

Data for Question 8

Selected values:

$$i = 6\%$$

$$p_x = .9540$$

$$P_{[x]} = .9699$$

$$p_{x+1} = .9502$$

$$P_{[x]+1} = .9502$$

$$\ddot{a}_x = 7.7250$$

Question 8In what range is $\ddot{a}_{[x]}$?

- (A) Less than 7.70
- (B) 7.70 but less than 7.75
- (C) 7.75 but less than 7.80
- (D) 7.80 but less than 7.85
- (E) 7.85 or more

Data for Question 6

1989

Normal retirement benefit: \$1,000 per year payable January 1, increasing by \$1,000 per year.

Actuarial assumptions:

Interest rate: 6%.

Preretirement deaths and terminations: None.

Postretirement mortality: In accordance with the formula

$${}_t p_x = .33(3-t) \text{ for } 0 < t \leq 3$$

Retirement age: 65.

Date of birth for sole participant: 1/1/25.

Question 6

In what range is the present value of the normal retirement benefit as of 1/1/89?

- (A) Less than \$2,600
- (B) \$2,600 but less than \$2,800
- (C) \$2,800 but less than \$3,000
- (D) \$3,000 but less than \$3,200
- (E) \$3,200 or more

49p

Data for Question 18 (3 points)

Current age of a mortgagee: 57.

Frequency of level mortgage payments: Annual, at the end of each year.

Remaining mortgage amount: \$50,000.

Remaining mortgage term: 3 years.

Interest rate: 5% per year, compounded annually.

The mortgage is insured by the purchase of a 3-year decreasing term insurance policy with a death benefit equal to the mortgage balance at the end of the year of death.

Selected values:

\underline{x}	\underline{l}_x
56	9604
57	9574
58	9541
59	9505
60	9467
61	9424

Question 18

In what range is the current present value of the insurance benefit?

- [A] Less than \$350
- [B] \$350 but less than \$360
- [C] \$360 but less than \$370
- [D] \$370 but less than \$380
- [E] \$380 or more

Data For Question 17 (4 Points)

$$e_{70:\overline{5}} = 4.66234$$

$$e_{70:\overline{15}} = 11.45220$$

$$e_{80} = 8.26871$$

$$e_{75:\overline{10}} = 7.70883$$

$$e_{75:\overline{5}} = 4.43230$$

$$e_{80:\overline{5}} = 4.08531$$

Question 17

In what range is e_{70} ?

- [A] Less than 14.00000
- [B] 14.00000 but less than 15.00000
- [C] 15.00000 but less than 16.00000
- [D] 16.00000 but less than 17.00000
- [E] 17.00000 or more

Data for Question 22 (3 points)

Given the following values:

<u>x</u>	<u>e_x</u>
107	0.6
108	0.2
109	0.0

A new table is constructed such that the force of mortality is doubled.

Y = the value of e_{107} based on the new table.

Question 22

In what range is Y ?

- (A) Less than 0.25
- (B) 0.25 but less than 0.27
- (C) 0.27 but less than 0.29
- (D) 0.29 but less than 0.31
- (E) 0.31 or more

Data for Question 6 (3 points)

Smith (age 65) purchases an annuity that pays \$1,000 at the end of each year. Payment ceases at the earlier of Smith's death or 25 years from purchase date.

Interest rate: 5%, compounded annually

Mortality: $p_x = 0.95$, for $x < 75$
Mortality rates at ages 75 and greater are double those under age 75

Y = The present value of this annuity

Question 6

In what range is Y ?

- (A) Less than \$6,500
- (B) \$6,500 but less than \$7,500
- (C) \$7,500 but less than \$8,500
- (D) \$8,500 but less than \$9,500
- (E) \$9,500 or more

Data for Question 14 (3 points)

$$q_{60} = 0.020$$

$$q_{61} = 0.022$$

Deaths are uniformly distributed over each year of age.

$$X = \overset{\circ}{e}_{60:\overline{1.5}|}$$

Question 14

In what range is X ?

- (A) Less than 1.450
- (B) 1.450 but less than 1.460
- (C) 1.460 but less than 1.470
- (D) 1.470 but less than 1.480
- (E) 1.480 or more

2005

Data for Question 20 (4 points)

Smith and Brown are independent lives.

Smith is age x as of 1/1/2005.

Brown is exactly one year older than Smith.

