

SOCIETY OF ACTUARIES
AMERICAN SOCIETY OF PENSION ACTUARIES
JOINT BOARD FOR THE ENROLLMENT OF ACTUARIES

COURSE P-360U (EA1) SEGMENT B
JOINT BOARD BASIC EXAMINATION

This is the May 1992 examination which has been released to
the public by the administering organizations.

92
SPRING
EA-1B

1992

Data for Question 1

Normal retirement benefit: \$25 per month for each year of service.

Early retirement reduction: None.

Actuarial cost method: Aggregate.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement deaths and terminations: None.

Retirement age:

Before 1992: 60.

After 1991: 65.

Data for sole participant:

Date of birth 1/1/40

Date of hire 1/1/80

Value of assets as of 1/1/92: \$5,000.

Selected annuity values:

$$\ddot{a}_{60}^{(12)} = 9.82 \quad \ddot{a}_{65}^{(12)} = 8.74$$

Question 1

In what range is the decrease in the normal cost as of 1/1/92 due to the change in the assumed retirement age?

- (A) Less than \$1,700
- (B) \$1,700 but less than \$1,850
- (C) \$1,850 but less than \$2,000
- (D) \$2,000 but less than \$2,150
- (E) \$2,150 or more

1992

Data for Question 2

Plan effective date: 1/1/91.

Normal retirement benefit: 30% of final 3-year average compensation.

Actuarial cost method: Aggregate.

Actuarial assumptions:

Interest rate: 7% per year.

Compensation increases: 5% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

Normal cost for 1991 as of 1/1/91: \$7,750.

Value of assets as of 1/1/92: \$8,292.

Ratio of present value of future compensation to
current annual compensation as of 1/1/91: 20.13.

Data for sole participant:

Date of birth	1/1/51
Compensation increase during 1991	8%

Question 2

In what range is the increase in the normal cost for 1992 as of 1/1/92 due to the actual increase in compensation over the assumed increase in compensation?

- (A) Less than \$227
- (B) \$227 but less than \$234
- (C) \$234 but less than \$241
- (D) \$241 but less than \$248
- (E) \$248 or more

1992

Data for Question 3

Normal retirement benefit: \$20 per month for each year of service.

Early retirement eligibility: Age 60.

Early retirement benefit: Accrued benefit, reduced by 1/15 for each year by which the benefit commencement date precedes the normal retirement date.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement deaths and terminations: None.

Probability of retirement:

Age 62: 25%.

Age 63: 50%.

Age 64: 75%.

Age 65: 100%.

Data for sole participant:

Date of birth 1/1/30

Date of hire 1/1/80

Selected annuity values:

$$\bar{a}_{62}^{(12)} = 9.18 \quad \bar{a}_{63}^{(12)} = 8.96$$

$$\bar{a}_{64}^{(12)} = 8.74 \quad \bar{a}_{65}^{(12)} = 8.51$$

Question 3

In what range is the present value of future benefits as of 1/1/92?

- (A) Less than \$22,000
- (B) \$22,000 but less than \$23,000
- (C) \$23,000 but less than \$24,000
- (D) \$24,000 but less than \$25,000
- (E) \$25,000 or more

1992

Data for Question 4

Plan effective date: 1/1/92.

Normal retirement benefit: 50% of final 3-year average compensation.

Actuarial cost method: Entry age normal.

Selected actuarial assumptions:

Interest rate: 7% per year.
Compensation increases: 5% per year.
Retirement age: 65.

Data for sole participant:

Date of birth 1/1/47
Date of hire 1/1/82
1991 compensation \$28,571

Selected preretirement commutation functions:

<u>x</u>	<u>D_x</u>	<u>*D_x</u>	<u>N_x</u>	<u>*N_x</u>
35	894	4,931	12,365	138,500
45	445	3,998	5,691	93,473
55	214	3,132	2,405	57,407
65	94	2,241	868	30,014

Selected post retirement annuity value:

$$\bar{a}_{65}^{(12)} = 8.74$$

Question 4

In what range is the expected accrued liability as of 1/1/93?

