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

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

Compute $E(T(84)^2]$.

- a. $\frac{60}{11}$
- b. $\frac{361}{66}$
- c. $\frac{181}{33}$
- d. $\frac{359}{66}$
- e. $\frac{11}{2}$
- Unanswered

The time is 10:02

2. Suppose that

$$s(x) = 1 - \frac{x}{\omega} \quad \text{and} \quad \mathring{e}_0 = 20.$$

Compute Var$(T(10))$

- a. 75.00
- b. 74.00
- c. 72.00
- d. 73.00
- e. 71.00
- Unanswered

The time is 10:02

3. You are given:

(i) $l_0 = 7000$
(ii) $s(x) = e^{-0.15\,x}$.

Calculate T_6, the total number of years lived beyond age (6) by the survivors of 7000 initial members.
This is not the same as $T(6)$, the future lifetime of (6).

- a. 18973
- b. 18640
- c. 19185
- d. 18835
- e. 18491
- Unanswered

The time is 10:02

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4. Suppose that $\mu = 0.235$ and that the force of interest is $\delta = 0.463$.
For an individual of age (x), compute $\left(\overline{IA}\right)x$.

- a. 0.4823
- b. 0.2975
- c. 0.6727
- d. 0.8493
- e. 0.0821
- Unanswered

The time is 10:02

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5. Suppose that $\mu = 0.368$ and that the force of interest is $\delta = 0.493$.
For an individual of age (x), compute $\left(\overline{IA}\right)^{1}_{x:\overline{5}|}$.

- a. 0.5008
- b. 0.4673
- c. 0.4762
- d. 0.4609

- e. 0.4317
- Unanswered

The time is 10:02

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6. An investment fund is established to provide benefits on 300 independent lives of age *x*.

> (i) On January 1, 2001, each life is issued a 11-year deferred whole life insurance of 1400, payable at the moment of death.
> (ii) Each life is subject to a constant morality of 0.06.
> (iii) The force of interest is 0.07.

Calculate the amount needed on January 1, 2001, so that the probability, as determined by the normal approximation, is 0.95 that the fund will have sufficient fund to provide for these benefits.

Need a Z-table

- a. 52,175
- b. 54,175
- c. 52,675
- d. 50,675
- e. 50,175
- Unanswered

The time is 10:02

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7. Lee age (57), considers the purchase of a single premium whole life insurnace of 10,000 with death benefit payable at the end of the year of death.
The company calculates benefit premiums using:

> (i) Mortality are based on the following table
> Click here to see the table in a different window
> (ii) $i = 0.05$

The company calculates contract premium as 112% of benefit premiums.
The single contract premium at age is 5748.
Lee decides to delay for two years and invests the 5748.

Calculate the minimum annual of return that the investment must earn to accumulate to an amount equal to the single contract premium at age 59.

- a. 0.024
- b. 0.062
- c. 0.057
- d. 0.044
- e. 0.061
- Unanswered

The time is 10:02

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8. Suppose $x = 43$ Suppose that T_x has the following pdf

$$f(t) = \begin{cases} 0.08e^{-0.08t}, & 0 \le t \le 9 \\ \dfrac{e^{-0.72}}{48} & 9 \le t \le 57 \end{cases}$$

Calculate the present value of a 9 year term annuity issued to (x) if $\delta = 0.05$ and one unit of annuity is paid continuously.

- a. 3.902
- b. 5.305
- c. 5.493
- d. 6.007
- e. 4.974
- Unanswered

The time is 10:02

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

(i) The payments are 120,000 per year starting immediately and continuing for the remainder of the worker's life.
(ii) Afrer the first 420,000 is paid by the insurance company, the remainder will be paid by a reinsurance company.
(iii) $_tp_x = \begin{cases} (0.5)^t & \text{for } 0 \le t \le 7.5 \\ 0 & \text{for } 7.5 < t \end{cases}$
(iv) $i = 0.05$

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

- a. 11,719
- b. 11,857
- c. 17,653
- d. 27,375
- e. 23,342
- Unanswered

The time is 10:02

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

$$A_{47:\overline{18}|}$$

- a. 0.3642290
- b. 0.3660890
- c. 0.3654090
- d. 0.3820590
- e. 0.4004690
- Unanswered

The time is 10:02

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11. For a fully continuous 23-year deferred life annuity of 1 issued to (37), You are given:

(i) Mortality follows de Moivre's law with $w = 81$
(ii) $i = 0$
(iii)Premium are paid continuously for 23 years.

Calculate the net premium reserve at the end of 14 years for this annuity.

- a. 5.533
- b. 4.663

- c. 5.323
- d. 4.933
- e. 5.093
- Unanswered

The time is 10:02

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12. A special fully discrete 3-year term insurance is issued to (x). You are given:

(i) $i = 0.05$
(ii)

k	b_{k+1}	q_{x+k}
0	700,000	0.02
1	525,000	0.05
2	350,000	0.08

(iii)Level benefits premiums are paid at the beginning of each year.

