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

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EA-1B

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Conditions Generally Applicable to
<u>All EA-1 Segment B Examination Questions</u>

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, 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) Neither the actuarial cost method nor the actuarial assumptions have 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.

1994

Data for Question 1

Plan effective date: 1/1/94.

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

Actuarial cost method: Frozen initial liability (entry age is age at hire).

Actuarial assumptions:

> Preretirement interest rate: 8% per year.
> Postretirement interest rate: 7% per year.
> Preretirement deaths and terminations: None.
> Retirement age: 65.

Valuation data for sole participant (active as of 1/1/94):

Date of birth	1/1/34
Date of hire	1/1/84

Accrued liability under unit credit method as of 1/1/94, based on a 7% rate for preretirement and postretirement interest: $14,900.

Question 1

In what range is the normal cost for 1994 as of 1/1/94?

(A) Less than $1,100

(B) $1,100 but less than $1,200

(C) $1,200 but less than $1,300

(D) $1,300 but less than $1,400

(E) $1,400 or more

1994

Data for Question 2

Normal retirement benefit:

Before 1994: 50% of final 5-year average compensation.
After 1993: 60% of final 5-year average compensation.

Actuarial cost method: Entry age normal (level percentage of compensation).

Actuarial assumptions:

Compensation increases: 5% per year.
Preretirement terminations other than death: None.
Retirement age: 65.

Valuation data for sole participant:

Date of birth	1/1/60
Date of hire	1/1/90
1994 valuation compensation	$25,000

Selected commutation functions:

x	D_x	^sD_x	N_x	^sN_x
30	1,262	5,454	17,888	164,704
34	958	5,033	13,323	143,532
65	94	2,241	868	30,013

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 8.776$$

Question 2

In what range is the change in the accrued liability as of 1/1/94 due to the plan amendment?

(A) Less than $1,350

(B) $1,350 but less than $1,450

(C) $1,450 but less than $1,550

(D) $1,550 but less than $1,650

(E) $1,650 or more

1994

Data for Question 3

Normal retirement benefit: 50% of 5-year final average compensation.

Actuarial cost method: Aggregate (level percentage of compensation).

Actuarial assumptions:

Interest rate: 7% per year.
Compensation increases:
Before 1994: 5% per year.
After 1993: 6% per year.
Preretirement deaths and terminations: None.
Retirement age: 65.

Valuation data for sole participant:

Date of birth	1/1/34
Date of hire	1/1/69
1994 valuation compensation	$100,000

Selected valuation results as of 1/1/94 before change in assumptions:

Normal cost as of 1/1	$ 38,120
Value of assets	200,000

Question 3

In what range is the normal cost for 1994 as of 1/1/94 after the change in actuarial assumptions?

(A) Less than $38,800

(B) $38,800 but less than $39,200

(C) $39,200 but less than $39,600

(D) $39,600 but less than $40,000

(E) $40,000 or more

1994

Data for Question 4

Normal retirement benefit: 2% of final 3-year average compensation for each year of service up to 20 years, plus 1% of final 3-year average compensation for each additional year of service.

Preretirement death benefit: None.

Actuarial cost method: Projected unit credit (based on actual accrual percentages as of valuation date).

Actuarial assumptions:

Interest rate: 7% per year.
Compensation increases: 5% per year.
Preretirement terminations other than deaths: None.
Retirement age: 65.

Valuation data for only participants (both active as of 1/1/94):

	Smith	Brown
Date of birth	1/1/44	1/1/44
Date of hire	1/1/69	1/1/84
1994 valuation compensation	$50,000	$50,000

Selected commutation functions:

x	D_x	N_x
50	310,647	3,752,218
65	94,414	868,052

Question 4

In what range is the accrued liability as of 1/1/94?

(A) Less than $140,000

(B) $140,000 but less than $150,000

(C) $150,000 but less than $160,000

(D) $160,000 but less than $170,000

(E) $170,000 or more

1994

Data for Question 5

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

Early retirement eligibility: Age 55.