The probability that neither Smith nor Brown dies during 2005 is equal to 150% of the probability that Brown dies during 2005.

Mortality data:

$$e_x^\circ = 2.0$$

$$e_{x+1}^\circ = 1.5$$

Deaths are uniformly distributed throughout each year of age.

$$Y = e_{x+2}$$

Question 20

In what range is Y ?

- (A) Less than 0.25
- (B) 0.25 but less than 0.45
- (C) 0.45 but less than 0.65
- (D) 0.65 but less than 0.85
- (E) 0.85 or more

Data for Question 1 (2 points)

Smith (age 30) purchases a single premium annuity on 1/1/2007 that has the following characteristics:

Payments: \$1 annually at the end of each year.

Term: Payments are for life with the final payment on the 12/31 following Smith's death.

Selected actuarial values:

$$N_{30} = 42738$$

$$N_{31} = 40437$$

Interest rate: 5%, compounded annually.

Question 1

In what range is the single premium for this annuity?

- (A) Less than \$17.65
- (B) \$17.65 but less than \$17.70
- (C) \$17.70 but less than \$17.75
- (D) \$17.75 but less than \$17.80
- (E) \$17.80 or more

Data for Question 3 (3 points)

Selected actuarial values:

$${}_{20}p_{10} = 0.960$$

$${}_{30}E_{10} \cdot {}_{10}E_{30} = 0.125$$

Interest rate: 5%, compounded annually.

$P =$ The probability that a life age 10 dies after age 40

Question 3

In what range is P ?

- (A) Less than 0.85
- (B) 0.85 but less than 0.87
- (C) 0.87 but less than 0.89
- (D) 0.89 but less than 0.91
- (E) 0.91 or more

Data for Question 4 (4 points)

Smith (age 60) retires on 1/1/2007 and is offered the following distribution options from a pension plan:

(1) Life annuity of \$1,000 payable annually commencing on 1/1/2007.

(2) Lump sum of \$15,000 payable at age 65 if Smith is still alive.

Selected actuarial values:

$$\ell_x = 100 - x; \quad 0 \leq x \leq 100$$

Interest rate: 6%, compounded annually.

$Y =$ The present value of (1) on 1/1/2007

$Z =$ The present value of (2) on 1/1/2007

Question 4

In what range is $|Y - Z|$?

- (A) Less than \$400
- (B) \$400 but less than \$800
- (C) \$800 but less than \$1,200
- (D) \$1,200 but less than \$1,600
- (E) \$1,600 or more

Data for Question 3 (3 points)

The present value of an annuity is given by:

$$\frac{(S_x - S_{x+3}) - (S_{x+5} - S_{x+8})}{D_x}$$

Question 3

In what range is the sum of the annuity payments?

- (A) Less than 12
- (B) 13
- (C) 14
- (D) 15
- (E) 16 or more

Data for Question 12 (3 points)

The following table applies to a group of 10 individuals, who are exactly age 90.

\underline{x}	$\underline{\ell}_x$
90	210
91	150
92	120
93	90
94	70
95	50
96	35
97	20
98	10
99	5
100	0

Deaths are uniformly distributed within each age.

Question 12

In what range is the total expected number of future years lived by the 10 individuals?

- (A) Less than 28.0
- (B) 28.0 but less than 35.0
- (C) 35.0 but less than 42.0
- (D) 42.0 but less than 49.0
- (E) 49.0 or more

Data for Question 24 (3 points)

$${}_{10}E_x = 0.400$$

$${}_{10|}a_x = 7.000$$

$$\ddot{s}_{x:\overline{10}|} = 15.000$$

Question 24

In what range is \ddot{a}_x ?

- (A) Less than 12.70
- (B) 12.70 but less than 12.90
- (C) 12.90 but less than 13.10
- (D) 13.10 but less than 13.30
- (E) 13.30 or more

2008

Data for Question 25 (4 points)

Smith (age 60) purchases an annuity on 1/1/2008 that has the following characteristics:

Payments \$1 annually at the beginning of each year

Term Payments are for life with the first payment on 1/1/2018

Mortality is based on the following formula: $\ell_x = 100 - x$.

Interest rate: 0%.

Y = the probability that the sum of payments made under the annuity will exceed the actuarial present value of the annuity as of 1/1/2008.

Question 25

In what range is Y ?

