1. Write in terms of ${}_{t|u}q_x$ the probability that (42) live to age 52 but does not survive to age 58.

- a. ${}_{6|10}q_{42}$
- b. ${}_{10|6}q_{52}$
- c. ${}_{10|6}q_{42}$
- d. ${}_{6|10}q_{52}$
- e. ${}_{6|32}q_{42}$
- Unanswered

The time is 9:18

2. Suppose that the survival function is given by

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

Compute ${}_{8|14}q_{40}$

- a. $\frac{4}{15}$
- b. $\frac{1}{5}$
- c. $\frac{3}{10}$
- d. $\frac{7}{30}$
- e. $\frac{1}{6}$
- Unanswered

The time is 9:18

3. You are given the following extract from a select-and-ultimate mortality table with a two year select period:

x	$l_{[x]}$	$l_{[x]+1}$	l_{x+2}	$x+2$
60	80,649	79,953	78,814	62
61	79,137	78,402	77,252	63
62	77,575	76,770	75,578	64

Assume UDD between integral ages, calculate ${}_{0.8}q_{[60]+0.7}$.

- a. 0.0097
- b. 0.0094
- c. 0.0104
- d. 0.0098
- e. 0.0105
- Unanswered

The time is 9:18

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4. Suppose that

$$f(x) = \frac{2(a-x)}{a^2}, \quad 0 \le x \le a$$

Find $\mu(x)$.

- a. $\frac{1}{a-x}$
- b. $\frac{2}{(a-x)^2}$
- c. $\frac{2}{a-x}$
- d. $\frac{(a-x)^2}{a^2}$
- e. $\frac{1}{(a-x)^2}$
- Unanswered

The time is 9:18

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5. You are given:

(i) $l_0 = 4000$
(ii) $s(x) = e^{-0.1\,x}$.

Calculate m_6, the central death rate of the interval $(6,\ 7)$.

- a. 0.12
- b. 0.02
- c. 0.18
- d. 0.06
- e. 0.10
- Unanswered

The time is 9:18

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6. Suppose that $\mu_x = 0.01$ and that the force of interest is $\delta = 0.05$.
An insurance pays 16 units at the time of death. Find the Mean of the present value of the benefit for a whole life policy.

- a. 2.343
- b. 2.487
- c. 2.572
- d. 2.667
- e. 2.717
- Unanswered

The time is 9:18

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7. For a group of individuals all age x, you are given:

(i) 26% are smokers and 74% are non-somokers.
(ii) The constant force of mortality fo smokers is 0.56.
(iii) The constant force of mortality fo non-smokers is 0.28.
(iv) $\delta = 0.06$.

Calculate $\mathrm{Var}\left(\overline{a}_{\overline{T(x)|}}\right)$ for an individual chosen at random from this group.

- a. 6.9
- b. 3.5
- c. 5.4
- d. 4.8
- e. 5.3
- Unanswered

The time is 9:18

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8. 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.

Find the continuous annual premium for a whole life policy of a life aged (30) that pays 70,000 at the moment of death.
In other words, compute $70{,}000\bar{P}(\bar{A}_{30})$.

- a. 462
- b. 492
- c. 496
- d. 481
- e. 495
- Unanswered

The time is 9:18

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9. 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 the year of death.

Find $P(\bar{A}_{53})$.

- a. 0.03295
- b. 0.01201
- c. 0.02286
- d. 0.01273
- e. 0.01215
- Unanswered

The time is 9:18

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

(i) P is the benefit premium.
(ii) L is the loss-at-issue random variable with the premium equal to P.
(iii) L^* is the loss-at-issue random variable with the premium equal to 1.25 P.
(iv) $\bar{a}_x = 5$
(v) $\delta = 0.079$
(vi) $\text{Var}(L) = 0.5584$

Calculate $\text{Var}(L^*)$.

- a. 0.7600
- b. 0.7250
- c. 0.7401
- d. 0.7227
- e. 0.7252
- Unanswered

The time is 9:18

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11. Your company sells a product that pays the cost of nursing home care for the remaining lifetime of the insured.

(i) Insureds who enter a nursing home remain there until death.
(ii) The force of mortality μ for each insured who enters a nursing home is constant.
(iii) μ is uniformly distributed on the interval [0.5, 1].
(iv)) The cost of nursing home care is 40,000 per year payable continuously.
(v) $\delta = 0.059$

Calculate the actuarial present value of this benefit for a randomly selected insured who has just entered a nursing home.

- a. 50,914
- b. 51,114
- c. 51,414
- d. 50,814
- e. 51,014
- Unanswered

The time is 9:18

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12. For a deferred temporary life annuity on (58), you are given:

(i) $\mu = 0.04$
(ii) $\delta = 0.07$
(iii) The premiums are payable continuously for the first two year at the rate of $\overline{P}$.
(iv) Annuity benefits are paid at the beginning of the year
(v) The following annuity payment schedule

Year	1	2	3	4	5	6	7	8	9 and after
Annuity benefit	0	0	0	11	*9*	*7*	*5*	*3*	0

Calculate the reserve at the end of year 3.