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.

Actuarial assumptions:

Interest rate: 7% per year.
Compensation increases: 5% per year.
Preretirement deaths and terminations: None.
Probability of retirement (retirements are assumed to occur at beginning of year):
Before 1994: 100% at age 65.
After 1993: 50% at age 62, 0% at ages 63 and 64, and 100% at age 65.

Valuation data for sole participant:

Date of birth	1/1/44
Date of hire	1/1/74
1994 valuation compensation	\$50,000

Selected annuity values:

$\ddot{a}_{62}^{(12)} = 9.394$ $\ddot{a}_{65}^{(12)} = 8.736$

Question 5

In what range is the change in the accrued liability as of 1/1/94 due to the change in the retirement age assumption?

(A) Less than \$2,150

(B) \$2,150 but less than \$2,200

(C) \$2,200 but less than \$2,250

(D) \$2,250 but less than \$2,300

(E) \$2,300 or more

Data for Question 6 1994

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

Early retirement eligibility: Age 60.

Early retirement benefit: Unreduced accrued benefit.

Optional form of payment: 95% of accrued benefit, payable until the last death of the participant and his surviving spouse.

Actuarial cost method: Projected unit credit.

Actuarial assumptions:

Interest rate: 7% per year.
Compensation increases: 5% per year.
Preretirement deaths and terminations: None.
Retirement age: 65.
Form of payment: Life annuity.

Valuation data for sole participant Smith:

Date of birth	1/1/34
Date of hire	1/1/74
1993 valuation compensation	$40,000
Actual annual compensation:	
1991	$36,281
1992	38,095
1993	40,000
Spouse's date of birth	1/1/34

Selected annuity values:

$\ddot{a}_{60}^{(12)} = 9.815$ $\ddot{a}_{60:60}^{(12)} = 8.094$

$\ddot{a}_{65}^{(12)} = 8.736$ $\ddot{a}_{65:65}^{(12)} = 6.896$

On 12/31/93, Smith retires and elects to receive his annuity under the optional form of payment commencing 1/1/94.

Question 6

In what range is the experience loss as of 1/1/94 due to Smith's retirement?

(A) Less than $30,000

(B) $30,000 but less than $40,000

(C) $40,000 but less than $50,000

(D) $50,000 but less than $60,000

(E) $60,000 or more

1994

Data for Question 7

Vesting: 100% after 5 years of service.

Actuarial cost method: Individual entry age normal (level percentage of compensation).

Actuarial assumptions:

Interest rate: 7% per year.
Compensation increases: 4% per year.
Preretirement deaths: None.
Retirement age: 65.

Valuation data for only participants (both active as of 1/1/94):

	Smith	Brown
Date of birth	1/1/59	1/1/56
Date of hire	1/1/94	1/1/91

Normal cost for 1994 as of 1/1/94:

For Smith:	$17,000
For Brown:	$16,000

Selected probabilities of termination:

x	$q_x^{(w)}$
35	0.25
36	0.20
37	0.15
38	0.10
39	0.05

Question 7

In what range is the accrued liability as of 1/1/94?

(A) Less than $65,000

(B) $65,000 but less than $80,000

(C) $80,000 but less than $95,000

(D) $95,000 but less than $110,000

(E) $110,000 or more

1994

Data for Question 8

Normal retirement benefit:

Effective 1/1/93: $15 per month for each year of service.
Effective 1/1/94: $18 per month for each year of service.

Actuarial cost method: Entry age normal.

Actuarial assumptions:

Interest rate:
Before 1994: 7% per year.
After 1993: 6% per year.
Preretirement deaths and terminations: None.
Retirement age: 65.

Valuation data for sole participant (active as of 1/1/94):

Date of birth	1/1/53
Date of hire	1/1/80

Selected annuity values:

	6%	7%
$12\ddot{a}_{65}^{(12)}$	112.14	104.83

As of 1/1/94, the increase in the accrued liability due to the change in the assumed interest rate is determined before the increase in the accrued liability due to the plan amendment.