- (A) Less than \$32,000
- (B) \$32,000 but less than \$33,000
- (C) \$33,000 but less than \$34,000
- (D) \$34,000 but less than \$35,000
- (E) \$35,000 or more

1992

Data for Question 5

Plan effective date: 1/1/75.

Normal retirement benefit: \$10 per month for each year of service.

Early retirement reduction: None.

Actuarial cost method: Entry age normal.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement deaths and terminations: None.

Retirement age:

Before 1992: 62.

After 1991: 65.

Data for sole participant:

Date of birth 1/1/35

Date of hire 1/1/80

Selected annuity values:

$$\ddot{a}_{62}^{(12)} = 9.39 \quad \ddot{a}_{65}^{(12)} = 8.74$$

Question 5

In what range is the change in the accrued liability as of 1/1/92 due to the change in the assumed retirement age?

- (A) Decrease of \$3,000 or more
- (B) Decrease of \$1,500 but less than \$3,000
- (C) \$0 or decrease of less than \$1,500
- (D) Increase of more than \$0 but less than \$1,500
- (E) Increase of \$1,500 or more

1992

Data for Question 6

Normal retirement benefit: \$41.67 per month for each year of service.

Early retirement eligibility: Age 55.

Early retirement benefit: Accrued benefit, reduced on an actuarially equivalent basis.

Actuarial cost method: Individual level premium.

Actuarial assumptions:

Interest rate: 7% per year.

Mortality: UP-84 Table.

Preretirement terminations other than deaths: None.

Retirement age: 65.

Data for participant Smith:

Date of birth 1/1/37

Date of hire 1/1/72

Date of participation 1/1/82

On 12/31/91, Smith retires and elects to begin receiving benefits on 1/1/92.

Selected annuity values and probability of survival:

$$\ddot{a}_{65}^{(12)} = 8.51$$

$$\ddot{a}_{45:\overline{20}|} = 10.79 \quad \ddot{a}_{46:\overline{19}|} = 7.37 \quad \ddot{a}_{36:\overline{30}|} = 12.82 \quad \ddot{a}_{35:\overline{20}|} = 11.12$$

$${}_{10}P_{55} = .8562$$

Question 6

In what range is the experience gain as of 12/31/91 due to Smith's early retirement?

- (A) Less than \$3,000
- (B) \$3,000 but less than \$6,000
- (C) \$6,000 but less than \$9,000
- (D) \$9,000 but less than \$12,000
- (E) \$12,000 or more

1992

Data for Question 7

Normal retirement benefit: \$40 per month for each year of service.

Preretirement death benefit: Lump sum equal to 50 times the monthly projected normal retirement benefit; provided by a whole life insurance policy.

Actuarial cost method: Aggregate, split-funded with life insurance.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

Data for sole participant:

Date of birth 1/1/52

Date of hire 1/1/87

Cash value at age 65 per \$1,000 of life insurance: \$200.

Annual premium as of 1/1/92: \$800.

Value of assets in side fund as of 1/1/92: \$5,000.

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 8.74$$

Question 7

In what range is the normal cost for the side fund for 1992 as of 1/1/92?

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

1992

Data for Question 8

Plan effective date: 1/1/91.

Normal retirement benefit: 50% of final 3-year average compensation.

Actuarial cost method: Individual level premium.

Actuarial assumptions:

Interest rate: 7% per year.

Compensation increases: None.

Preretirement deaths and terminations: None.

Retirement age: 65.

Data for sole participant:

Date of birth	1/1/51
Date of hire	1/1/91
Compensation used in 1/1/91 valuation	\$60,000

Normal cost for 1992 as of 1/1/92: \$3,032.

