

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

COURSE P-36OU (EA1) SEGMENT B  
JOINT BOARD BASIC EXAMINATION

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SPRING 1995  
EA-1B

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1995

**Conditions Generally Applicable to  
All EA-1 Segment B Examination Questions**

The following conditions should be considered a part of the data for each question, unless otherwise stated or implied.

**General Conditions Regarding Plan Provisions**

- (1) "Plan" or "pension plan" means a defined benefit pension plan.
- (2) The plan is sponsored by a single employer.
- (3) The normal retirement age is 65.
- (4) Retirement pensions commence at normal retirement age and are paid monthly for life at the beginning of each month.
- (5) There are no preretirement death benefits.
- (6) The plan covers all active employees of the employer; there is no age or service requirement for participation. Thus, when referring to active employees, the terms "employee" and "participant" are synonymous.
- (7) There are no mandatory or voluntary employee contributions.
- (8) Service for purposes of vesting and benefit accrual is credited on the basis of time elapsed since date of hire.
- (9) When the normal retirement benefit is computed as a dollar amount, or as a percentage of compensation, for each year of service, the accrued benefit is defined likewise.
- (10) Actuarial equivalence is based on the mortality table and interest rate assumed for funding purposes.
- (11) The plan has not been amended since its effective date.

**General Conditions Regarding Funding**

- (12) Any actuarial valuation encompasses not only all active employees but also retired employees, beneficiaries, and former employees entitled to vested deferred pensions.
- (13) The valuation date is the first day of the plan year; i.e., participant data, present values, asset values, etc. are as of that date. Also, normal costs are payable annually, the first being due on the valuation date.
- (14) Where the normal cost under an actuarial cost method may be computed as either a level percentage of compensation or a level dollar amount, the level percentage approach is used if the plan benefits are based on compensation, and the level dollar approach is used if they are not.
- (15) Under the frozen initial liability method, whenever there is a change in the plan, actuarial assumptions, or asset valuation method, the unfunded liability is adjusted by adding to it the increase (positive or negative) in the unfunded entry age normal accrued liability due to the change. Likewise, under the attained age normal method, the unfunded liability is adjusted by adding to it the increase in the unfunded unit credit accrued liability.
- (16) The actuarial cost method and actuarial assumptions have not been changed since the plan effective date.
- (17) Expenses are paid directly by the employer, rather than from the assets of the plan, and therefore do not affect the funding of the plan.
- (18) Assumed compensation increases first apply to the year immediately following the latest year for which valuation compensation is shown.

The preceding conditions should be considered a part of the data for each question, unless otherwise stated or implied.

1995

Data for Question 1

Plan effective date: 1/1/95.

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

Preretirement death benefit: None.

Actuarial cost method: Aggregate.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement terminations other than deaths: None.

Retirement age: 65.

Selected valuation data for only participants (all active as of 1/1/95):

	<u>Smith</u>	<u>Brown</u>	<u>Green</u>
Date of birth	1/1/60	1/1/60	1/1/50
Date of hire	1/1/81	1/1/81	1/1/71

Selected commutation functions and annuity value:

<u>x</u>	<u>D<sub>x</sub></u>	<u>N<sub>x</sub></u>
35	894,190	12,364,650
45	445,008	5,690,850
65	94,414	868,052

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

Question 1

In what range is the normal cost for 1995 as of 1/1/95?

- (A) Less than \$1,600
- (B) \$1,600 but less than \$1,700
- (C) \$1,700 but less than \$1,800
- (D) \$1,800 but less than \$1,900
- (E) \$1,900 or more

1995

Data for Question 2

Normal retirement benefit: 2% of final year's compensation for each year of service.

Early retirement eligibility: Age 55.

Early retirement benefit: Accrued benefit, reduced by 5% for each year by which the benefit commencement date precedes the normal retirement date.

Actuarial assumptions:

Interest rate: 7% per year.

Compensation increases: 5% per year.

Preretirement deaths and terminations: None.

Probabilities of retirement (assumed to occur at beginning of year):

At age 62	25%
At age 63	50%
At age 64	75%
At age 65	100%

Valuation data for sole participant (active as of 1/1/95):

Date of birth	1/1/33
Date of hire	1/1/75
1994 compensation	\$50,000

Selected annuity values:

$$\ddot{a}_{62}^{(12)} = 9.18 \qquad \ddot{a}_{64}^{(12)} = 8.74$$

$$\ddot{a}_{63}^{(12)} = 8.96 \qquad \ddot{a}_{65}^{(12)} = 8.51$$

Question 2

In what range is the present value of future benefits as of 1/1/95?