- a. 24.69
- b. 23.61
- c. 30.21
- d. 26.02
- e. 23.27
- Unanswered

The time is 9:18

---

13. You are given:

$$A_x = \frac{19}{100 - x}$$

Compute 2000 ${}_{30}V_{19}$.

- a. 337
- b. 361
- c. 333
- d. 397
- e. 381
- Unanswered

The time is 9:18

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14. For a portfolio of 1200 insurances, you are given

(i) Each insurance is a fully discrete 5-year term insurance on (50).
(ii) Premiums are determined using the equivalence principle.
(iii) The composition of the portfolio on January 1, 1997 is as follows:

Issue Date	Number	Face Amount
January 1, 1996	300	3000
January 1, 1995	300	1000
January 1, 1994	400	3000
January 1, 1994	200	2000

(iv) ${}_kL$ is the prospective loss random variable for 5-year term insurance of 1000 on (50).
(v)

k	$1000\ {}_kV^{1}_{50:\overline{5}|}$	$\mathrm{Var}[{}_kL \mid K(50) \geq k]$
1	1.06	21,304
2	1.66	17,735
3	1.73	13,057

(vi) The losses are independent.

Calculate the variance of the prospective losses for the portfolio on January 1,1997.

- a. 120,055,100
- b. 119,995,600
- c. 120,292,100
- d. 120,015,100
- e. 120,060,600
- Unanswered

The time is 9:18

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15. You are given that (89) and (89) are independent and their mortality follows De Moivre's Law with $\omega = 100$.
Calculate the probability that the last survivor die between ages 93 and 95.

- a. 0.15
- b. 0.17
- c. 0.21
- d. 0.20
- e. 0.16
- Unanswered

The time is 9:18

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16. A fully continuous insurnace policy is issued to (x) and (y).
A death benefit of 10,000 is payable upon the second death.
The premium is payable continuously until the last death. The rate of the annual premimium is K while (x) is alive and reduces to .5K upon the death of (x) if (x) dies before (y). You are given:

(i) $\delta = 0.04$
(ii) $\bar{a}_x = 10$
(iii) $\bar{a}_y = 13$
(iV) $\bar{a}_{xy} = 8$

Calculate K.

- a. 316.93
- b. 320.00
- c. 321.41
- d. 317.85
- e. 316.08
- Unanswered

The time is 9:18

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17. You are given:

(i) (x) and (y) are independent lives, each subject to a constant for of mortality, $\mu = 0.056$
(ii) $\delta = 0.055$

Calculate $\mathring{e}_{\overline{xy}}$.

- a. 25.7
- b. 25.2
- c. 26.8
- d. 26.4
- e. 27.4
- Unanswered

The time is 9:18

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18. For two independent lives (60) and (69).
You are given

(i) The survival function of (60) follows De Moivre's law with $\omega = 80$.
(ii) The survival function of (69) follows De Moivre's law with $\omega = 84$.

Calculate the probability that (60) dies after (7) years but after (69) dies.

- a. 0.457
- b. 0.537

- c. 0.463
- d. 0.543
- e. 0.624
- Unanswered

The time is 9:18

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

x	$q_x^{(1)}$	$q_x^{(2)}$	$q_x^{(3)}$
37	0.14	0.09	0.16
38	0.13	0.15	0.12
39	0.03	0.07	0.12
40	0.15	0.09	0.16
41	0.10	0.10	0.14
42	0.14	0.11	0.15

Calculate $\mu_{40}^{(1)}(0.67)$, assumming uniform distribution of decrements on the interval $(40,\ 40+1)$.

- a. 0.192
- b. 0.113
- c. 0.188
- d. 0.205
- e. 0.183
- Unanswered

The time is 9:18

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20. For a double decrement model you are given

(i) $\mu_x^{(1)}(t) = \frac{3}{100-x+t}, \quad t \geq 0$

(ii) $\mu_x^{(2)}(t) = \frac{5}{100-x+t}, \quad t \geq 0$

(iii) T is the time until decrement random variable for (x)

(iv) J is the cause-of-decrement random variable for (x)

Calculate

$$f_{T,J}(20,\ 1), \quad \text{for} \quad (41)$$

- a. 0.0061
- b. 0.0974
- c. 0.0597
- d. 0.0037
- e. 0.0922
- Unanswered

The time is 9:18

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21. For a double decrement model you are given

(i) $\mu_x^{(1)}(t) = \frac{10}{100-x+t}, \quad t \geq 0$

(ii) $\mu_x^{(2)}(t) = \frac{9}{100-x+t}, \quad t \geq 0$

(iii) T is the time until decrement random variable for (x)

(iv) J is the cause-of-decrement random variable for (x)

Calculate

$$f_J(1), \quad \text{for} \quad (20)$$

- a. 0.366
- b. 0.736
- c. 0.056
- d. 0.526
- e. 0.326
- Unanswered

The time is 9:18

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

(i) $\mu_x^{(1)}(t) = 0.02, \quad t \geq 0$

(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 accidental causes.