Selected annuity value:

$$\bar{a}_{65}^{(12)} = 8.74$$

Question 8

In what range is the participant's projected 3-year average compensation used in the 1/1/92 actuarial valuation?

- (A) Less than \$44,000
- (B) \$44,000 but less than \$49,000
- (C) \$49,000 but less than \$54,000
- (D) \$54,000 but less than \$59,000
- (E) \$59,000 or more

1992

Data for Question 9

Early retirement eligibility: Age 55.

Early retirement benefit: Accrued benefit, reduced by $1/15$ for each of the first 5 years and $1/30$ for each of the next 5 years by which the benefit commencement date precedes the normal retirement date.

Actuarial cost method: Unit credit.

Actuarial assumptions:

Interest rate: 6% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

On 12/31/91, there are 3 active participants aged 56, 59, and 63 who retire and elect to commence receiving benefits on 1/1/92.

Selected annuity values:

x	$\ddot{a}_x^{(12)}$
56	11.50
57	11.33
58	11.17
59	11.00
60	10.83
61	10.67
62	10.50
63	10.33
64	10.17
65	10.00

Question 9

Which, if any, of the elections will result in an experience gain?

- (A) The election by the age 59 participant only.
- (B) The election by the age 63 participant only.
- (C) The election by the age 56 and age 59 participants only.
- (D) The election by the age 56 and age 63 participants only.
- (E) The correct answer is not given by (A), (B), (C), or (D) above.

1992

Data for Question 10

Annual annuity: \$10,000 payable each 1/1 for the life of retiree. Upon the death of the retiree, \$5,000 is payable each 1/1 to the surviving spouse.

Assumed interest rate: 7% per year.

On 1/1/92, there are 100 retirees, all age 70. All are married with spouses age 67.

Mortality experience in 1992:

5 retirees die in 1992, and 3 of their spouses survive to 1/1/93.

95 retirees survive to 1/1/93, and 93 of their spouses survive to 1/1/93.

Selected annuity values:

$$\bar{a}_{67} = 8.74 \quad \bar{a}_{70} = 8.06$$

$$\bar{a}_{68} = 8.52 \quad \bar{a}_{71} = 7.83$$

$$\bar{a}_{67:70} = 6.51$$

Question 10

In what range is the experience gain or loss from mortality for 1992 as of 12/31/92?

- (A) Loss of \$400,000 or more
- (B) Loss of \$200,000 but less than \$400,000
- (C) \$0 or loss of less than \$200,000
- (D) Gain of more than \$0 but less than \$200,000
- (E) Gain of \$200,000 or more

1992

Data for Question 11

Normal retirement benefit: 40% of final year's compensation.

Actuarial cost method: Aggregate.

Initial valuation results as of 1/1/92:

Present value of all future benefits	\$ 1,600,000
Present value of future benefits for retired and terminated participants	320,000
Value of assets	400,000
Present value of future compensation	19,200,000
Annual compensation	3,200,000

As of 1/1/92, there are no active participants within one year of the assumed retirement age.

After completing the valuation, it was discovered that all active participants received a 7% increase in annual compensation which had not been reported, and the valuation results were recalculated.

Question 11

In what range is the recalculated normal cost for 1992 as of 1/1/92?

- (A) Less than \$210,500
- (B) \$210,500 but less than \$214,500
- (C) \$214,500 but less than \$218,500
- (D) \$218,500 but less than \$222,500
- (E) \$222,500 or more

1992

Data for Question 12

Normal retirement benefit: \$1,000 per month.

Normal form of payment: Life annuity with 5 years certain.

Actuarially equivalent optional forms of payment:

Option A: The initial monthly benefit is payable for 5 years certain and the remaining lifetime of the participant, with 50% of the initial monthly benefit payable for the surviving beneficiary's lifetime following the participant's death. However, there is no reduction in the benefit paid to the surviving beneficiary until the end of the 5-year certain period.