- (A) Less than \$155,000
- (B) \$155,000 but less than \$165,000
- (C) \$165,000 but less than \$175,000
- (D) \$175,000 but less than \$185,000
- (E) \$185,000 or more

1995

Data for Question 3

Lump sum death benefit: \$100,000, payable at end of year of death.

Actuarial cost method for all benefits: Individual aggregate.

Actuarial assumptions:

Interest rate: 7% per year.

Probability of mortality at each age from 50 through 64: .005

Preretirement terminations other than deaths: None.

Retirement age: 65.

Valuation data for sole participant (active as of 1/1/95):

Date of birth	1/1/45
Projected monthly retirement benefit	\$5,000

Value of assets as of 1/1/95: \$71,500.

Selected annuity value:

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

Question 3

In what range is the normal cost for 1995 as of 1/1/95?

- (A) Less than \$11,500
- (B) \$11,500 but less than \$11,550
- (C) \$11,550 but less than \$11,600
- (D) \$11,600 but less than \$11,650
- (E) \$11,650 or more

1995

Data for Question 4

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

Preretirement death benefit: None.

Termination benefit: Vested accrued benefit, payable at normal retirement date.

Vesting eligibility: 100% after 5 years.

Actuarial cost method: Unit credit.

Actuarial assumptions:

Interest rate: 6% per year.

Preretirement terminations other than deaths and withdrawals: None.

Retirement age: 65.

Valuation data for sole participant (active as of 1/1/95):

Date of birth 1/1/62

Date of hire 1/1/92

Selected values from preretirement single-decrement tables:

$x$	$l_x^{(d)}$	$l_x^{(w)}$
30	10,000	10,000
31	9,985	9,500
32	9,969	9,000
33	9,952	8,500
34	9,934	8,000
35	9,915	7,500
65	7,900	2,000

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 9.439$$

Question 4

In what range is the accrued liability for preretirement vested termination benefits as of 1/1/95?

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

1995

Data for Question 5

Plan effective date: 1/1/95.

Funding medium: Individual whole life insurance policies and a side fund.

Actuarial cost method: Individual level premium with normal cost for side fund determined for benefits not provided by cash values of insurance policies at age 65.

The amount of whole life insurance is 60 times the expected monthly retirement benefit.

Actuarial assumptions for side fund:

Interest rate: 6% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

Date of birth for sole participant (active as of 1/1/95): 1/1/56.

Expected monthly retirement benefit: \$400.

Cash value at age 65 per \$1,000 of insurance: \$550.

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 10$$

Question 5

In what range is the normal cost for 1995 as of 12/31/95 for the side fund?

- (A) Less than \$480
- (B) \$480 but less than \$510
- (C) \$510 but less than \$540
- (D) \$540 but less than \$570
- (E) \$570 or more



1995

Data for Question 6

Mandatory employee contribution: 0.5% of compensation, paid on 1/1.

Actuarial cost method: Aggregate.

Present value of future benefits (excluding any benefits due to voluntary employee contributions) as of 1/1/95:

Retirement benefits	\$1,000,000
Return of mandatory employee contributions at death or termination	20,000
Employer-provided termination benefits	80,000

Present value of future compensation as of 1/1/95: \$4,800,000.

Total valuation compensation for 1995: \$600,000.

Mandatory employee contributions for 1995: \$3,000 paid on 1/1/95.

Voluntary employee contributions for 1995: \$2,000 paid on 1/1/95.

Value of assets as of 12/31/94:

Mandatory employee contributions with interest	\$30,000
Voluntary employee contributions with interest	20,000
Other assets	<u>150,000</u>
Total assets	200,000

Question 6

In what range is the employer normal cost for 1995 as of 1/1/95?

- (A) Less than \$109,500
- (B) \$109,500 but less than \$111,000
- (C) \$111,000 but less than \$112,500
- (D) \$112,500 but less than \$114,000
- (E) \$114,000 or more

1995

Data for Question 7

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

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

All optional forms of payment are actuarially equivalent to the normal form of payment.

Valuation data for participant Smith:

Date of birth	1/1/36
Date of hire	1/1/72
Date of retirement	12/31/95
Date of benefit commencement	1/1/96

Smith originally elected an optional form of payment under which, for each \$100 of monthly early retirement single life annuity benefit, he will receive a monthly benefit of \$80 for his lifetime with one-half of this amount continuing after his death to his surviving spouse for her remaining lifetime.