Compute the first terminal reserve(i.e the reserve at the end of year 1).

- a. 8,800
- b. 8,000
- c. 8,200
- d. 8,700
- e. 8,500
- Unanswered

The time is 10:02

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13. For a 5-year endowment insurance on (x) you are given:

(i) The death benefits are payable at the moment of death.
(ii) Premiums are paid continuously, are determined using the equivalence principle.
(iii) $\mu_x(t) = 0.05$ for $t > 0$
(iv) $\delta = 0.04$
(v) ${}_tL$ is the prospective loss at time t.
(vi) You may not need all of the above to do the problem.

Calculate $V({}_0L)$

- a. 0.14
- b. 0.12
- c. 0.08
- d. 0.03
- e. 0.15
- Unanswered

The time is 10:02

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14. Tom, Dick and Henry have the same birthday and their current age are exactly 30, 32 and 35. Their future lifetime are independent and subject to the survival rate

$$ {}_t p_x = 1 - \frac{t}{104 - x} $$

Calculate the probabilty that they will not all be alive after 12 years simultsneously.

- a. 0.4191
- b. 0.4198
- c. 0.4232
- d. 0.4256
- e. 0.4276
- Unanswered

The time is 10:02

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15. You are given

(i) $T(x)$ and $T(y)$ are not independent.
(ii) $q_{x+k} = q_{y+k} = 0.053, \quad k = 0, 1, 2, \ldots$
(iii) ${}_k p_{\text{xy}} = 1.011 \;\; {}_k p_x \;\; {}_k p_y, \quad k = 0, 1, 2, \ldots$

Compute $e_{\overline{\text{xy}}}$, the curtate expectation of the life of the survivor status.

- a. 29.04
- b. 25.88
- c. 26.95
- d. 28.21
- e. 24.93

- Unanswered

The time is 10:02

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16. For two independent lives (64) and (73).
You are given

(i) The survival function of (64) follows De Moivre's law with $\omega = 83$.
(ii) The survival function of (73) follows De Moivre's law with $\omega = 89$.

Calculate the probability that (64) does not survive at least *8* years longer than (73)

- a. 0.199
- b. 0.170
- c. 0.830
- d. 0.801
- e. 0.845
- Unanswered

The time is 10:02

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17. For a claim process, you are given:

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

$$\lambda(t) = \begin{cases} 1, & 0 \leq t < 1 \\ 4, & 1 \leq t < 2 \\ 6, & 2 \leq t \end{cases}$$

(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 $[200,\ 800]$.
(iv) The random variable P is the number of claims amount less than 500 by time $t = 4$
(v) The random variable Q is the number of claims amount greater than 500 by time $t = 4$
(vi) R is the conditional expected value of P given that $Q = 10$

Calculate R.

- a. 9.6
- b. 5.4
- c. 8.5
- d. 7.0
- e. 9.4
- Unanswered

The time is 10:02

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18. For an allosaur with 10,000 calories stored at the start of the day, you are given the following:

(i) The allosaur uses calories uniformly at the rate of 5,000 calories per day. If his stored calories reaches 0, he dies.
(ii) Each day the allosaur eats one scientist (10,000 calories with probability 0.41 and no scientist with probability 0.59.
(iii) The allosaur eats only scientists.
(iv) The allosaur can store calories without limit until needed.

Calculate the probability that the allosaur ever has 15,000 or more calories stored.

- a. 0.601
- b. 0.470
- c. 0.541
- d. 0.589
- e. 0.507
- Unanswered

The time is 10:02

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19. For a double-decrement model, you are given the following information:

x	$l_x^{(\tau)}$	$d_x^{(1)}$
30	9,428	30
31	9,209	62
32	8,787	149
33	7,749	303
34	6,210	421
35	4,210	573

Calculate the probability that (32) will leave the cohort of lives within *2* years due to decrement (2).

- a. 0.160
- b. 0.339
- c. 0.204
- d. 0.242
- e. 0.312
- Unanswered

The time is 10:02

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

x	$q_x^{(1)}$	$q_x^{(2)}$	$q_x^{(3)}$
37	0.02	0.02	0.05
38	0.05	0.05	0.10
39	0.05	0.05	0.16
40	0.07	0.06	0.02
41	0.07	0.14	0.06
42	0.05	0.05	0.06

If $l_{37}^{(\tau)} = 1000$, compute

$$d_{39}^{(\tau)}$$

- a. 53.48
- b. 80.81
- c. 189.28
- d. 189.23
- e. 189.34
- Unanswered

The time is 10:02

21. 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	0.03	0.07	0.10	0.80	1000.00	30.00	70.00	100.00	200.00
38	0.16	0.08	0.04	0.72	800.00	128.00	64.00	32.00	224.00
39	0.02	0.07	0.02	0.89	576.00	11.52	40.32	11.52	63.36
40	0.17	0.14	0.15	0.54	512.64	87.15	71.77	76.90	235.82
41	0.03	0.10	0.07	0.80	276.83	8.30	27.68	19.38	55.36
42	0.08	0.16	0.09	0.67	221.46	17.72	35.43	19.93	73.08

Compute ${}_2q_{39}^{(\tau)}$

- a. 0.611
- b. 0.581
- c. 0.575
- d. 0.519
- e. 0.606
- Unanswered

The time is 10:02

22. You are given the following information about $q_x^{(j)}$

(i) In a double decrement model:
(a) $j = 1$ if the cause of death is beri-beri.
(b) $j = 2$ if the cause of death is other than beri-beri.
(ii) $q_x^{(\tau)} = \frac{x}{100}$
(iii) $q_x^{(1)} = \frac{1}{2}\, q_x^{(1)}$

Calculate the probability that an individual age 43 will die from causes other than Beri-Beri within 3 years.

