SOCIETY OF ACTUARIES

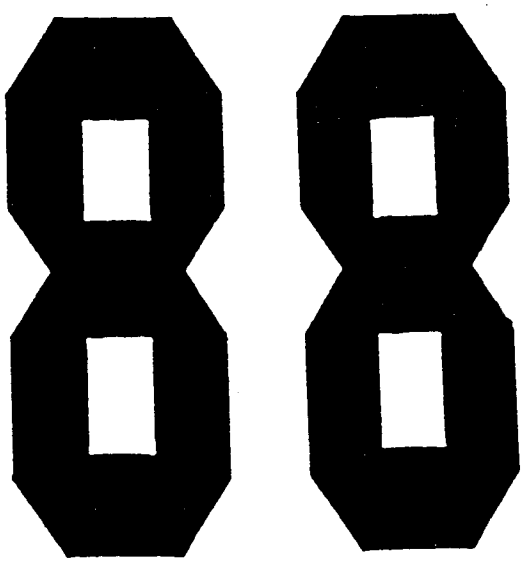
AMERICAN SOCIETY OF PENSION ACTUAREIS

JOINT BOARD FOR THE ENROLLMENT OF ACTUARIES

Part 7P(US) (EA1) Segments ~~A and~~ B

JOINT BOARD PENSION EXAMINATION

This is the May 1988 examination which has been released to the public by the administering organizations.



SPRING

EA-1B

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

The following facts 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) 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.

(6) There are no mandatory or voluntary employee contributions.

(7) Service for purposes of vesting and benefit accrual is credited on the basis of time elapsed from date of hire.

(8) When the normal retirement benefit is computed as a dollar amount, or as a percentage of pay, for each year of service, the accrued benefit is defined likewise.

(9) Actuarial equivalence is based on the mortality table and interest rate assumed for funding purposes.

(10) The plan has not been amended since its effective date.

General Conditions Regarding Funding

(11) Any actuarial valuation encompasses not only all active employees but also retired employees, surviving spouses, and former employees entitled to vested deferred pensions.

(12) 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.

(13) Where the normal cost under a funding method may be computed as either a level percentage of pay or a level dollar amount, the level percentage approach is used if the plan benefits are based on pay, and the level dollar approach if they are not.

(14) Neither the actuarial cost method nor the actuarial assumptions have been changed since the plan effective date.

(15) The valuation date is the first day of the plan year; i.e., participant data, present value items, asset values, etc. are as of that date. Also, normal costs are payable annually, the first being due on the valuation date.

(16) Under the frozen initial liability method, whenever there is a change in either the plan or assumptions, the unfunded liability is adjusted by adding to it the increase (positive or negative) in the 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 unit credit accrued liability.

Data for Question 1

Plan effective date: 1/1/87.

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

Actuarial cost method: Individual level premium.

Actuarial assumptions:

Interest: 6%.
Preretirement deaths and terminations: None.
Retirement age: 65.

Data for sole participant:

Date of birth	1/1/37
Compensation for 1987	$100,000
Compensation for 1988	$120,000

Contribution for 1987: Normal cost as of 1/1, paid on 1/1/87.

Actuarial value of assets as of 1/1/88: $15,000.

Contribution for 1988: Normal cost as of 1/1, plus 10-year amortization of 1987 experience gain or loss, paid on 1/1/88.

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 9.333$$

Question 1

In what range is the contribution for 1988?

(A) Less than $18,600

(B) $18,600 but less than $18,650

(C) $18,650 but less than $18,700

(D) $18,700 but less than $18,750

(E) $18,750 or more

Data for Question 2

Plan effective date: 1/1/83.

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

Actuarial cost method:

Before 1988: Aggregate.
After 1987: Individual aggregate with assets allocated in proportion to the present value of accrued benefits as of 1/1/88.

Actuarial assumptions:

Interest: 6%.
Preretirement deaths and terminations: None.
Retirement age: 65.

Actuarial value of assets as of 1/1/88: $10,000.