Under an early retirement program, Smith's retirement benefits are enhanced by determining his normal and early retirement benefits with his service increased by one year, and his early retirement benefits reduced now by 3% for each year by which commencement of payments precedes age 63.

Due to the early retirement program, Smith revises his election to an optional form of payment under which he will receive a monthly benefit of \$80 for his lifetime with X% of this amount continuing after his death to his surviving spouse for her remaining lifetime.

Question 7

In what range is the value of X%?

- (A) Less than 75%
- (B) 75% but less than 81%
- (C) 81% but less than 87%
- (D) 87% but less than 93%
- (E) 93% or more

1995

Data for Question 8

Normal retirement benefit:

Before 1995: \$150 per year for each year of service.

After 1994: \$200 per year for each year of service.

Actuarial cost method: Individual entry age normal.

Actuarial assumptions:

Interest rate: 7% per year.

Compensation increases: None.

Preretirement deaths and terminations: None.

Retirement age: 65.

Valuation data and selected valuation results for only participants (both active as of 1/1/95):

	<u>Smith</u>	<u>Brown</u>
Date of birth	1/1/65	1/1/40
Date of hire	1/1/90	1/1/80
Normal cost per \$1,000 of projected annual benefit	\$43.04	\$135.85

Question 8

In what range is the increase in the accrued liability as of 1/1/95 due to the plan amendment?

- (A) Less than \$4,500
- (B) \$4,500 but less than \$5,000
- (C) \$5,000 but less than \$5,500
- (D) \$5,500 but less than \$6,000
- (E) \$6,000 or more

1995

Data for Question 9

Normal retirement benefit: 60% of final year's compensation.

Actuarial cost method: Individual aggregate.

Actuarial assumptions:

Interest rate: 7% per year.

Compensation increases: 3% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

Valuation data for participant Smith (active as of 1/1/95):

Date of birth	1/1/40
1994 compensation	\$90,000
Allocated assets as of 1/1/95	18,000

Selected annuity value:

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

Question 9

In what range is the normal cost attributable to Smith for 1995 as of 1/1/95?

- (A) Less than \$35,000
- (B) \$35,000 but less than \$36,500
- (C) \$36,500 but less than \$38,000
- (D) \$38,000 but less than \$39,500
- (E) \$39,500 or more

1995

Data for Question 10

Actuarial cost method: Frozen initial liability.

Actuarial assumptions:

Interest rate: 7% per year.

Compensation increases: 5% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

As of 1/1/94, all participants were active and under age 63.

Selected valuation results as of 1/1/94:

Normal cost as of 1/1	\$ 150,000
Present value of future benefits	2,500,000
Unfunded liability	750,000
Value of assets	250,000
Total valuation compensation for 1994	4,000,000

Contribution for 1994: \$225,000 paid on 12/31/94.

There were no deaths, terminations, or retirements during 1994. There was one new entrant as of 1/1/95 who was age 50 with valuation compensation for 1995 of \$50,000.

Value of assets as of 1/1/95: \$510,000.

Experience gains or losses due to compensation increases during 1994: \$0.

Question 10

In what range is the absolute value of the change in the normal cost for 1995 as of 1/1/95 due to investment experience gains or losses during 1994?

- (A) Less than \$1,900
- (B) \$1,900 but less than \$1,910
- (C) \$1,910 but less than \$1,920
- (D) \$1,920 but less than \$1,930
- (E) \$1,930 or more

1995

Data for Question 11

Normal retirement benefit:

Before 1995: \$30 per month for each year of service.

After 1994: \$35 per month for each year of service.

Actuarial cost method: Aggregate.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

As of 1/1/94, all participants were active and under age 63.

Selected valuation results as of 1/1/94:

Present value of future benefits	\$900,000
Value of assets	500,000
Average present value of future working lifetime of active participants	11

The contribution for 1994 was paid on 1/1/94 in an amount equal to the normal cost for 1994 as of 1/1/94.

There were no deaths, terminations, or retirements during 1994, and there are no new participants on 1/1/95.

There were no investment experience gains or losses during 1994.

Question 11

In what range is the normal cost for 1995 as of 1/1/95?

- (A) Less than \$43,300
- (B) \$43,300 but less than \$47,300
- (C) \$47,300 but less than \$51,300
- (D) \$51,300 but less than \$54,300
- (E) \$54,300 or more

1995

Data for Question 12

Normal retirement benefit:

Before 1995: 30.0% of final year's compensation.

After 1994: 37.5% of final year's compensation.

Actuarial cost method: Individual entry age normal.