- a. 0.667
- b. 0.421
- c. 0.376
- d. 0.428
- e. 0.333
- Unanswered

The time is 9:18

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23. A population of 3000 lives age 60 is subject to 3 decrements, death (1), disability (2), and retirement (3). You are given:

(i)

x	$q'^{(1)}_x$	$q'^{(2)}_x$	$q'^{(3)}_x$
60	0.008	0.024	0.072
61	0.011	0.044	0.176

(ii) Decrements are uniformly distributed over each age in the multiple decrement table.

Calculate the expected number of people who will retire before age 62

- a. 744
- b. 674
- c. 734
- d. 584
- e. 664
- Unanswered

The time is 9:18

24. A population of 6000 lives age 60 is subject to 3 decrements, death (1), disability (2), and retirement (3). You are given:

(i)

x	$q'^{(1)}_x$	$q'^{(2)}_x$	$q'^{(3)}_x$
60	0.008	0.024	0.072
61	0.010	0.040	0.160

(ii) Decrements are uniformly distributed over each age in its associated single decrement table.

Calculate the expected number of people who will retire before age 62.

- a. 1267
- b. 1260
- c. 1301
- d. 1257
- e. 1266
- Unanswered

The time is 9:18

25. For special 6-year 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) $\mu^{(1}(t) = 0.00025, \quad t \geq 0$
(vi) $\mu^{(2)}(t) = 0.00050, \quad t \geq 0$
(vii) $\mu^{(3)}(t) = 0.00100, \quad t \geq 0$
(viii) $\delta = 0.08$

Calculate the APV of this insurance.

- a. 720
- b. 710
- c. 750
- d. 740
- e. 700
- Unanswered

The time is 9:18

26. For a pension plan portfolio, you are given:

(i) $i = .06$
(ii) 120 individuals with mutually independent future lifetimes are each to receive a whole life annuity-due.
(iii)

Age	Number of annuitants	Annual payments	$\ddot{a}_x$	A_x	^2A_x
59	70	*5*	11.38181	0.35575	0.16713
74	50	*2*	7.48639	0.57624	0.37008

Using the normal approximation, calculate the 95th percentile of the distribution of the present value random variable of this portfolio.

- a. 5,006
- b. 5,007
- c. 4,978
- d. 4,990
- e. 5,004
- Unanswered

The time is 9:18

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

(i) $i = 0.07$.
(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. 1052
- b. 1032
- c. 1042
- d. 1022
- e. 1012
- Unanswered

The time is 9:18

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28. The RIP Life Insurance Company specializes in selling a fully discrete whole life insurance of 10,000 to (64) year olds by telephone. For each policy:

(i) The annual contract premium is 500.
(ii) Mortality follows the Illustrative Life Table.
Click here to see the table in a different window
(iii) $i = 0.06$
(iv) The number of telephone inquiries RIP receives follows a Poisson process with mean 45 per day.
(v) 18 % of the inquiries result in the sale of a policy.
(vi) The number of inquiries and the future lifetimes of all the insureds who purchase policies on a particular day are independent.

Using the normal approximation, calculate the probability that S, the total prospective loss at issue for all the policies sold on a particular day, will be less than zero.

Need a Z-table

- a. 0.45
- b. 0.85
- c. 0.50
- d. 0.52

- e. 0.72
- Unanswered

The time is 9:18

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29. For a special fully discrete whole life of 10,000 on (x), you are given:

(i) ${}_{10}\text{AS} = 1672$
(ii) $G = 300$
(iii) ${}_{11}\text{CV} = 1675$
(iv) $c_{10} = 0.05$ is the fraction of gross premium paid at time 10 for expenses.
(v) $e_{10} = 80$ is the amount of per policy expense paid at time 10.
(vi) Death and withdrawal are the only decrements.
(vii) $q_{x+10}^{(d)} = 0.04$
(viii) $q_{x+10}^{(w)} = 0.19$
(ix) $i = 0.06$

Calculate ${}_{11}\text{AS}$.

- a. 1,727
- b. 1,700
- c. 1,586
- d. 1,553
- e. 1,651
- Unanswered

The time is 9:18

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30. For (x), you are given:

(i) K is the curtate future lifetime random variable
(ii)

k	q_{x+k}
0	0.12
1	0.22
2	0.32

Calculate $E\left[(K \wedge 3)^2\right]$

- a. 5.56
- b. 5.46
- c. 5.27
- d. 5.38
- e. 5.06
- Unanswered

The time is 9:18

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