- (A) Less than 0.445
- (B) 0.445 but less than 0.465
- (C) 0.465 but less than 0.485
- (D) 0.485 but less than 0.505
- (E) 0.505 or more

2008

Data for Question 26 (3 points)

Retirement benefit: \$50 per month for each year of service.

Interest rate: 6.00%, compounded annually.

Pre-retirement decrements: Mortality only.

Retirement age: 65.

Data for Smith:

Date of birth 1/1/1962

Date of hire 1/1/1997

Present value as of 1/1/2007 of Smith's anticipated retirement benefit at age 65: \$26,475.

Present value as of 1/1/2008 of Smith's anticipated retirement benefit at age 65: \$28,174.

Question 26

In what range is q_{45} ?

- (A) Less than 0.00250
- (B) 0.00250 but less than 0.00300
- (C) 0.00300 but less than 0.00350
- (D) 0.00350 but less than 0.00400
- (E) 0.00400 or more

2009

Data for Question 5 (4 points)

$$q_{20} = 0.10$$

$$q_x = 0.05 \text{ for all } x > 20$$

$i = 4.0\%$, compounded annually

Question 5

In what range is \ddot{a}_{20} ?

- (A) Less than 9.7
- (B) 9.7 but less than 10.2
- (C) 10.2 but less than 10.7
- (D) 10.7 but less than 11.2
- (E) 11.2 or more

2009

Data for Question 6 (3 points)

$$\mu(x) = \frac{1}{100-x}, \quad 0 \leq x \leq 100$$

$$i = 0.0\%$$

Question 6

In what range is \ddot{a}_{40} ?

- (A) Less than 29.9
- (B) 29.9 but less than 30.4
- (C) 30.4 but less than 30.9
- (D) 30.9 but less than 31.4
- (E) 31.4 or more

Data for Question 17 (2 points)

The following assumed rates of retirement are used in the actuarial valuation of a defined benefit pension plan:

<u>Age</u>	<u>Retirement rate at exact age</u>
62	40%
63	25%
64	25%
65	100%

No other decrements apply from ages 62 through 65.

All active participants are currently under age 62.

X = the weighted average assumed retirement age for the pension plan.

Question 17

In what range is X ?

- (A) Less than 63.25
- (B) 63.25 but less than 63.45
- (C) 63.45 but less than 63.65
- (D) 63.65 but less than 63.85
- (E) 63.85 or more

2009

Data for Question 18 (3 points)

Smith (age 45) purchases a single premium annuity with the following characteristics:

Single premium	\$100,000
Monthly payment	Z at the beginning of each month
Payment period	For Smith's lifetime, with payments guaranteed for the first 120 months
Interest rate	3% per year, compounded annually

Selected commutation functions:

\underline{x}	$\underline{D_x}$	$\underline{N_x}$
45	2,392,905	
...
55	1,639,330	24,032,177

Question 18

In what range is Z ?

- (A) Less than \$440.00
- (B) \$440.00 but less than \$445.00
- (C) \$445.00 but less than \$450.00
- (D) \$450.00 but less than \$455.00
- (E) \$455.00 or more

2009

Data for Question 22 (3 points)

Terms of an immediate annuity payable for life to a life age x on 1/1/2009:

Payment \$100,000 per year payable annually

Interest 5% per year, compounded annually

Mortality rates before improvement:

$$q_x = 0.051$$

$$q_{x+1} = 0.057$$

$$q_{x+2} = 0.063$$

Mortality rates are projected to improve by 1% per year, compounded annually, beginning 1/1/2010.

$Z =$ the present value as of 1/1/2009 of the third payment.

Question 22

In what range is Z ?

- (A) Less than \$72,570
- (B) \$72,570 but less than \$72,600
- (C) \$72,600 but less than \$72,630
- (D) \$72,630 but less than \$72,660
- (E) \$72,660 or more

Data for Question 26 (3 points)

$$\ddot{a}_{60:\overline{5}|} = 4.3393$$

$$\ddot{a}_{65:\overline{5}|} = 4.2985$$

$$\ddot{a}_{60} = 11.7952$$

$$\ddot{a}_{65} = 10.8207$$

$$\ddot{a}_{70} = 9.7262$$

Question 26

In what range is ${}_{10}E_{60}$?

