

Data for Question 10

33.0% of those who die between ages 30 and 70 die before age 50.

The probability of a person aged 30 dying before age 50 is 20.0%.

Question 10

In what range is the probability that a person aged 50 will survive to age 70?

- [A] Less than 40%
- [B] 40% but less than 45%
- [C] 45% but less than 50%
- [D] 50% but less than 55%
- [E] 55% or more

Data for Question 15

Smith's age as of 1/1/95: 92.

Brown's age as of 1/1/95: 93.

Green's age as of 1/1/95: 94.

Selected values from a mortality table:

x	l_x
92	1,000
93	913
94	822
95	723
96	615
97	498
98	378
99	246
100	143

Question 15

In what range is the probability that at least one of Smith, Brown, or Green will survive to 1/1/2001?

- [A] Less than .30
- [B] .30 but less than .40
- [C] .40 but less than .50
- [D] .50 but less than .60
- [E] .60 or more

Data for Question 11 (2 points)

$$l_{x+1} = 960$$

$$L_x = 975$$

Assume a uniform distribution of deaths between x and $x+1$.

Question 11

In what range is $1000 * m_x$?

- (A) Less than 30.0
- (B) 30.0 but less than 30.5
- (C) 30.5 but less than 31.0
- (D) 31.0 but less than 31.5
- (E) 31.5 or more

Data for Question 29 (3 points)

Selected items related to a mortality table over the age interval [98, 99]:

$$\mu_{98.55} = 0.5980 \text{ under the uniform death distribution}$$

$${}_yq_{98.35} = 0.2486 \text{ under the uniform death distribution}$$

$$Z = {}_yq_{98.15} \text{ under constant force of mortality}$$

Question 29

In what range is Z?

- (A) Less than 0.246
- (B) 0.246 but less than 0.254
- (C) 0.254 but less than 0.262
- (D) 0.262 but less than 0.270
- (E) 0.270 or more

Data for Question 13 (3 points)

$$\mu_x = 0.1, \text{ for } x > 0$$

P = The probability that two independent lives age 30 and 50 will die within 10 years of each other.

Question 13

What is P?

- (A) $0.1e^{-1}$
- (B) $0.5e^{-1}$
- (C) e^{-1}
- (D) $0.5(1 - e^{-1})$
- (E) $1 - e^{-1}$

Data for Question 23 (3 points)

$${}_{15}P_{25} = 0.8108$$

$${}_{15|15}q_{25} = 0.2027$$

$${}_{10}q_{55} = 0.2222$$

$$X = {}_{30|10}q_{25}$$

Question 23

In what range is X?

- (A) Less than 0.015
- (B) 0.015 but less than 0.065
- (C) 0.065 but less than 0.115
- (D) 0.115 but less than 0.165
- (E) 0.165 or more

2005

Data for Question 27 (5 points)

$$q_{[40]+s}^{(w)} = q_{[40]}^{(w)} - 0.02s; s = 0 \text{ or } 1$$

$$q_x^{(w)} = 0.10 - 0.003(x - 40)$$

All rates of withdrawal are less than 0.50.

Number of participants as of 1/1/2005:

<u>Years of Service</u>	<u>Age 40</u>	<u>Age 41</u>
0	200	0
1	0	150
2 or more	900	0

120 of these individuals are expected to terminate employment in 2006.

Question 27

In what range is $q_{[40]}^{(w)}$?

- (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 7 (4 points)

Data from a select and ultimate mortality table:

\underline{x}	$\underline{q}_{[x]}$	$\underline{q}_{[x]+1}$	$\underline{q}_{[x]+2}$	\underline{q}_{x+3}	$\underline{x+3}$
50	0.074	0.094	0.114	0.126	53
51	0.076	0.096	0.116	0.128	54
52	0.078	0.098	0.118	0.130	55
53	0.080	0.100	0.120	0.132	56
54	0.083	0.103	0.123	0.135	57

$$\ell_{55} = 13,200$$

$$Z = d_{[53]+2} - d_{[53]+1}$$

Question 7In what range is Z ?

- (A) Less than 120
- (B) 120 but less than 150
- (C) 150 but less than 180
- (D) 180 but less than 210
- (E) 210 or more

Data for Question 19 (4 points)

Mortality Table A

$$\ell_x = 1000\sqrt{240 - 2x}, \quad 0 \leq x \leq 120$$

Mortality Table B

Constant force of mortality = $2\mu_{43}$ from
Mortality Table A

$$Z = {}_{2|2}q_{41} \text{ under Mortality Table B}$$

Question 19

In what range is Z ?