Participant data as of 1/1/88:

	Smith	Brown
Date of birth	1/1/38	1/1/28
Date of hire	1/1/83	1/1/73

Selected annuity value:

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

Question 2

In what range is Smith's normal cost for 1988 as of 1/1/88?

(A) Less than $300

(B) $300 but less than $500

(C) $500 but less than $700

(D) $700 but less than $900

(E) $900 or more

Data for Question 3

Plan effective date: 1/1/88.

Normal retirement benefit: $10 per month for each year of service before 1/1/88 plus $15 per month for each subsequent year of service.

Actuarial cost method: Attained age normal.

Actuarial assumptions:

Interest: 6%.
Preretirement deaths and terminations: None.
Retirement age: 65.

Participant data as of 1/1/88:

	Smith	Brown
Date of birth	1/1/43	1/1/28
Date of hire	1/1/73	1/1/68

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 9$$

Question 3

In what range is the normal cost for 1988 as of 1/1/88?

(A) Less than $1,800

(B) $1,800 but less than $1,900

(C) $1,900 but less than $2,000

(D) $2,000 but less than $2,100

(E) $2,100 or more

Data for Question 4

Employee contributions: 2% of compensation, paid at the beginning of each year.

Actuarial cost method: Frozen initial liability.

Assumed interest rate: 6%.

Valuation results as of 1/1/88:

Present value of future benefits (including refunds of employee contributions)	$ 2,600,000
Actuarial value of assets	650,000
Unfunded liability	300,000
Present value of future compensation	12,500,000
Annual compensation	1,000,000

Question 4

In what range is the employer's normal cost for 1988 as of 12/31/88?

(A) Less than $114,000

(B) $114,000 but less than $119,000

(C) $119,000 but less than $124,000

(D) $124,000 but less than $129,000

(E) $129,000 or more

Data for Question 5

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

Actuarial cost method: Entry age normal.

Actuarial assumptions:

Interest: 6%.
Compensation increases: 5% per year.
Preretirement deaths and terminations: None.
Retirement age: 65.

Data for sole participant as of 1/1/88:

Date of birth	1/1/38
Date of hire	1/1/73
Compensation for 1988	$50,000

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 9$$

Question 5

In what range is the normal cost for 1988 as of 1/1/88?

(A) Less than $5,750

(B) $5,750 but less than $6,000

(C) $6,000 but less than $6,250

(D) $6,250 but less than $6,500

(E) $6,500 or more

Data for Question 6

Plan year: Calendar year.

Valuation date: 12/31.

Actuarial cost method: Unit credit.

Assumed interest rate: 6%.

Valuation results as of 12/31/86:

Normal cost as of 12/31	$ 20,000
Unfunded accrued liability (excluding normal cost for 1986)	250,000

Contributions for 1986: $7,000 paid on 3/31/86, $7,000 paid on 6/30/86, and $20,000 paid on 12/31/86.

Question 6

In what range is the expected unfunded accrued liability as of 12/31/87?

(A) Less than $235,000

(B) $235,000 but less than $240,000

(C) $240,000 but less than $245,000

(D) $245,000 but less than $250,000

(E) $250,000 or more

Data for Question 7

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

Actuarial cost method: Frozen initial liability.

Actuarial assumptions:

Interest: 6%.
Preretirement deaths and terminations: None.
Retirement age: Normal retirement age.

Date of birth of sole participant: 1/1/38.

The plan is amended effective 1/1/88 to change the normal retirement age from 65 to 62 and to increase the benefit rate for all years of service from $10 to $12.

Valuation results as of 1/1/88, based on $10 benefit rate:

	Assumed Retirement Age	
	65	62
Present value of future benefits	$15,000	$18,400
Unfunded liability	6,150	-
Actuarial value of assets	5,000	5,000
Accrued liability under entry age normal method	13,100	16,350

Question 7

In what range is the normal cost for 1988 as of 1/1/88?

(A) Less than $400

(B) $400 but less than $475

(C) $475 but less than $550

(D) $550 but less than $625

(E) $625 or more

Data for Question 8

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

Actuarial cost method:

Before 1988: Unit credit.
After 1987: Aggregate.

