

Data for Question 3

Selected absolute rates of decrement from a table with three decrements [1,2,3]:

$$q_x^{[1]} = 0.20$$

$$q_x^{[2]} = 0.20$$

$$q_x^{[3]} = 0.40$$

Question 3

In what range is $q_x^{[T]}$?

- [A] Less than 0.625
- [B] 0.625 but less than 0.685
- [C] 0.685 but less than 0.745
- [D] 0.745 but less than 0.805
- [E] 0.805 or more

2004

Data for Question 20 (5 points)

A company's benefit plan has 1,000 active participants, all age 40 as of 1/1/2004.

The plan will provide the following benefits during 2004 and 2005:

- (i) \$2,000 lump-sum death benefit paid at the end of the year for death
- (ii) \$1,000 lump-sum severance benefit at the end of the year of withdrawal
- (iii) \$3,000 bonus payment to remaining employees at the end of 2005

A two-decrement service table (death and withdrawal) is used in an actuarial valuation of this plan. Selected values from the service table are:

$$q_{41}^{(d)} = 0.0007 \qquad q_{41}^{(w)} = 200 q_{40}^{(d)}$$

$i = 7\%$, compounded annually.

2004 withdrawal benefit term cost as of 1/1/2004 = \$93,084.

Present value of the bonus payments as of 1/1/2004 = \$2,167,971.

X = the 2004 death benefit term cost as of January 1, 2004.

Question 20

In what range is X ?

- (A) Less than \$770
- (B) \$770 but less than \$795
- (C) \$795 but less than \$820
- (D) \$820 but less than \$845
- (E) \$845 or more

Data for Question 31 (2 points)

In a double decrement table, you are given:

x	$q_x^{(1)}$	$q_x^{(2)}$	$\ell_x^{(T)}$
25	0.05	0.30	
26	0.05	0.20	6,500

Z = the absolute value of the change in $d_{26}^{(1)}$ if $q_{25}^{(2)}$ changes from 0.30 to 0.25.

Question 31

In what range is Z ?

- (A) Less than 21.50
- (B) 21.50 but less than 22.50
- (C) 22.50 but less than 23.50
- (D) 23.50 but less than 24.50
- (E) 24.50 or more

Data for Question 12 (4 points)

Data from a double-decrement table:

$$\begin{array}{lll}
 l_{63}^{(T)} = 500 & l_{66}^{(T)} = 0 & \\
 q_{63}^{(1)} = 0.050 & q_{63}^{(2)} = 0.500 & \\
 {}_1q_{63}^{(1)} = 0.070 & {}_2q_{63}^{(1)} = 0.042 & {}_2q_{63}^{(2)} = 0.600
 \end{array}$$

Question 12In what range is $d_{65}^{(2)}$?

- (A) Less than 97
- (B) 97 but less than 103
- (C) 103 but less than 109
- (D) 109 but less than 115
- (E) 115 or more

Data for Question 16 (4 points)

For a defined benefit pension plan, you are given:

- (i) The retirement benefit is \$15 per month per year of service.
- (ii) Retirement is allowed beginning at age 63 with no benefit reduction.
- (iii) An employee currently age 45 was hired at age 40.

Selected values:

Age	$q'_x{}^{(r)}$	$\ddot{a}_x^{(12)}$
63	0.2	10.0
64	0.3	9.5
65	1.0	9.0

Employees retire only on their birthdays, and there are no decrements other than retirement.

Interest rate: 5%, compounded annually

X is the present value at age 45 of the projected retirement benefit for this employee.

Question 16

In what range is X?

- (A) Less than \$13,500
- (B) \$13,500 but less than \$14,500
- (C) \$14,500 but less than \$15,500
- (D) \$15,500 but less than \$16,500
- (E) \$16,500 or more

Data for Question 26 (4 points)

Participant date of birth: 1/1/1965

Disability benefit: \$25,000 payable at the end of each year beginning in the year of disability and continuing for life except that payments stop upon attainment of age 65.

Interest rate: 7%, compounded annually.

Recovery rate ($q_x^{(rec)}$): 3% per year after the year of disability.

Mortality rate ($q_x^{(d)}$): 8% per year after year of disability.
No mortality before disability.

Death and recovery are assumed to occur at the end of each year after any payments are made.

$$q_{40}^{(i)} = 0.005$$

Y is the term cost as of 1/1/2005

Question 26

In what range is Y?

- (A) Less than \$697.50
- (B) \$697.50 but less than \$722.50
- (C) \$722.50 but less than \$747.50
- (D) \$747.50 but less than \$772.50
- (E) \$772.50 or more

Data for Question 28 (3 points)

Values from a double decrement table:

$$l_{40}^{(T)} = 500,000$$

$$l_{41}^{(T)} = 417,362$$

Associated value:

$$q'_{40}^{(1)} = 0.0934$$

Each decrement is uniformly distributed within each year of age in the associated single decrement table.

$$X = m_{40}^{(2)}$$

Question 28

In what range is X?