Assumed compensation increases: None.

Selected valuation results for sole participant (active as of 1/1/95), before plan amendment:

Present value of future benefits	\$41,000
Unfunded accrued liability	8,000
Value of assets	10,000
Present value of future compensation	460,000

Increase in annual projected retirement benefit due to plan amendment: \$3,000.

Question 12

In what range is the normal cost for 1995 as of 1/1/95 after the plan amendment?

- (A) Less than \$2,200
- (B) \$2,200 but less than \$2,700
- (C) \$2,700 but less than \$3,200
- (D) \$3,200 but less than \$3,700
- (E) \$3,700 or more

1995

Data for Question 13

Normal retirement benefit: 50% of final year's compensation.

Actuarial cost method: Aggregate.

Assumed compensation increases: 3% per year.

Selected valuation results as of 1/1/95:

Present value of future benefits	\$ 149,000
Value of assets	20,000
Present value of future compensation	1,200,000
Annual compensation	150,000

Investment gain during 1994: \$1,600.

Actual compensation increases during 1994: 10%.

There were no other experience gains or losses during 1994.

There have never been any inactive participants.

Question 13

In what range is the change in the normal cost for 1995 as of 1/1/95 due to experience gains and losses?

- (A) Less than \$1,000
- (B) \$1,000 but less than \$1,100
- (C) \$1,100 but less than \$1,200
- (D) \$1,200 but less than \$1,300
- (E) \$1,300 or more



1995

Data for Question 14

Plan effective date: 1/1/90.

Actuarial cost method: Frozen initial liability.

Initial accrued liability: \$150,000.

Assumed interest rate: 7% per year.

Selected valuation results as of 1/1/95:

Present value of future benefits	\$300,000
Value of assets	200,000
Present value of future compensation	600,000
Annual compensation	60,000

The contribution for 1995 is paid on 12/31/95 in an amount equal to the normal cost for 1995 as of 12/31/95 plus a 10-year amortization payment as of 12/31/95 of the initial accrued liability.

Contribution for 1995: \$25,000.

Question 14

In what range is the unfunded liability as of 1/1/95?

- (A) Less than \$50,000
- (B) \$50,000 but less than \$55,000
- (C) \$55,000 but less than \$60,000
- (D) \$60,000 but less than \$65,000
- (E) \$65,000 or more

1995

Data for Question 15

Normal retirement benefit: 2% of final year's compensation for each year of service.

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: Projected unit credit.

Actuarial assumptions:

Interest rate: 9% per year.

Compensation increases: 3% per year.

Preretirement deaths and terminations: None.

Retirement age: 65.

Date of birth for selected participants (all active as of 12/31/94):

<u>Smith</u>	<u>Brown</u>	<u>Green</u>
1/1/39	1/1/35	1/1/32

Smith, Brown, and Green all retire and elect to commence receiving benefits as of 1/1/95.

Selected annuity values:

$$\ddot{a}_{56}^{(12)} = 9.84 \qquad \ddot{a}_{63}^{(12)} = 8.71$$

$$\ddot{a}_{60}^{(12)} = 9.25 \qquad \ddot{a}_{65}^{(12)} = 8.39$$

Question 15

Which, if any, of the participants generated an experience gain as of 1/1/95 due to his retirement?

- (A) Smith only
- (B) Brown only
- (C) Smith and Brown only
- (D) Brown and Green only
- (E) The correct answer is not given by (A), (B), (C), or (D) above.

1995

Data for Question 16

Actuarial cost method: Aggregate.

Assumed interest rate: 7% per year.

Selected valuation results as of 1/1/95:

Present value of future benefits	\$1,200,000
Present value of future compensation	9,500,000
Annual compensation	750,000

The plan's assets earned a 4% return in 1994; the resulting investment experience loss increased the normal cost for 1995 as of 1/1/95 by \$100.

There were no contributions or disbursements during 1994.

Question 16

In what range is the value of assets as of 1/1/95?

- (A) Less than \$34,000
- (B) \$34,000 but less than \$37,000
- (C) \$37,000 but less than \$40,000
- (D) \$40,000 but less than \$43,000
- (E) \$43,000 or more

1995

Data for Question 17

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

Postponed retirement benefit: Greater of (a) the normal retirement benefit determined as of the date of postponed retirement based on compensation and service up to the date of postponed retirement, or (b) the actuarial equivalent of the normal retirement benefit determined at age 65.

Normal form of payment: Life annuity.

Optional form of payment for married participants: Joint and 100% survivor annuity which is actuarially equivalent to the normal form of payment.

