Society of Actuaries Course 8P Fall 2003

BEGINNING OF EXAMINATION 8
PENSION FUNDING MATHEMATICS SEGMENT

1. *(5 points)* You are the actuary for a company that sponsors a non-contributory, defined benefit pension plan established on January 1, 2003. You are given:

Plan Provisions

Normal Retirement Benefit:	\$45 per month per year of service to a maximum of 30 years
Normal form of payment:	Life only, payable monthly in advance
Normal Retirement Age:	Age 65
Early retirement reduction:	4% per year for benefit commencement prior to age 65
Other ancillary benefits:	None

Actuarial Assumptions and Methods

Interest rate:	7% per annum
Retirement age:	Age 65
Pre-retirement decrements:	None
Actuarial cost method:	Individual level premium (level dollar)

$\ddot{a}_{63}^{(12)} = 10.0$

$\ddot{a}_{65}^{(12)} = 9.0$

Participant Data as of January 1, 2003

Employee	Age	Service	Normal Cost
Giles	62	22	\$35,320
Faith	43	13	\$2,780

The company contributes the normal cost on January 1, 2003. The fund earns 6% during 2003. Giles retires and commences his retirement benefit on December 31, 2003. On January 1, 2004, the Normal Retirement Benefit is changed to \$50 per month per year of service to a maximum of 35 years.

Determine the January 1, 2004, company contribution of normal cost plus a five-year amortization of any unfunded accrued liability.

Show all work.

2. *(4 points)* You are the actuary for a company that sponsors a non-contributory, defined benefit pension plan.

You are given:

Plan Provisions

Normal Retirement Benefit:	\$50 per month per year of service to a maximum of 30 years
Normal form of payment:	Life only, payable monthly in advance
Optional form of payment:	Actuarially equivalent 50% joint and survivor "pop-up" annuity, where • a reduced amount X is paid while both member and spouse are alive • 50% of the reduced amount X is paid while only the spouse is alive • the original amount calculated under the Normal Retirement Benefit formula is paid while only the member is alive
Normal Retirement Age:	Age 65
Early retirement reduction:	Actuarial equivalence
Other ancillary benefits:	None
Actuarial equivalence:	Based on valuation assumptions

Actuarial Assumptions and Methods

Interest rate:	6% per annum
Retirement age:	Age 65
Pre-retirement decrements:	None
Actuarial cost method:	Unit Credit

Factors Based on Post-Retirement Assumptions

Member	Spouse	Member: Spouse
$\ddot{a}_{57}^{(12)} = 11.9558$	$\ddot{a}_{57}^{(12)} = 13.2893$	$\ddot{a}_{62:57}^{(12)} = 10.0844$
$\ddot{a}_{62}^{(12)} = 10.7330$	$\ddot{a}_{60}^{(12)} = 12.6869$	$\ddot{a}_{65:60}^{(12)} = 9.2251$
$\ddot{a}_{65}^{(12)} = 9.9166$	$\ddot{a}_{62}^{(12)} = 12.2459$	
${}_8p_{57} = .9229$		
${}_3p_{62} = .9631$		

2. Continued

The following member retires on January 1, 2003:

	Data as of January 1, 2003
Member's age:	62
Spouse's age:	57
Years of Service:	35

(a) Calculate the experience gain or loss on January 1, 2003, caused by the retirement of the member under the normal form of payment.

(b) Briefly explain why there is a gain or loss even though the early retirement benefit is determined on an actuarially equivalent basis.

(c) Calculate the member's annual pension (while both member and spouse are alive) under the optional form of payment.

Show all work.

3. *(7 points)* You are the new actuary for a non-contributory, defined benefit pension plan.

You are given the prior actuary's results for 2002 as follows:

Plan Provisions

Normal Retirement Benefit:	2% of final year's earnings times years of service
Normal form of payment:	Life only, payable monthly in advance
Normal Retirement Age:	Age 65
Early retirement eligibility:	Age 55
Early retirement reduction:	3% per year for benefit commencement prior to age 65
Termination benefit:	Accrued pension, deferred to age 65
Other ancillary benefits:	None

Actuarial Assumptions and Methods

Interest rate:	7% per annum
Retirement age:	Age 60
Salary increases:	4% per annum
Termination rates:	5% per year at the end of each of the first five years of service, 0% thereafter
Other pre-retirement decrements:	None
Actuarial cost method:	Projected Unit Credit
Asset method:	Market value of assets

$\ddot{a}_{58}^{(12)} = 10.36$

$\ddot{a}_{60}^{(12)} = 10.11$

$\ddot{a}_{65}^{(12)} = 9.22$

3. **Continued**

Valuation Results as of January 1, 2002

	Employee X	Employee Y	Employee Z
Participant status:	Active	Active	Active
Accrued liability:	$50,000	$5,000	$100,000
Normal cost:	$5,000	$1,250	$8,333
Age:	45	35	57
Years of service:	10	4	12
Earnings:	Not available	Not available	Not available

You are also given the following 2002 experience:

- Employee Y terminated on December 31, 2002.
- Employee Z retired and commenced benefits on January 1, 2003.
- Salaries increased by 6% as of January 1, 2003.
- Plan assets returned 0% during 2002.