- (A) Less than 0.077
- (B) 0.077 but less than 0.079
- (C) 0.079 but less than 0.081
- (D) 0.081 but less than 0.083
- (E) 0.083 or more

Data for Question 11 (2 points)

Selected actuarial values:

$$\ell_x = 1000$$

$$q'_x^{(1)} = 0.050$$

$$q'_x^{(2)} = 0.030$$

$$q'_x^{(3)} = 0.300$$

Decrement (1) and (3) are uniformly distributed throughout the year.

Decrement (2) occurs at the end of the year.

Y = the number of decrements at age x due to cause (2).

Question 11

In what range is Y ?

- (A) Less than 19.50
- (B) 19.50 but less than 20.00
- (C) 20.00 but less than 20.50
- (D) 20.50 but less than 21.00
- (E) 21.00 or more

Data for Question 23 (3 points)

Data from a double decrement table:

$${}_tq_x^{(1)} = 0.1t, \quad 0 \leq t \leq 1$$

$${}_tq_x^{(2)} = ct, \quad 0 \leq t \leq 1; \quad c \text{ is a constant, } 0 \leq c \leq 1$$

$$q_x^{(T)} = 0.28$$

Question 23

In what range is $q_x^{(2)}$?

- (A) Less than 0.175
- (B) 0.175 but less than 0.185
- (C) 0.185 but less than 0.195
- (D) 0.195 but less than 0.205
- (E) 0.205 or more

Data for Question 28 (3 points)

A multiple decrement table is constructed based on the following three single decrement tables:

<u>Decrement #1</u>		<u>Decrement #2</u>		<u>Decrement #3</u>	
<u>x</u>	<u>ℓ_x</u>	<u>x</u>	<u>ℓ_x</u>	<u>x</u>	<u>ℓ_x</u>
25	100	25	100	25	100
26	90	26	80	26	70

Uniform distribution of decrement is assumed in each of the above single decrement tables.

Question 28

In what range is $q_{25}^{(2)}$?

- (A) Less than 0.154
- (B) 0.154 but less than 0.161
- (C) 0.161 but less than 0.168
- (D) 0.168 but less than 0.175
- (E) 0.175 or more

Data for Question 22 (3 points)

Selected actuarial values:

$$q_x^{(1)} = 0.075$$

$$q_x^{(2)} = 0.095$$

Decrement 1 has a uniform distribution of decrement within each year of its associated single decrement table.

Decrement 2 has a constant force of decrement throughout each year.

Question 22

In what range is ${}_{0.75}p_x^{(\tau)}$?

- (A) Less than 0.8747
- (B) 0.8747 but less than 0.8762
- (C) 0.8762 but less than 0.8777
- (D) 0.8777 but less than 0.8792
- (E) 0.8792 or more

Data for Question 24 (5 points)

Data from a two decrement model:

x	$q_x^{(1)}$	$q_x^{(2)}$	$q_x^{(\tau)}$	$\ell_x^{(\tau)}$
68	0.05	0.35	-	-
69	-	-	0.80	1,235
70	0.06	0.94	-	-

Question 24In what range is ${}_2q_{68}^{(\tau)}$?

- (A) Less than 0.1175
- (B) 0.1175 but less than 0.1185
- (C) 0.1185 but less than 0.1195
- (D) 0.1195 but less than 0.1205
- (E) 0.1205 or more

2008

Data for Question 15 (5 points)

All employees are hired at exact age 22.

3% of the employees at each age terminate employment at the end of each year

5% of those at exact age 42 are promoted out of the business unit

All employees retire at exact age 62

There are no other decrements from the population.

Question 15

In what range is the expected length of service for a new entrant?

- (A) Less than 23.00
- (B) 23.00 but less than 23.25
- (C) 23.25 but less than 23.50
- (D) 23.50 but less than 23.75
- (E) 23.75 or more

Data for Question 18 (4 points)

Selected values from a multiple decrement table:

x	$q_x^{(withdrawal)}$	$q_x^{(death)}$	$q_x^{(retirement)}$
55	0.070	0.025	0.150
56	0.050	0.029	0.100
57	0.030	0.033	0.100
58	0.020	0.037	0.200
59	0.010	0.042	0.300
60	0.000	0.000	1.000

Z = the percentage of employees hired at 55 who withdraw before age 60.

Question 18

In what range is Z ?

- (A) Less than 7.0%
- (B) 7.0% but less than 9.0%
- (C) 9.0% but less than 11.0%
- (D) 11.0% but less than 13.0%
- (E) 13.0% or more

Data for Question 30 (3 points)

Selected values from a two-decrement model:

x	$q_x^{(1)}$	$q_x^{(2)}$
46	0.0244	0.1000
47	0.0273	0.0900
48	0.0309	0.0800
49	0.0345	0.0700
50	0.0390	0.0600

$$Z = {}_{2|2}q_{46}^{(2)}$$

Question 30

In what range is Z ?