- a. 0.550
- b. 0.625
- c. 0.489

- d. 0.627
- e. 0.462
- Unanswered

The time is 10:02

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

x	$q'^{(1)}_x$	$q'^{(2)}_x$	$q'^{(3)}_x$
37	0.13	0.09	0.12
38	0.10	0.05	0.02
39	0.17	0.09	0.13
40	0.09	0.13	0.12
41	0.06	0.12	0.09
42	0.12	0.16	0.09

Calculate ${}_2p^{(\tau)}_{38}$.

- a. 0.489
- b. 0.622
- c. 0.551
- d. 0.496
- e. 0.535
- Unanswered

The time is 10:02

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

(i) $\mu^{(1)}_x(t) = 0.01, \quad t \geq 0$
(ii) $\mu^{(2)}_x(t) = 0.02 \quad t \geq 0$
(iii) $\mu^{(3)}_x(t) = 0.03 \quad t \geq 0$

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 by dying.

- a. 0.500
- b. 0.107
- c. 0.333
- d. 0.258
- e. 0.167
- Unanswered

The time is 10:02

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25. A non-homogenous Markov model has:

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

$$Q_n = \begin{pmatrix} 0.76 & 0.24 & 0 \\ 0.08 & 0.73 & 0.19 \\ 0 & 0 & 1 \end{pmatrix} \qquad \text{for} \quad n = 0,\ 1,\ 2$$

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

An individual starts out in state 1, what is the probabilty that this individual will ever be in state 2?

- a. 0.582
- b. 0.434
- c. 0.624
- d. 0.608
- e. 0.540
- Unanswered

The time is 10:02

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26. The future lifetime T of (0), has a spliced distribution.

(i) $f_1(t)$ follows the Illustrative Life Table
Click here to see the table in a different window .

(ii) $f_2(t)$ follows DeMoivre's law with $\omega = 100$

(iii) $f_T(t) = \begin{cases} k f_1(t), & 0 \le t \le 50 \\ 1.2 f_2(t) & 50 < t \end{cases}$

Calculate ${}_8p_{36}$

- a. 0.94
- b. 0.96
- c. 0.84
- d. 0.90
- e. 0.95
- Unanswered

The time is 10:02

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27. For a double decrement table, you are given:

(i) $\mu_x^{(1)}(t) = 0.2\mu_x^{(\tau)}(t), \quad t > 0$

(ii) $\mu_x^{(\tau)}(t) = kt^2, \quad t > 0$

(iii) $q'^{(1)}_x(t) = 0.03$

Calculate ${}_3q_x^{(2)}$

- a. 0.98
- b. 0.85
- c. 0.65
- d. 0.73
- e. 0.79
- Unanswered

The time is 10:02

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28. For a semi-continuous 20-year endowment insurance of 25,000 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	23 %	3	14

Renewal	*7* %	0.47	*2*

(ii) Deaths are uniformly distributed over each year of age.
(iii) $\bar{A}_{x:\overline{20|}} = 0.4058$
(iv) $A_{x:\overline{20|}}^{\ \ 1} = 0.3195$
(v) $\ddot{a}_{x:\overline{20|}} = 12.522$
(vi) $i = 0.05$
(vii) Premiums are determined using the equivalence principle.

Calculate the level annual expense-loaded premium.

- a. 902
- b. 915
- c. 895
- d. 917
- e. 905
- Unanswered

The time is 10:02

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29. For a semi-continuous 20-year endowment insurance of 25,000 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	26 %	*3*	15
Renewal	*6* %	0.42	*4*

(ii) $\bar{A}_{x:\overline{20|}} = 0.4058$
(iii) $\ddot{a}_{x:\overline{20|}} = 12.522$
(vi) $i = 0.05$
(vii) Premiums are determined using the equivalence principle.

Calculate the level annual expense premium.

- a. 894
- b. 909
- c. 899
- d. 911

- e. 905
- Unanswered

The time is 10:02

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30. For two indpendent lives (35) and (49) you are given:

(i) $\delta = 0.04$
(ii) Mortality for both lives follows De Moivre's law with $\omega = 100$

Compute $\bar{a}_{35:49}$

- a. 11.070
- b. 10.271
- c. 10.360
- d. 10.804
- e. 11.674
- Unanswered

The time is 10:02

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