- (A) Less than 0.014
- (B) 0.014 but less than 0.017
- (C) 0.017 but less than 0.020
- (D) 0.020 but less than 0.023
- (E) 0.023 or more

Data for Question 29 (3 points)

Selected actuarial values:

$$\ell_0 = 1140$$

$$\ell_{53} = 270$$

$$p_x = 0.75, x \geq 50$$

Deaths are uniformly distributed over $[0, 50]$.

Question 29

In what range is the number of deaths occurring between ages 45.50 and 55.75?

- (A) Less than 558.0
- (B) 558.0 but less than 560.0
- (C) 560.0 but less than 562.0
- (D) 562.0 but less than 564.0
- (E) 564.0 or more

Data for Question 8 (3 points)

Data from a select and ultimate mortality table:

x	$\ell_{[x]}$	$\ell_{[x]+1}$	$\ell_{[x]+2}$	ℓ_{x+3}	$x+3$
65	991	980	966	948	68
66	975	963	947	928	69
67	957	944	927	906	70
68	937	923	905	883	71

Question 8In what range is ${}_{1|3}q_{[66]+1}$?

- (A) Less than 0.06200
- (B) 0.06200 but less than 0.06400
- (C) 0.06400 but less than 0.06600
- (D) 0.06600 but less than 0.06800
- (E) 0.06800 or more

Data for Question 28 (3 points)

Selected actuarial values:

$$\ell_{100} = 95,000$$

$$\ell_{101} = 66,500$$

The probability that a person age 100 will survive for at least four months is estimated using the following methods:

- I. Uniform distribution of deaths
- II. Constant force of mortality
- III. Balducci's assumption

Question 28

Which of the following is true?

- (A) $II < III < I$
- (B) $I < III < II$
- (C) $III < II < I$
- (D) $II < I < III$
- (E) The correct answer is not given by (A), (B), (C), or (D)

Data for Question 31 (3 points)

$$\ell_{x+1} = 910$$

$$L_x = 930$$

Assume a uniform distribution of deaths over the interval $[x, x+1]$

Question 31

In what range is $\mu_{x+0.2}$?

- (A) Less than 0.04190
- (B) 0.04190 but less than 0.04230
- (C) 0.04230 but less than 0.04270
- (D) 0.04270 but less than 0.04310
- (E) 0.04310 or more

Data for Question 19 (3 points)

$${}_{10}p_{40} = 0.90$$

$${}_{15}p_{50} = 0.75$$

$${}_{10}p_{55} = 0.80$$

X = the probability that two independent lives age 40 and age 50 will both die between age 55 and age 65.

Question 19

In what range is X ?

- (A) Less than 0.02900
- (B) 0.02900 but less than 0.03000
- (C) 0.03000 but less than 0.03100
- (D) 0.03100 but less than 0.03200
- (E) 0.03200 or more

Data for Question 22 (2 points)

$$\ell_{[x]+t} = 100 - x - \frac{t}{2}, \quad 0 \leq t \leq 6$$

$$\ell_{x+t} = 103 - x - t, \quad t > 6$$

Y = the probability that a life now age 52 and who entered the selection period 2 years ago, will die between ages 54 and 58.

Question 22

In what range is Y ?

- (A) Less than 0.050
- (B) 0.050 but less than 0.060
- (C) 0.060 but less than 0.070
- (D) 0.070 but less than 0.080
- (E) 0.080 or more

Data for Question 23 (2 points)

Deaths are uniformly distributed over each year of age.

For a given integer x :

$$q_x = 0.400$$

$$q_{x+1} = 0.500$$

Question 23

In what range is $q_{x+0.5}$?

- (A) Less than 0.405
- (B) 0.405 but less than 0.425
- (C) 0.425 but less than 0.445
- (D) 0.445 but less than 0.465
- (E) 0.465 or more

2008

Data for Question 31 (4 points)

A mortality table is projected from the year 2000 to 2008 according to the following formula:

$$q_x^{[Year]} = q_x^{[2000]}(1 - AA_x)^{(Year-2000)}$$

Selected values from the basic table and the projection scale:

\underline{x}	$\underline{q_x^{[2000]}}$	$\underline{AA_x}$
35	0.000475	0.011
36	0.000514	0.012
37	0.000554	0.013
38	0.000598	0.014
39	0.000648	0.015

$$Y = {}_5q_{35}^{[2008]}$$

Question 31

In what range is Y ?

