$.

- a. 2.1155
- b. 2.0668
- c. 2.1602
- d. 2.0658
- e. 2.1086
- Unanswered

The time is 9:24

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4. Suppose that $\mu_x = \frac{1}{108-x}$, $0 \le x \le 108$ and $v_t = \frac{1}{1+0.052\,t}$.
An insurance pays 17 units at the time of death. Find the mean of the present value of the benefit for a whole life policy issued to an individual aged 58.

- a. 7.8925
- b. 8.0789
- c. 7.9253
- d. 7.6277
- e. 8.3753
- Unanswered

The time is 9:24

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5. You are given:

(i) $q_x = 0.09$
(ii) $q_{x+1} = 0.2$
(iii) $i = 0.09$
(iv) Deaths are uniformly distributed over each year of a age.

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

- a. 0.238
- b. 0.259
- c. 0.246
- d. 0.239
- e. 0.256
- Unanswered

The time is 9:24

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6. The future life time follows the illustrative life table at 6 % with UDD over each year of age. A continuous life annuity of 3000 issued to (59).
Find the expected present value of this annuity.
Click here to see the table in a different window

- a. 32,538
- b. 32,626
- c. 32,318
- d. 31,920
- e. 32,258
- Unanswered

The time is 9:24

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7. You are given:

(i) $\ddot{a}_x = 10$
(ii) $v = 0.92$

Calculate A_x.

- a. 0.21
- b. 0.18
- c. 0.19
- d. 0.20
- e. 0.27

- Unanswered

The time is 9:24

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8. You are given:

(i) $p_{84} = 0.8$
(ii) $p_{85} = 0.75$
(iii) $p_{86} = 0.61$
(iv) $p_{87} = 0.49$
(v) $p_{88} = 0$

Calculate $a_{84:\overline{2}|}$ if $i = 0.07$.

- a. 1.272
- b. 1.357
- c. 1.297
- d. 1.317
- e. 1.185
- Unanswered

The time is 9:24

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9. A person age 41 wins 5,000 in the actuarial lotery. Rather than receiving the money at once, the winner is offered the actuarially equivalent option of receiving and annual payment of X (at the beginning of each year) guaranteed for 13 years and continue thereafter for life.
You are given:

(i) $A_{41} = 0.28$
(ii) $A_{54} = 0.32$
(iii) $A^{1}_{41:\overline{13}|} = 0.07$
(iii) $i = 0.044$

Calculate X.

- a. 245
- b. 241
- c. 238
- d. 237
- e. 236
- Unanswered

The time is 9:24

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10. You are given:

    (ii) Mortality follows the illustrative life table at 6%.
    Click here to see the table in a different window
    (ii) Assume UDD over each year of age.

Compute the variance of the loss of whole life policy on a life aged (46) that pays 70,000 at the moment of death.

- a. 241,643,400
- b. 242,163,400
- c. 241,953,400
- d. 242,133,400
- e. 241,893,400
- Unanswered

The time is 9:24

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11. Your age is 34 and you want to buy a 4-year term life policy with a benefit of 200,000 payable at the end of year of death. Suppose that $i = 0.04$ and
$p_{34} = 0.96, \quad p_{35} = 0.94, \quad p_{36} = 0.91, \; p_{37} = 0.88.$
Find the standard deviation of the loss function.

- a. 87,445
- b. 87,337
- c. 87,336
- d. 87,562

- e. 87,345
- Unanswered

The time is 9:24

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12. Consider a fully continuous 20 year term insurnace contract of 1 for an individual aged 38. Suppose that $\delta = 0.05$ and mortality follows de Moivre's law with $w = 100$. Compute the level premium using the equivalence principle.

- a. 0.01864
- b. 0.02913
- c. 0.02930
- d. 0.00626
- e. 0.00669
- Unanswered

The time is 9:24

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13. For a fully continuous whole life insurance 42, you are given:

(i) The level annual premium is 67, payable for the first 20 years at the beginning of each year.
(ii) The death benefit is 2000 for the first 20 years and 1000 thereafter.
(iii) $\delta = 0.06$
(iv) $1000\bar{A}_{52} = 333.91$
(v) $1000\bar{A}^{1}_{52:\overline{10|}} = 197.07$
(vi) $1000 \ {}_{10}E_{52} = 405.29$

Calculate ${}_{10}V$, the benefit reserve for this insurance at time 10..