Actuarial assumptions:

Interest: 6%.
Preretirement deaths and terminations: None.
Retirement age: 65.

Data for sole participant:

Date of birth 1/1/40
Date of hire 1/1/78

Valuation results as of 1/1/87:

Actuarial value of assets	$6,300
Unfunded accrued liability	2,500

Contribution for 1987: $1,250 paid on 12/31/87.

There were no noninvestment experience gains or losses during 1987.

The rate of return on the actuarial value of assets during 1987 was 10%.

Question 8

In what range is the normal cost for 1988 as of 1/1/88?

(A) Less than $1,700

(B) $1,700 but less than $1,800

(C) $1,800 but less than $1,900

(D) $1,900 but less than $2,000

(E) $2,000 or more

Data for Question 9

Actuarial cost method: Frozen initial liability.

Assumed interest rate: 6%.

Selected valuation results:

	1/1/87	1/1/88
Normal cost as of 1/1	$ 25,000	$ -
Present value of future benefits	500,000	565,000
Present value of future normal costs	210,000	-
Actuarial value of assets	80,000	-

Contributions for 1987: $25,000 paid on 6/30/87 and $20,000 paid on 12/31/87.

Benefit payments for 1987: $0.

The rate of return on the actuarial value of assets during 1987 was 8.4%.

Question 9

In what range is the present value of future normal costs as of 1/1/88?

(A) Less than $195,000

(B) $195,000 but less than $205,000

(C) $205,000 but less than $215,000

(D) $215,000 but less than $225,000

(E) $225,000 or more

Data for Question 10

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

Early retirement benefit: Normal retirement benefit reduced by 6% for each year by which commencement of retirement payments precedes age 65.

Actuarial cost method: Aggregate.

Actuarial assumptions:

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

Participant data as of 1/1/88:

	Smith	Brown
Date of birth	1/1/33	1/1/26
Date of hire	1/1/58	1/1/51
Status	Active	Active

Actuarial value of assets as of 1/1/88: $15,000.

Selected commutation functions and annuity values:

x	D_x	$N_x - N_{65}$	$\ddot{a}_x^{(12)}$
55	367	2,730	11.74
62	224	623	10.10
65	178	0	9.35

After the 1/1/88 valuation was completed, it was found that Brown retired on 12/31/87.

Question 10

In what range is the change in the normal cost for 1988 as of 1/1/88 due to Brown's retirement?

(A) Less than $(2,400)

(B) $(2,400) but less than $(1,200)

(C) $(1,200) but less than $0

(D) $0 but less than $1,200

(E) $1,200 or more

Data for Question 11

Actuarial cost method: Entry age normal.

Assumed interest rate: 6%.

Data for participant Smith:

Date of birth	1/1/18
Date of retirement	1/1/83
Date of death	12/31/87
Retirement benefit:	$1,000 per month, payable as a life annuity with ten years certain.

Selected commutation functions:

x	D_x	$N_x^{(12)}$
65	1,886	17,624
69	1,344	11,179
70	1,227	9,889
75	743	5,006

Selected annuity values:

$\ddot{a}^{(12)}_{\overline{5}|.06} = 4.348$ $\quad \ddot{a}^{(12)}_{\overline{6}|.06} = 5.076$ $\quad \ddot{a}^{(12)}_{\overline{10}|.06} = 7.597$

Question 11

In what range is the experience gain recognized as of 1/1/88 due to Smith's death?

(A) Less than $39,000

(B) $39,000 but less than $42,000

(C) $42,000 but less than $45,000

(D) $45,000 but less than $48,000

(E) $48,000 or more

Data for Question 12

Plan effective date: 1/1/87.

Normal retirement benefit: $15 per month for each year of service up to 20 years plus $20 per month for each subsequent year of service.

Death benefit: None.

Actuarial cost method: Attained age normal.

Actuarial assumptions:

Interest: 6%.
Preretirement deaths and terminations: None.
Retirement age: 65.

Participant data as of 1/1/87:

	Smith	Brown
Date of birth	1/1/37	1/1/27
Date of hire	1/1/62	1/1/72

Brown dies on 12/31/87. There were no new participants during 1987.