- (A) Less than 0.002430
- (B) 0.002430 but less than 0.002530
- (C) 0.002530 but less than 0.002630
- (D) 0.002630 but less than 0.002730
- (E) 0.002730 or more

Data for Question 2 (3 points)

$$d_{45} = 502$$

$$\ell_{47} = 89,472$$

$${}_1q_{45} = 0.006141$$

Question 2

In what range is d_{46} ?

- (A) Less than 512
- (B) 512 but less than 532
- (C) 532 but less than 552
- (D) 552 but less than 572
- (E) 572 or more

Data for Question 4 (3 points)

Selected values from a basic mortality table:

\underline{x}	$\underline{q_x}$
84	0.0762
85	0.0852
86	0.0953
87	0.1075
88	0.1204
89	0.1341
90	0.1493

The basic mortality table is adjusted using a 1-year set forward for male lives and using a 2-year set back for female lives.

$x =$ male life age 85

$y =$ female life age 86

Question 4

In what range is ${}_3p_{xy}^-$?

- (A) Less than 0.9075
- (B) 0.9075 but less than 0.9150
- (C) 0.9150 but less than 0.9225
- (D) 0.9225 but less than 0.9300
- (E) 0.9300 or more

Data for Question 12 (3 points)

The following is an extract from a table with a 3-year select period:

\underline{x}	$\underline{q_{[x]}}$	$\underline{q_{[x]+1}}$	$\underline{q_{[x]+2}}$	$\underline{q_{x+3}}$	$\underline{x+3}$
50	0.074	0.094	0.114	0.126	53
51	0.076	0.096	0.116	0.128	54
52	0.078	0.098	0.118	0.130	55
53	0.080	0.100	0.120	0.132	56
54	0.083	0.103	0.123	0.135	57

$$\ell_{55} = 13,200$$

Question 12

In what range is $d_{[53]+1}$?

- (A) Less than 1,460
- (B) 1,460 but less than 1,480
- (C) 1,480 but less than 1,500
- (D) 1,500 but less than 1,520
- (E) 1,520 or more

2009

Data for Question 30 (3 points)

Smith is 55, Jones is 45, and Brown is 40.

The underlying mortality is the same for all three individuals.

There is a 40% probability that both Smith and Brown will be alive in 15 years.

There is a 44% probability that Jones will die before age 70.

X = the probability that Brown will die before age 45.

Question 30

In what range is X ?

- (A) Less than 0.250
- (B) 0.250 but less than 0.300
- (C) 0.300 but less than 0.350
- (D) 0.350 but less than 0.400
- (E) 0.400 or more

Data for Question 11 (3 points)

Data from a select and ultimate mortality table:

x	$\ell_{[x]}$	$\ell_{[x+1]}$	$\ell_{[x+2]}$	ℓ_{x+3}	$x+3$
27	93,347	93,215	93,052	92,863	30
28	93,149	93,016	92,849	92,656	31
29	92,948	92,812	92,642	92,443	32
30	92,742	92,604	92,429	92,222	33
31	92,543	92,403	92,224	92,012	34

For purposes of performing a pension valuation, the plan's actuary applies a one-year age setback to the above table. Assume no other pre-retirement decrements apply.

X = the probability, calculated for the pension valuation, that a newly-hired participant, hired at age 29, dies during his third or fourth year of employment.

Question 11

In what range is X ?

- (A) Less than 0.0043
- (B) 0.0043 but less than 0.0044
- (C) 0.0044 but less than 0.0045
- (D) 0.0045 but less than 0.0046
- (E) 0.0046 or more

Data for Question 17 (3 points)

$${}_{15}p_{25} = 0.8108$$

$${}_{15|15}q_{25} = 0.2027$$

$${}_{10}q_{55} = 0.2222$$

Question 17

In what range is ${}_{30|10}q_{25}$?

- (A) Less than 0.015
- (B) 0.015 but less than 0.065
- (C) 0.065 but less than 0.115
- (D) 0.115 but less than 0.165
- (E) 0.165 or more

2010

Data for Question 26 (3 points)

Smith (age 60), can retire from Company A between age 61 and 65.

The following rates of retirement are used in the actuarial valuation of Company A's plan:

<u>Age</u>	<u>Rate</u>
61	40%
62	35%
63-64	20%
65	100%

No other decrements apply from age 60 to age 65.

Retirements occur at the beginning of the year.

X = the average assumed retirement age for Smith.

Question 26

In what range is X ?

- (A) Less than 62.22
- (B) 62.22 but less than 62.52
- (C) 62.52 but less than 62.82
- (D) 62.82 but less than 63.12
- (E) 63.12 or more