Preretirement death benefit: None.

Data for participant Smith (active as of 12/31/94):

Date of birth	1/1/29
Date of hire	1/1/64
Date of retirement	1/1/95
Spouse's date of birth	1/1/29
Annual compensation:	
1991	\$30,000
1992	42,000
1993	45,000
1994	32,000

Selected commutation functions and annuity values:

$x$	$D_x$	$N_x^{(12)}$
65	94,414	824,779
66	86,246	734,109

  

$\ddot{a}_{65:65}^{(12)} = 6.5$	$\ddot{a}_{66:66}^{(12)} = 6.3$
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Question 17

In what range is Smith's annual benefit under the joint and 100% survivor annuity option?

- (A) Less than \$20,000
- (B) \$20,000 but less than \$21,000
- (C) \$21,000 but less than \$22,000
- (D) \$22,000 but less than \$23,000
- (E) \$23,000 or more

1995

Data for Question 18

Actuarial cost method: Entry age normal (level dollar amount).

Assumed retirement age: 65.

Valuation data for sole participant (active as of 1/1/95):

Date of birth	1/1/50
Date of hire	1/1/80

Projected monthly benefit as of 1/1/95: \$2,500.

Selected commutation functions and annuity value:

<u>x</u>	<u>D<sub>x</sub></u>	<u>N<sub>x</sub></u>
30	1,261,611	17,887,840
45	445,008	5,690,850
65	94,414	868,052

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

Question 18

In what range is the accrued liability for retirement benefits as of 1/1/95?

- (A) Less than \$35,000
- (B) \$35,000 but less than \$37,000
- (C) \$37,000 but less than \$39,000
- (D) \$39,000 but less than \$41,000
- (E) \$41,000 or more

1995

Data for Question 19

Plan effective date: 1/1/92.

Actuarial cost method: Frozen initial liability.

Assumed interest rate: 6% per year.

Initial accrued liability: \$10,000,000.

Normal cost for 1992 as of 1/1/92: \$3,000,000.

Normal cost for 1993 as of 1/1/93: \$3,200,000.

Normal cost for 1994 as of 1/1/94 (after plan amendment): \$3,500,000.

Increase in unfunded liability as of 1/1/94 due to plan amendment: \$5,000,000.

Investment fund activity for 1992 through 1994:

<u>Year</u>	<u>Contribution</u>	<u>Date of Contribution</u>	<u>Actual Investment Return</u>
1992	\$4,500,000	1/1/92	8.0%
1993	5,000,000	4/1/93	7.5
1994	5,500,000	4/1/94	5.5

Question 19

In what range is the unfunded liability as of 1/1/95?

- (A) Less than \$11,050,000
- (B) \$11,050,000 but less than \$11,200,000
- (C) \$11,200,000 but less than \$11,350,000
- (D) \$11,350,000 but less than \$11,500,000
- (E) \$11,500,000 or more

1995

Data for Question 20

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

Early retirement benefit: Accrued benefit, reduced by 0.5% for each month by which the benefit commencement date precedes the normal retirement date.

Normal form of payment: Fully subsidized 100% joint and survivor annuity for married participants; life annuity for unmarried participants.

Actuarial cost method: Individual entry age normal.

Actuarial assumptions:

Interest rate: 7% per year.

Preretirement deaths and terminations: None.

Retirement age: 62.

Marital characteristics: 80% of participants at the assumed retirement age are married with a spouse the same age.

Valuation data for participant Smith:

Date of birth	1/1/35
Date of hire	1/1/85
Date of retirement	12/31/94
Date of benefit commencement	1/1/95
Spouse's date of birth	1/1/35

Selected annuity values:

$$\ddot{a}_{60}^{(12)} = 10.0 \qquad \ddot{a}_{62}^{(12)} = 9.0 \qquad \ddot{a}_{65}^{(12)} = 8.0$$

$$\ddot{a}_{60:60}^{(12)} = 8.0 \qquad \ddot{a}_{62:62}^{(12)} = 7.5 \qquad \ddot{a}_{65:65}^{(12)} = 7.0$$

Question 20

In what range is the absolute value of the experience gain or loss as of 1/1/95 due to Smith's early retirement?

- (A) Less than \$450
- (B) \$450 but less than \$900
- (C) \$900 but less than \$1,350
- (D) \$1,350 but less than \$1,800
- (E) \$1,800 or more

1995

**ANSWER KEY**

**MAY 1995 COURSE P-360U (EA-1) SEGMENT B**

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