Contribution for 1987: Normal cost as of 1/1 plus $3,000 paid on 1/1/87.

Selected annuity value:

$$12\ddot{a}_{65}^{(12)} = 112$$

Question 12

In what range is the unfunded liability as of 1/1/88?

(A) Less than $36,500

(B) $36,500 but less than $37,000

(C) $37,000 but less than $37,500

(D) $37,500 but less than $38,000

(E) $38,000 or more

Data for Question 13

Plan effective date: 1/1/88.

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

Actuarial cost method: Entry age normal (aggregate basis).

Actuarial assumptions:

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

Participant data as of 1/1/88:

	Smith	Brown
Date of birth	1/1/53	1/1/43
Date of hire	1/1/78	1/1/78

Selected commutation functions and annuity values:

x	D_x	$\ddot{a}_{x:\overline{65-x}\rceil}$
25	2,441	15.62
35	1,348	14.22
45	737	11.84
55	389	7.92
65	189	0.00

$\ddot{a}_{65}^{(12)} = 9.35$

Question 13

In what range is the accrued liability as of 1/1/88?

(A) Less than $6,600

(B) $6,600 but less than $7,200

(C) $7,200 but less than $7,800

(D) $7,800 but less than $8,400

(E) $8,400 or more

Data for Question 14

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

Actuarial cost method: Unit credit.

Actuarial assumptions:

Interest: 6%.
Preretirement terminations other than deaths: None.
Retirement age: 65.

Participant data as of 1/1/88: 1,000 active participants, all born on 1/1/43 and hired on 1/1/81.

During 1988, 12 participants died and there were no new participants.

Selected commutation functions:

x	D_x
44	322
45	303
46	283
65	77

Selected annuity value:

$$\ddot{a}_{65}^{(12)} = 9.35$$

Question 14

In what range is the mortality gain for 1988 as of 1/1/89?

(A) Less than $4,200

(B) $4,200 but less than $4,400

(C) $4,400 but less than $4,600

(D) $4,600 but less than $4,800

(E) $4,800 or more

Data for Question 15

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

Actuarial cost method: Frozen initial liability.

Actuarial assumptions:

Interest: 6%.
Compensation increases: 4% per year.
Preretirement deaths and terminations: None.
Retirement age: 65.

Valuation results as of 1/1/87:

Normal cost as of 1/1	$ 84,000
Present value of future benefits	
Active participants	2,000,000
Inactive participants	0
Unfunded liability	500,000
Actuarial value of assets	100,000
Present value of future compensation	10,000,000
Annual compensation	600,000

Contribution for 1987: $150,000 paid on 1/1/88.

All participants on 1/1/87 were under age 60.

There were no new participants during 1987.

Each participant received a 7.5% compensation increase on 1/1/88. There were no experience gains or losses during 1987 from any other source.

Question 15

In what range is the normal cost for 1988 as of 1/1/88?

(A) Less than $90,000

(B) $90,000 but less than $92,000

(C) $92,000 but less than $94,000

(D) $94,000 but less than $96,000

(E) $96,000 or more

Data for Question 16

Actuarial cost method:

Before 1987: Unit credit.
After 1986: Frozen initial liability.

Assumed interest rate: 6%.

Assumed compensation increases: 5% per year.

Selected valuation results:

	1/1/87	1/1/88
Present value of future benefits	$ 11,000,000	$ 12,000,000
Actuarial value of assets	3,000,000	4,000,000
Present value of future compensation	112,500,000	115,000,000
Annual compensation	16,500,000	-
Accrued liability under unit credit method	4,325,000	5,000,000
Accrued liability under entry age normal method	6,500,000	7,600,000

Contribution for 1987: $1,000,000 paid on 12/31/87.

Question 16

In what range is the normal cost rate (as a percentage of compensation) for 1988 as of 1/1/88?

(A) Less than 3.970%

(B) 3.970% but less than 3.980%

(C) 3.980% but less than 3.990%

(D) 3.990% but less than 4.000%

(E) 4.000% or more

Data for Question 17

Plan effective date: 1/1/87.