Option B: Same as Option A, except the percentage continuing to the surviving beneficiary is 75%.

Initial monthly benefit under Option A: \$840.

Question 12

In what range is the initial monthly benefit under Option B?

- (A) Less than \$750
- (B) \$750 but less than \$760
- (C) \$760 but less than \$770
- (D) \$770 but less than \$780
- (E) \$780 or more

1992

Data for Question 13

Normal retirement benefit: \$10 per month for each year of service.

Actuarial cost method: Frozen initial liability.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

Unfunded liability as of 1/1/92: \$10,000.

Value of assets as of 1/1/92: \$41,952.

Data and valuation results for the only participants:

	<u>Smith</u>	<u>Brown</u>
Date of birth	1/1/47	1/1/27
Date of hire	1/1/72	1/1/52
Date of retirement		12/31/91
Present value of future benefits as of 1/1/92	\$10,841	\$41,952

Contribution for 1992: Normal cost for 1992 as of 1/1, plus an amount to amortize the unfunded liability as of 1/1/92 over 10 years; paid on 1/1/92.

Investment rate of return for 1992: 7%, compounded annually.

As of 1/1/93 Smith is active and Brown is retired.

Selected annuity values:

$$\ddot{a}_{65}^{(12)} = 8.74$$

$$\ddot{a}_{66}^{(12)} = 8.51$$

Question 13

In what range is the normal cost for 1993 as of 1/1/93?

- (A) Less than \$64
- (B) \$64 but less than \$129
- (C) \$129 but less than \$194
- (D) \$194 but less than \$289
- (E) \$289 or more

1992

Data for Question 14

Normal retirement benefit: \$10 per month for each year of service.

Preretirement death benefit: Lump sum equal to 100 times the projected monthly normal retirement benefit, payable at the end of the year of death.

Actuarial cost method: Unit credit for retirement benefits;
term cost for preretirement death benefits.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement terminations other than deaths: None.

Retirement age: 65.

Data for sole participant:

Date of birth 1/1/47
Date of hire 1/1/72

Selected commutation functions:

<u>x</u>	<u>D_x</u>	<u>N_x</u>
44	4,885	63,045
45	4,548	58,163
46	4,236	53,615
64	1,054	9,926
65	965	8,872
66	881	7,907

Question 14

In what range is the total normal cost for 1992 as of 1/1/92?

- (A) Less than \$205
- (B) \$205 but less than \$255
- (C) \$255 but less than \$305
- (D) \$305 but less than \$355
- (E) \$355 or more

1992

Data for Question 15

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

Actuarial cost method:

Before 1992: Unit credit.

After 1991: Entry age normal.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

Data for sole participant: -

Date of birth 1/1/42

Date of hire 1/1/87

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 8.74$$

Question 15

In what range is the change in the accrued liability as of 1/1/92 due to the change in the actuarial cost method?

- (A) Decrease of \$5,400 or more
- (B) Decrease of \$1,800 but less than \$5,400
- (C) Decrease of less than \$1,800 or increase of less than \$1,800
- (D) Increase of \$1,800 but less than \$5,400
- (E) Increase of \$5,400 or more

1992

Data for Question 16

Normal retirement benefit: 2% of final 3-year average compensation for each year of service up to 10 years.

Actuarial cost method: Projected unit credit, with benefits prorated over the years of service during which benefits are expected to accrue.

Actuarial assumptions:

Interest rate: 8% per year.

Compensation increases: 4% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

Data for sole participant:

Date of birth	1/1/37
Date of hire	1/1/87
1991 compensation	\$31,000

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 8.50$$

Question 16

In what range is the normal cost as of 1/1/92?

- (A) Less than \$1,500
- (B) \$1,500 but less than \$2,000
- (C) \$2,000 but less than \$2,500
- (D) \$2,500 but less than \$3,000
- (E) \$3,000 or more

1992

Data for Question 17

Normal retirement benefit:

Before 1992: \$10.00 per month for each year of service.
After 1991: \$10.50 per month for each year of service; applicable to
active and inactive participants.