Question 8

In what range is the absolute value of the difference between (a) the increase in the accrued liability as of 1/1/94 due to the change in the assumed interest rate, and (b) the increase in the accrued liability due to the plan amendment?

(A) Less than $100

(B) $100 but less than $200

(C) $200 but less than $300

(D) $400 but less than $500

(E) $500 or more

1994

Data for Question 9

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

Termination benefit: Accrued benefit payable at normal retirement date.

Vesting: Full and immediate.

Preretirement death benefit: None.

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

Actuarial assumptions:

Interest rate: 7% per year.
Pretermination deaths: None.
Post-termination deaths: Included in commutation functions below.
Preretirement terminations: 30% at age 50 only (terminations are assumed to occur at beginning of year).
Retirement age: 65.

Valuation data for sole participant (active as of 1/1/94):

Date of birth	1/1/54
Date of hire	1/1/84

Selected commutation functions based on post-termination assumptions:

x	D_x
30	1,262
40	632
50	311
65	94

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 8.7$$

Question 9

In what range is the normal cost for 1994 as of 1/1/94?

(A) Less than $950

(B) $950 but less than $1,000

(C) $1,000 but less than $1,050

(D) $1,050 but less than $1,100

(E) $1,100 or more

1994

Data for Question 10

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

Postponed retirement benefit: Actuarial equivalent of normal retirement benefit, based on postretirement valuation assumptions.

Preretirement death benefit: None.

Actuarial cost method: Unit credit.

Actuarial assumptions:

Interest rate: 7% per year.
Preretirement deaths and terminations: None.
Probabilities of retirement (retirements are assumed to occur at beginning of year):

Age	
65	60%
66	80%
67	100%

Valuation data for sole participant (active as of 1/1/94):

Date of birth	1/1/29
Date of hire	1/1/70

Selected commutation functions based on postretirement valuation assumptions:

x	D_x	$N_x^{(12)}$
65	94	825
66	86	734
67	79	651

Question 10

In what range is the accrued liability as of 1/1/94?

(A) Less than $50,000

(B) $50,000 but less than $51,000

(C) $51,000 but less than $52,000

(D) $52,000 but less than $53,000

(E) $53,000 or more

1994

Data for Question 11

Retirement benefit: \$20,000 payable each 1/1 during the lifetime of the participant, with \$10,000 payable each 1/1 after the participant's death to the surviving spouse.

Date of birth for sole participant Smith (retired): 1/1/23.

Date of birth of Smith's spouse: 1/1/28.

Smith's spouse dies during 1993.

Selected annuity values and probabilities of survival:

$\ddot{a}_{65} = 10.00$	$\ddot{a}_{66} = 9.80$	$p_{65} = .9735$
$\ddot{a}_{70} = 9.00$	$\ddot{a}_{65:70} = 8.00$	$p_{70} = .9636$
$\ddot{a}_{71} = 8.80$		

Question 11

In what range is the net mortality gain during 1993 as of 1/1/94?

(A) Less than \$14,000

(B) \$14,000 but less than \$15,000

(C) \$15,000 but less than \$16,000

(D) \$16,000 but less than \$17,000

(E) \$17,000 or more

1994

Data for Question 12

Normal retirement benefit: 50% of final 5-year average compensation.

Actuarial cost method: Entry age normal (level percentage of compensation).

Actuarial assumptions:

Compensation increases: 6% per year.
Preretirement terminations other than deaths: None.
Retirement age: 65.

Valuation data for sole participant (active as of 1/1/94):

Date of birth	1/1/44
Date of hire	1/1/84
1994 valuation compensation	$53,000

Selected commutation functions:

x	D_x	^sD_x	N_x	^sN_x
40	49,876	513,015	666,789	15,607,843
50	24,505	451,387	295,992	10,748,428
65	7,448	328,780	68,476	4,770,425

Selected annuity value:

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

Question 12

In what range is the accrued liability as of 1/1/94?