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

Actuarial cost method: Attained age normal.

Actuarial assumptions:

Interest: 6%.
Preretirement deaths and terminations: None.
Retirement age: 65.

Participant data as of 1/1/88:

	Smith	Brown
Date of birth	1/1/43	1/1/53
Date of hire	1/1/73	1/1/88

There were no deaths or terminations during 1987.

Contribution for 1987: $1,000 paid on 12/31/87.

Selected annuity value:

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

Question 17

In what range is the unfunded liability as of 1/1/88?

(A) Less than $4,800

(B) $4,800 but less than $5,600

(C) $5,600 but less than $6,400

(D) $6,400 but less than $7,200

(E) $7,200 or more

Data for Question 18

Normal retirement benefit: $12,000 per year payable annually on 1/1.

Spouse's death benefit: $6,000 per year payable annually commencing on the 1/1 following the participant's death.

Assumed interest rate: 6%.

Data for sole participant Smith:

Date of birth	1/1/22
Date of retirement	1/1/85
Spouse's date of birth	1/1/27

Smith's spouse died on 7/1/87.

Selected unisex values:

$\ddot{a}_{60} = 10.15$	$\ddot{a}_{65} = 8.95$	$\ddot{a}_{60:65} = 8.05$
$\ddot{a}_{61} = 9.80$	$\ddot{a}_{66} = 8.60$	$\ddot{a}_{61:66} = 7.70$
$p_{60} = .99$	$p_{65} = .98$	

Question 18

In what range is the mortality gain for 1987 recognized as of 1/1/88?

(A) Less than $10,000

(B) $10,000 but less than $11,500

(C) $11,500 but less than $13,000

(D) $13,000 but less than $14,500

(E) $14,500 or more

Data for Question 19

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

Early retirement benefit:

Before 1988: Accrued benefit reduced by 6% for each year preceding age 65.

After 1987: Unreduced accrued benefit, plus a monthly supplement payable to 65 of $6.67 per month for each year of service.

Actuarial cost method: Projected unit credit.

Actuarial assumptions:

Interest: 8%.
Preretirement terminations other than deaths: None.
Retirement age:
Before 1988: 65.
After 1987: 60.

Data for sole participant as of 1/1/88:

Date of birth 1/1/38
Date of hire 1/1/68

Selected commutation functions:

x	D_x	$N_x^{(12)}$
50	202	2,162
55	133	1,330
60	86	787
65	54	440

Question 19

In what range is the combined increase in the accrued liability as of 1/1/88 due to the plan amendment and the assumption change?

(A) Less than $9,250

(B) $9,250 but less than $10,750

(C) $10,750 but less than $12,250

(D) $12,250 but less than $13,750

(E) $13,750 or more

Data for Question 20

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

Actuarial cost method: Unit credit.

Actuarial assumptions:

Interest: 6%.
Preretirement terminations other than deaths: None.
Retirement age: 65.

Participants as of 1/1/87: 100 active employees, all age 60.

Normal cost for 1987 as of 1/1/87: $100,000.

There were no experience gains or losses during 1987.

There were no new participants during 1987.

Selected mortality value:

$q_{60} = .04$

Question 20

In what range is the normal cost for 1988 as of 1/1/88?

(A) Less than $95,000

(B) $95,000 but less than $100,000

(C) $100,000 but less than $105,000

(D) $105,000 but less than $110,000

(E) $110,000 or more

ANSWER KEY

May 1988 Part 7P(US) (EA1)

Segment A		Segment B	
1.	B	1.	B
2.	A	2.	D
3.	D	3.	C
4.	C	4.	B
5.	E	5.	B
6.	C	6.	D
7.	D	7.	C
8.	D	8.	B
9.	A	9.	E
10.	B	10.	A
11.	B	11.	D
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13.	B	13.	C
14.	D	14.	E
15.	D	15.	B
16.	D	16.	D
17.	C	17.	B
18.	C	18.	B
19.	C	19.	C
20.	B	20.	D
21.	C		
22.	D		
23.	C		
24.	E		
25.	E		