- (A) Less than 0.0905
- (B) 0.0905 but less than 0.1005
- (C) 0.1005 but less than 0.1105
- (D) 0.1105 but less than 0.1205
- (E) 0.1205 or more

Data for Question 10 (4 points)

A service table has two sources of decrement.

$$q_x^{(1)} = 4q_x^{(2)}$$

$$q_x^{(T)} = 0.24$$

Question 10

In what range is $q_x^{(1)}$?

- (A) Less than 0.195
- (B) 0.195 but less than 0.198
- (C) 0.198 but less than 0.201
- (D) 0.201 but less than 0.204
- (E) 0.204 or more

Data for Question 13 (3 points)

You have the following information about a group of participants in a pension plan:

Number of active participants at exact age 50	1,000
Number of deaths between exact ages 50 and 51	10
Number of decrements other than death between exact ages 50 and 51	57

All decrements other than death occur one-third of the way during the period between consecutive ages.

X = the rate of mortality at age 50 in the associated single decrement mortality table.

Question 13

In what range is X ?

- (A) Less than 0.01025
- (B) 0.01025 but less than 0.01035
- (C) 0.01035 but less than 0.01045
- (D) 0.01045 but less than 0.01055
- (E) 0.01055 or more

Data for Question 19 (2 points)

Values for a double decrement service table:

$$q_x^{(1)} = 0.015, \quad 50 \leq x \leq 70$$

$$q_x^{(2)} = 0.050, \quad 50 \leq x \leq 70$$

No other decrements exist.

$X =$ the probability that a 53-year old will still be employed by age 62.

Question 19

In what range is X ?

- (A) Less than 0.5465
- (B) 0.5465 but less than 0.5475
- (C) 0.5475 but less than 0.5485
- (D) 0.5485 but less than 0.5495
- (E) 0.5495 or more

Data for Question 25 (2 points)

Given the following values from a single decrement table:

x	q_x
46	0.07000
47	0.06500
48	0.06000
49	0.05000

A 2-year select mortality table based on this single decrement table has the following characteristics:

$$q_{[x]} = 1.5q_x$$

$$q_{[x]+1} = 1.3q_{x+1}$$

Question 25

In what range is ${}_1|q_{[46]+1}$?

- (A) Less than 0.05400
- (B) 0.05400 but less than 0.05450
- (C) 0.05450 but less than 0.05500
- (D) 0.05500 but less than 0.05550
- (E) 0.05550 or more

2009

Data for Question 32 (2 points)

Data for members of a professional association:

Members as of 1/1/2008	1,000
Retirements during 2008	10
Deaths during 2008	8
Suspensions during 2008	12
Non-renewals during 2008	42

Retirements occur at the beginning of each calendar year.

Deaths and suspensions occur uniformly throughout each calendar year.

Non-renewals occur at the end of each calendar year.

There are no other exits from the population.

X = the rate of suspension for 2008, given the data presented.

Question 32

In what range is X ?

- (A) Less than 0.012200
- (B) 0.012200 but less than 0.012400
- (C) 0.012400 but less than 0.012600
- (D) 0.012600 but less than 0.012800
- (E) 0.012800 or more

Data for Question 19 (5 points)

Data from a two decrement model:

\underline{x}	$\frac{q_x^{(1)}}{}$	$\frac{q_x^{(2)}}{}$	$\frac{q_x^{(\tau)}}{}$	$\frac{\ell_x^{(\tau)}}{}$
68	0.05	0.35	-	-
69	-	-	0.80	1,235
70	0.06	0.94	-	-

Question 19In what range is ${}_2q_{68}^{(\tau)}$?

- (A) Less than 0.1175
- (B) 0.1175 but less than 0.1185
- (C) 0.1185 but less than 0.1195
- (D) 0.1195 but less than 0.1205
- (E) 0.1205 or more

Data for Question 25 (3 points)

Data from a multiple decrement table:

x	$q_x^{(\text{termination})}$	$q_x^{(\text{mortality})}$	$q_x^{(\text{retirement})}$
55	0.070	0.025	0.000
56	0.050	0.029	0.000
57	0.030	0.033	0.000
58	0.020	0.037	0.000
59	0.010	0.042	0.000
60	0.000	0.047	1.000

Y = the probability that an employee age 55 retires at age 60.

Question 25

In what range is Y ?

- (A) Less than 0.625
- (B) 0.625 but less than 0.675
- (C) 0.675 but less than 0.725
- (D) 0.725 but less than 0.775
- (E) 0.775 or more

Data for Question 7

Selected values from a combined disability and mortality table:

$${}^{aa}l_{40} = 100,000$$

$${}^{aa}l_{41} = 99,788$$

$$r_{40} = .000415$$

$$r_{41} = .000430$$

$${}^{ii}l_{40} = 180$$

$${}^{ii}l_{41} = 187$$

$${}^{ii}l_{42} = 194$$

r_x is the probability of an active life aged x becoming disabled during the year.

Disabled lives are assumed not to recover.

Question 7

In what range is the probability that a disabled life aged 40 will die between age 41 and age 42?

- [A] Less than .145
- [B] .145 but less than .159
- [C] .159 but less than .173
- [D] .173 but less than .187
- [E] .187 or more

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