(A) Less than $60,000

(B) $60,000 but less than $62,500

(C) $62,500 but less than $65,000

(D) $65,000 but less than $67,500

(E) $67,500 or more

1994

Data for Question 13

Plan effective date: 1/1/93.

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

Preretirement death benefit: None.

Actuarial cost method: Attained age normal.

Actuarial assumptions:

Interest rate: 7% per year.
Preretirement terminations other than deaths: None.
Retirement age: 65.

Valuation data for sole participant (active as of 1/1/94):

Date of birth	1/1/44
Date of hire	1/1/92

Contribution for 1993: $1,125 paid on 12/31/93.

Selected commutation functions:

x	D_x	N_x
49	101,241	1,238,268
50	94,135	1,137,027
65	28,610	263,044

Question 13

In what range is the unfunded liability as of 1/1/94?

(A) Less than $550

(B) $550 but less than $565

(C) $565 but less than $580

(D) $580 but less than $595

(E) $595 or more

1994

Data for Question 14

Normal retirement benefit: $15 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.

Date of birth for only participant ever covered by plan (active as of 1/1/94): 1/1/42.

Selected valuation results:

	1/1/93	1/1/94
Present value of future benefits	$122,000	
Value of assets		$27,500
Unfunded liability		48,500
Value of assets plus unfunded liability	65,000	76,000

Question 14

In what range is the investment experience gain or loss during 1993?

(A) Loss of $200 or more

(B) Loss of less than $200

(C) $0 or gain of less than $200

(D) Gain of $200 but less than $400

(E) Gain of $400 or more

1994

Data for Question 15

Plan effective date: 1/1/94.

Normal retirement benefit: $900 per month.

Early retirement eligibility: Age 60.

Early retirement benefit: Normal retirement benefit minus $50 per month for each year by which the benefit commencement date precedes the normal retirement date.

Actuarial cost method: Individual aggregate.

Actuarial assumptions:

Interest rate: 7% per year.
Preretirement deaths and terminations: None.
Probability of retirement (retirements are assumed to occur at beginning of year):

Age	
63	33.33%
64	66.67%
65	100.00%

Valuation data for sole participant:

Date of birth	1/1/49
Date of hire	1/1/94

Selected annuity value:

$\ddot{a}_{63}^{(12)} = 8.96$ $\ddot{a}_{64}^{(12)} = 8.74$ $\ddot{a}_{65}^{(12)} = 8.51$

Question 15

In what range is the normal cost for 1994 as of 1/1/94?

(A) Less than $2,200

(B) $2,200 but less than $2,300

(C) $2,300 but less than $2,400

(D) $2,400 but less than $2,500

(E) $2,500 or more

1994

Data for Question 16

Plan effective date: 1/1/90.

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

Compensation: Base rate of pay as of 1/1.

Actuarial cost method: Individual level premium.

Actuarial assumptions:

Interest rate: 7% per year.
Compensation increases: None.
Preretirement deaths and terminations: None.
Retirement age: 65.

Valuation data for sole participant:

Date of birth	1/1/30
Date of hire	1/1/90
Base rate of pay as of 1/1/90	$60,000
Base rate of pay as of 1/1/91	60,000
Base rate of pay as of 1/1/92	80,000
Base rate of pay as of 1/1/93	80,000
Base rate of pay as of 1/1/94	65,000

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 8.786$$

Question 16

In what range is the normal cost for 1994 as of 1/1/94?

(A) Less than $45,000

(B) $45,000 but less than $47,500

(C) $47,500 but less than $50,000

(D) $50,000 but less than $52,500

(E) $52,500 or more

1994

Data for Question 17

Normal retirement benefit: $2,000 per month.

Actuarial cost method: Aggregate with side fund and life insurance (split-funded).