The company's funding policy is to contribute the normal cost plus a five-year amortization of any unfunded accrued liability as of the beginning of the year, interest-adjusted using the valuation interest rate to the date of actual payment.

The market value of plan assets as of January 1, 2002, was $150,000 before the 2002 employer contribution. The company contributed the 2002 funding policy contribution on July 1, 2002.

(a) Derive the earnings used for the January 1, 2002 valuation.

(b) Calculate the funding policy contribution for 2003 as of January 1, 2003.

(c) Calculate the gains and losses by source for 2002.

Show all work.

4. *(3 points)* You are the actuary for a company that sponsors a non-contributory, defined benefit pension plan established on January 1, 2003. You are given:

Plan Provisions

Normal Retirement Benefit:	2% of final year's earnings times years of service
Normal form of payment:	Life only, payable monthly in advance
Normal Retirement Age:	Age 60

Actuarial Assumptions and Methods

Interest rate:	6% per annum
Retirement age:	Age 60
Salary increases:	4% per annum
Pre-retirement decrements:	None
Actuarial cost method:	Aggregate

$\ddot{a}_{60}^{(12)} = 12.7$

Participant Data as of January 1, 2003

Age:	40
Years of service:	0
2003 earnings:	$100,000

(a) Calculate the January 1, 2003, employer Normal Cost.

(b) On December 31, 2003, the company makes its first contribution to the plan in the amount of $20,000 and the member receives a salary increase of 10%. Calculate the January 1, 2004, employer Normal Cost.

Show all work.

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5. *(7 points)* You are the actuary for a company that sponsors a non-contributory, defined benefit pension plan established on January 1, 2002. You are given:

Plan Provisions

Normal Retirement Benefit:	\$50 per month per year of service
Normal form of payment:	10 year certain and life thereafter, payable monthly in advance
Normal Retirement Age:	Age 60
Ancillary benefits:	None

Actuarial Assumptions and Methods

Interest rate:	7% per annum
Retirement age:	Age 60
Pre-retirement decrements:	None
Actuarial cost method:	Entry age normal (level dollar)
Asset method:	Market value of assets

x	$\ddot{a}_x^{(12)}$	${}_{10}p_x$
60	11.0	0.91
70	9.0	0.88

Data as of January 1, 2003 for sole participant

Age:	45
Years of service:	15

Financial Information

Company contribution made on July 1, 2002:	\$7,000
Market value of assets at January 1, 2003:	\$7,500

5. Continued

The company's funding policy is to contribute an amount equal to the Normal Cost plus a 10-year amortization of any unfunded accrued liability.

(a) Determine the funding policy contribution for 2003 as of January 1, 2003.

(b) Determine the Normal Retirement Benefit dollar multiplier such that the 2003 funding policy contribution would remain the same if given the following:

- the actuarial cost method is changed to Attained Age Normal retroactive to the date the plan was established, and
- the 2003 funding policy is changed to be the Normal Cost plus a 15-year amortization of any unfunded accrued liability.

Show all work.

6. *(4 points)* You are the actuary for a company that sponsors a non-contributory, defined benefit pension plan.

You are given:

Plan Provisions

Normal Retirement Benefit:	1.5% of final year's earnings times years of service
Normal form of payment:	Life only, payable monthly in advance
Normal Retirement Age:	Age 65

Actuarial Assumptions and Methods

Interest rate:	6% per annum
Salary increase:	3% per annum
Retirement age:	Age 65
Pre-retirement decrements:	None
Actuarial cost method:	Entry Age Normal (level % of earnings)

$\ddot{a}_{65}^{(12)} = 9.9166$

Participant Data as of January 1, 2003

Age:	37
Years of service:	10
2003 earnings:	Not available
Present value of future benefits:	$150,000

(a) Determine the accrued liability as of January 1, 2003.

(b) Determine the normal cost as of January 1, 2003.

Show all work.

****END OF EXAMINATION****