- a. 86.95
- b. 88.29
- c. 79.26
- d. 92.72
- e. 93.56
- Unanswered

The time is 9:24

14. For a fully discrete whole life insurance of 6000 on 47, the contract premium is the level annual benefit premium based on the mortality rates at issue. At time 10, the actuary decided to change the mortality rates for ages 57 and higher.
You are given:

(i) $d = 0.06$
(ii) Mortality assumptions:

At issue	${}_{k\|}q_{47} = 0.024, \quad 0 \le k \le 56 \quad$ and $\; {}_{k\|}q_{47} = 0, \quad k \ge 57$
Revised prospectively at time 10	${}_{k\|}q_{57} = 0.048, \quad 0 \le k \le 24$ and $\; {}_{k\|}q_{47} = 0, \quad k \ge 25$

(iii) ${}_{10}L$ is the prospective loss random variable at time 10 using the contract premium.

Calculate $E[{}_{10}L | K(47) \ge 10]$ using the revised mortality assumptions.

- a. 2,188
- b. 2,208
- c. 2,080
- d. 2,184
- e. 2,144
- Unanswered

The time is 9:24

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

(i) The death benefit is 0 in the first year and 6000 thereafter.
(ii)Level benefit premiums are payable for life at the beginning of each year.
(iii) $q_x = 0.055$
(iv) $v = 0.86$
(v) $\ddot{a}_x = 6$
(vi) ${}_9V_x = 0.21$
(vii) ${}_9V$ is the benefit reserve at the end of year 9 for this insurance.

Calculate ${}_9V$.

- a. 1422

- b. 1482
- c. 1542
- d. 1432
- e. 1472
- Unanswered

The time is 9:24

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16. 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 3000 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 3000 on (x).
(iii) $q_{x+10} = 0.0041$
(iv) ${}_{10}V^A - {}_{10}V^B = 101.37$
(v) $i = 0.07$
(vi) The annual benefit premium for type B insurance is 8.39

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

- a. 96
- b. 97
- c. 98
- d. 95
- e. 100
- Unanswered

The time is 9:24

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17. Tom, Dick and Henry have the same birthday and their current age are exactly 29, 30 and 33. Their future lifetime are independent and subject to the survival rate

$$ {}_tp_x = 1 - \frac{t}{102 - x} $$

Calculate the probabilty that they will not all be alive after 10 years simultsneously.

- a. 0.3625
- b. 0.3659
- c. 0.3597
- d. 0.3646
- e. 0.3615
- Unanswered

The time is 9:24

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18. The force of mortality is

$$\mu_x = \frac{1}{113 - x}, \quad 0 \le x \le 113$$

For independent lives 73 and 84, calculate ${}_9p_{\overline{73:84}}$

- a. 0.946684
- b. 0.957018
- c. 0.907006
- d. 0.930172
- e. 0.918590
- Unanswered

The time is 9:24

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19. A company has purchased two new tools with independent future liftimes. Each tool has its own distinct De Moivre survival pattern. One has a 12-year maximum lifetime and the other has a 6-year maximum lifetime.
Calculate the expected time until both tools have failed.

- a. 7.45
- b. 6.90
- c. 5.63
- d. 6.14
- e. 6.50

- Unanswered

The time is 9:24

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20. Suppose that people arrive at a desert island at a Poisson rate $\lambda = 2$ per day. What is the probability that the elapsed time between two consecutive arrivals exceed 4 hours.

- a. 0.283
- b. 0.717
- c. 0.312
- d. 0.688
- e. 0.646
- Unanswered

The time is 9:24

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21. 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 95% chance of observing at least 4 claims each exceeding 30,000.

- a. 3
- b. 5
- c. 7
- d. 4
- e. 2
- Unanswered

The time is 9:24

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

(i) Benefits are payable at the the moment of death.
(ii) If cause of death is cause (1), the insurance pays 200,000.
(iii) If cause of death is cause (2), the insurance pays 100,000.
(iv) If cause of death is cause (3), the insurance pays 50,000.
(v) $\mu^{(1}(t) = 0.00024, \quad t \geq 0$

(vi) $\mu^{(2)}(t) = 0.00048, \quad t \geq 0$
(vii) $\mu^{(3)}(t) = 0.00096, \quad t \geq 0$
(viii) $\delta = 0.06$

Calculate the APV of this insurance.

- a. 2,310
- b. 2,350
- c. 2,300
- d. 2,330
- e. 2,360
- Unanswered

The time is 9:24

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

(i) $v = 0.95$
(ii)The benefit for accidental death (Cause (1)) is 0 for all years.
(iii) $\mu_{65}^{(1}(t) = .1(5 - t), \quad t \leq 5$
(iv) $\mu_{65}^{(2)}(t) = .1t, \quad t \leq 5$
(v) Payments of 30,000 begin today, his 65^{th} birthday.
(vi) On every birthdays up to and including his 70^{th} birthday, he will receive 30,000 as long as he has not recovered or died.