- (A) Less than 0.4000
- (B) 0.4000 but less than 0.4500
- (C) 0.4500 but less than 0.5000
- (D) 0.5000 but less than 0.5500
- (E) 0.5500 or more

2009

Data for Question 33 (2 points)

A company provides for a lump sum severance benefit equal to 6 months salary for employees under age 45 who terminate during the next year. Assume that the benefits are paid mid-year.

Data for all employees:

\underline{x}	$\underline{q_x^{(\text{Termination})}}$	<u>Total salary</u>
30	0.15	\$5,000,000
35	0.10	\$9,000,000
40	0.05	\$6,000,000

$i = 8\%$, compounded annually.

$X =$ the one-year term cost of the severance benefit as of 1/1/2009.

Question 33

In what range is X ?

- (A) Less than \$925,000
- (B) \$925,000 but less than \$945,000
- (C) \$945,000 but less than \$965,000
- (D) \$965,000 but less than \$985,000
- (E) \$985,000 or more

Data for Question 2 (3 points)

Selected annuity values:

\underline{x}	$\underline{\ddot{a}}_x$
50	12.0787
51	11.9212
52	11.7585

Interest rate: 7.0% per year, compounded annually.

X = the probability an annuitant age 50 dies before age 52.

Question 2

In what range is X ?

- (A) Less than 0.005
- (B) 0.005 but less than 0.010
- (C) 0.010 but less than 0.015
- (D) 0.015 but less than 0.020
- (E) 0.020 or more

2010

Data for Question 4 (3 points)

$$\ell_x = 110 - x, \quad 0 \leq x \leq 110$$

Interest rate: 7.0% per year, compounded annually.

Question 4

In what range is \ddot{a}_{65} ?

- (A) Less than 10.60
- (B) 10.60 but less than 11.60
- (C) 11.60 but less than 12.60
- (D) 12.60 but less than 13.60
- (E) 13.60 or more

Data for Question 15 (3 points)

Given the following values:

x	e_x
107	0.60
108	0.20
109	0.00

A new table is constructed such that the force of mortality at each age is doubled.

Y = the value of e_{107} from the new table.

Question 15

In what range is Y ?

- (A) Less than 0.25
- (B) 0.25 but less than 0.27
- (C) 0.27 but less than 0.29
- (D) 0.29 but less than 0.31
- (E) 0.31 or more

Data for Question 28 (3 points)

Mortality is one-year select and ultimate.

$$\ddot{a}_{70} = 9.8269$$

$$\frac{P_{[70]}}{P_{70}} = 1.013$$

Question 28

In what range is $\ddot{a}_{[70]}$?

- (A) Less than 9.9270
- (B) 9.9270 but less than 9.9370
- (C) 9.9370 but less than 9.9470
- (D) 9.9470 but less than 9.9570
- (E) 9.9570 or more

2010

Data for Question 29 (4 points)

An insurance company requires a single premium of \$118,218 for an annual 7-year certain and life annuity immediate of X to Smith (age 60 on 1/1/2010).

The term structure of interest rates is:

<u>Date</u>	<u>Spot rate</u>
12/31/2010	5.0%
12/31/2011	5.0%
12/31/2012	5.0%
12/31/2013	5.0%
12/31/2014	5.0%
12/31/2015+	6.0%

Given the following values:

$${}_7p_{60} = 0.9482$$

<u>Annual interest rate</u>	<u>a_{67}</u>
5.0%	10.8376
6.0%	9.9819

Question 29

In what range is X ?

- (A) Less than \$9,770
- (B) \$9,770 but less than \$9,820
- (C) \$9,820 but less than \$9,870
- (D) \$9,870 but less than \$9,920
- (E) \$9,920 or more

Data for Question 30 (4 points)

Smith (age 65) purchases a 2-year temporary annuity immediate of \$100,000 at 1/1/2010.

Unprojected mortality rates are as follows:

x	q_x
65	0.0156
66	0.0176

To compute the single premium for this annuity, the seller uses projected mortality and assumes the following:

Rates of mortality will reduce by 1.5% at 1/1/2011

Interest is 5.0%, compounded annually.

Question 30

In what range is the single premium?

- (A) Less than \$180,525
- (B) \$180,525 but less than \$181,525
- (C) \$181,525 but less than \$182,525
- (D) \$182,525 but less than \$183,525
- (E) \$183,525 or more

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