Actuarial cost method: Unit credit.

Assumed interest rate: 7% per year.

Selected valuation results:

	<u>1/1/91</u>	<u>1/1/92</u>
Normal cost as of 1/1	\$ 1,000	\$ 1,500
Accrued liability	20,000	22,500
Value of assets	10,000	13,500

Contribution for 1991: \$2,000 paid on 7/1/91.

Benefits payments for 1991: \$500 paid on 7/1/91.

Question 17

In what range is the experience gain for 1991?

- (A) Less than \$500
- (B) \$500 but less than \$1,000
- (C) \$1,000 but less than \$1,500
- (D) \$1,500 but less than \$2,000
- (E) \$2,000 or more

1992

Data for Question 18

Normal retirement benefit: \$15 per month for each year of service.

Preretirement death benefit: Lump sum equal to 100 times the monthly accrued benefit, payable at the time of death.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement terminations other than deaths: None.

Retirement age: 65.

Deaths are assumed to occur at the beginning of each year.

Data for sole participant:

Date of birth 1/1/30

Date of hire 1/1/60

Selected annuity value and probabilities of mortality:

$$\ddot{a}_{65}^{(12)} = 8.70 \quad q_{65} = .017 \quad q_{66} = .019 \quad q_{67} = .021$$

Question 18

In what range is the present value of future preretirement death benefits as of 1/1/92?

- (A) Less than \$2,500
- (B) \$2,500 but less than \$2,600
- (C) \$2,600 but less than \$2,700
- (D) \$2,700 but less than \$2,800
- (E) \$2,800 or more

1992

Data for Question 19

Plan effective date: 1/1/87.

Normal retirement benefit: \$100 per month for each year of service.

Actuarial cost method: Unit credit.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

Data for sole participant:

Date of birth	1/1/32
Date of hire	1/1/87

Value of assets as of 1/1/91: \$19,000.

Contribution for 1991: \$8,000 paid on 12/31/91.

Value of assets as of 1/1/92: \$26,000.

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 8.74$$

Question 19

In what range is the absolute value of the experience gain or loss for 1991 as of 12/31/91?

- (A) Less than \$2,000
- (B) \$2,000 but less than \$2,500
- (C) \$2,500 but less than \$3,000
- (D) \$3,000 but less than \$3,500
- (E) \$3,500 or more

1992

Data for Question 20

Normal retirement benefit: 2% of final 3-year average compensation for each year of service up to 30 years.

Early retirement eligibility: Age 60.

Early retirement benefit: Accrued benefit, reduced by 3% for each year by which the benefit commencement date precedes the normal retirement date.

Actuarial cost method: Projected unit credit, with benefits prorated over the years of service during which benefits are expected to accrue.

Actuarial assumptions:

Interest rate: 8% per year.

Compensation increases: 6% per year.

Preretirement deaths and terminations: None.

Probability of retirement:

Age 62: 15% at the beginning of the year.

Age 65: 100% at the beginning of the year.

Data for sole participant:

Date of birth	1/1/57
Date of hire	1/1/90
1991 compensation	\$25,000

Selected annuity values:

$$\ddot{a}_{62}^{(12)} = 8.77$$

$$\ddot{a}_{65}^{(12)} = 8.20$$

Question 20

In what range is the accrued liability as of 1/1/92?

- (A) Less than \$4,430
- (B) \$4,430 but less than \$4,500
- (C) \$4,500 but less than \$4,570
- (D) \$4,570 but less than \$4,640
- (E) \$4,640 or more

ANSWER KEY

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1. D
2. D
3. B
4. B
5. B
6. A
7. B
8. B
9. A
10. D
11. C
12. D
13. C
14. D
15. D
16. E
17. D
18. B
19. B
20. B