Actuarial assumptions:

Compensation increases: None.
Preretirement terminations other than deaths: None.
Retirement age: 65.

Valuation data as of 1/1/94:

Value of assets in side fund	$10,000
Annual premium for life insurance	2,000
Cash value of life insurance at age 65	50,000

Date of birth for sole participant (active as of 1/1/94): 1/1/49.

Selected commutation functions based on preretirement assumptions:

x	D_x	N_x
45	445	5,691
55	214	2,405
65	94	868

Selected annuity value:

$\ddot{a}_{65}^{(12)} = 8.78$

Question 17

In what range is the total normal cost for 1994 as of 1/1/94?

(A) Less than $4,000

(B) $4,000 but less than $4,300

(C) $4,300 but less than $4,600

(D) $4,600 but less than $4,900

(E) $4,900 or more

1994

Data for Question 18

Normal retirement benefit: 50% of final 5-year average compensation.

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, but not before 1/1/98.

Selected valuation results as of 1/1/93:

Present value of future benefits	$ 500,000
Unfunded liability	100,000
Value of assets	100,000
Present value of future compensation	3,000,000
Valuation compensation	200,000

Contribution for 1993: $30,000 paid on 1/1/93.

There were no experience gains or losses from any source during 1993.

There were no terminations, deaths, or retirements during 1993, and there were no new entrants on or before 1/1/94.

Question 18

In what range is the normal cost for 1994 as of 1/1/94?

(A) Less than $20,940

(B) $20,940 but less than $20,980

(C) $20,980 but less than $21,020

(D) $21,020 but less than $21,060

(E) $21,060 or more

1994

Data for Question 19

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

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 assumptions:

Interest rate: 7% per year.
Preretirement deaths and terminations: None.
Probability of retirement (retirements are assumed to occur at beginning of year):

Age	
60	20%
61	20%
62	50%
63	0%
64	0%
65	100%

Valuation data for sole participant (active as of 1/1/94):

Date of birth	1/1/44
Date of hire	1/1/84

Selected annuity values:

$\ddot{a}_{60}^{(12)} = 9.815$ $\ddot{a}_{62}^{(12)} = 9.394$ $\ddot{a}_{64}^{(12)} = 8.958$

$\ddot{a}_{61}^{(12)} = 9.607$ $\ddot{a}_{63}^{(12)} = 9.178$ $\ddot{a}_{65}^{(12)} = 8.736$

Question 19

In what range is the present value of future benefits as of 1/1/94?

(A) Less than $9,000

(B) $9,000 but less than $10,000

(C) $10,000 but less than $11,000

(D) $11,000 but less than $12,000

(E) $12,000 or more

1994

Data for Question 20

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

Termination benefit: Accrued benefit payable at normal retirement age.

Vesting: Full and immediate.

Preretirement death benefit: None.

Actuarial cost method: Unit credit.

Actuarial assumptions:

Interest rate: 7% per year.
Pretermination deaths: None.
Post-termination deaths: Included in commutation functions below.
Preretirement terminations: 10% at age 50 only (terminations are assumed to occur at beginning of year).
Retirement age: 65.

Valuation data for sole participant (active as of 1/1/94):

Date of birth	1/1/54
Date of hire	1/1/84

Selected commutation functions based on post-termination assumptions:

x	D_x
30	1,262
40	632
50	311
65	94

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 8.7$$

Question 20

In what range is the accrued liability as of 1/1/94?

(A) Less than $3,700

(B) $3,700 but less than $3,800

(C) $3,800 but less than $3,900

(D) $3,900 but less than $4,000

(E) $4,000 or more

ANSWER KEY

MAY 1994 COURSE P-360U (EA-1) SEGMENT B

1. A
2. A
3. B
4. D
5. A

6. C
7. B
8. A
9. E
10. C

11. B
12. C
13. B
14. B
15. B

16. C
17. B
18. C
19. B
20. B