Calculate the APV of Harold's disability payments.

- a. 66,293
- b. 68,198
- c. 62,978
- d. 64,788
- e. 68,320
- Unanswered

The time is 9:24

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24. A casino has a game that makes payouts at a Poisson rate of 5 per hour and the payout amounts are 1, 2, 3,... without limit. The probability that any given payout is equal to i is $\frac{1}{2^i}$. Payouts are independent.
Calculate the probability that there are no payouts of 1, 2, or 3 in a given 30 minute period.

- a. 0.18
- b. 0.11
- c. 0.16
- d. 0.20
- e. 0.06
- Unanswered

The time is 9:24

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25. A fully discrete 2-year endowment insurance issued to (x).
You are given:

(i) $i = 0.06$.
(ii) $p_{x+k-1} = 0.9, \quad k = 1, 2$
(iii) P is the level annual benefit premium
(iv)The pure endowment is 2000
(v) The death benefit for year k is $1000\,k$ plus the benefit reserve at the end of year $k, \quad k = 1, 2$

Calculate P.

- a. 1066
- b. 1086
- c. 1056
- d. 1026
- e. 1046
- Unanswered

The time is 9:24

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26. For a special fully discrete 30-payment whole life insurance on (49), you are given:

(i) The death benefit of 2000 is payable at the end of the year of death.
(ii) The benefit premium for this insurance is equal to $2000P_{49}$ for the first 15 years followed by an increased level annual premium of π for the remaining 15 years.
(iii) Mortality follows Illustrative Life Table at 6%
Click here to see the table in a different window
(iv) $i = .06$

Calculate π.

- a. 41.3
- b. 41.7
- c. 42.1
- d. 41.9
- e. 41.1
- Unanswered

The time is 9:24

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27. For a perpetuity-immediate with annual payments of 1:

(i) The sequence of annual discount factors follows a Markov chain with the following three states:

State Number	0	1	2
Annual Discount Factor v	0.95	0.94	0.93

(ii) The transition matrix for the annual discount factors is:

$$Q = \begin{bmatrix} .0 & 1.0 & .0 \\ 0.7 & 0.0 & 0.3 \\ .0 & 1.0 & .0 \end{bmatrix}$$

(iii) Y is the present value of the perpetuity payments when the initial state is 1.

Calculate $E(Y)$

- a. 18.11
- b. 16.22

- c. 15.38
- d. 16.75
- e. 15.28
- Unanswered

The time is 9:24

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28. A member of a high school math team is practicing for a contest. Her advisor has given her practice problems: Her advisor told her to first choose problems from three specific ptoblems *x*, *y*, and *z* and once these problems are solved she can move to solve other problems.
She randomly chooses one of the problems *x*, *y*, and *z*, and works on it until she solves it. Then she randomly chooses one of the remaining two unsolved problems, and works on it until solved. Then she works on the last unsolved problem and then moves on to the remaining problems.
She solves problems at a Poisson rate of 1 problem per *4* minutes.
Calculate the probability that she has solved problem *z* within 12 minutes of starting the problems.

- a. 0.84
- b. 0.66
- c. 0.78
- d. 0.67
- e. 0.60
- Unanswered

The time is 9:24

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29. For a fully discrete 11-year endowment insurance of 1000 on (*x*), you are given:

(i) Expenses are paid at the beginning of each year.
(ii) Annual per policy renewal expenses are *5*.
(iii) Percent of premium renewal expenses are 9.8% of the expense-loaded premium.
(iv) $1000P_{x:\overline{11|}} = 76.64$
(v) The expense reserve at the end of year 10 is negative 1.54
(vi) Expense-loaded premiums were calculated using the equivalence principle.

Calculate the expense-loaded premium for this insurance.

- a. 88.80
- b. 92.67
- c. 92.22
- d. 94.21
- e. 94.41
- Unanswered

The time is 9:24

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30. For a 20-payment whole life insurance with annual premiums, you are given:

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

Year	% of Premium Expenses	Per Policy expenses
1	102 %	47
Years 2-10	*9* %	20
Years 11 and after	*4* %	20

(ii) $\ddot{a}_x = 16.23$

(iii) $\ddot{a}_{x:\overline{10}|} = 7.97$

(iii) $\ddot{a}_{x:\overline{20}|} = 12.11$

Calculate the policy fee to be paid each year

- a. 37.06
- b. 36.07
- c. 36.79
- d. 35.92
- e. 34.15
- Unanswered

The time is 9:24

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