BEGINNING OF EXAMINATION 8
PENSION FUNDING MATHEMATICS SEGMENT

1. (*6 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 20 years
Normal Retirement Age:	Age 65
Normal form of payment:	Life only, payable monthly in advance
Optional form of payment:	Actuarially equivalent 50% joint & survivor annuity

Actuarial Assumptions and Methods

Interest rate:	7.0% per annum
Assumed retirement age:	Age 65
Pre-retirement decrements:	None
Actuarial cost method:	Aggregate
Asset method:	Market value of assets

$\ddot{a}_{65}^{(12)} = 10.1$

$\ddot{a}_{65:65}^{(12)} = 8.5$

$\ddot{a}_{70}^{(12)} = 8.9$

$\ddot{a}_{70:70}^{(12)} = 7.2$

$\ddot{a}_{71}^{(12)} = 8.7$

Participant Information as of January 1, 2004

Participant	Hire Age	Age as of January 1, 2004	Spouse Age as of January 1, 2004	Retirement Age	Benefit Form
A	30	50	N/A	N/A	Still active
B	50	70	70	65	50% joint & survivor

1. **Continued**

Financial Information

Asset Value at January 1, 2004:	$80,000
Contribution made on July 1, 2004:	Normal Cost as of January 1, 2004
Return on fund during 2004:	$0

(a) Determine the Normal Cost as of January 1, 2004.

(b) Participant B dies on June 14, 2004. Determine the Normal Cost as of January 1, 2005.

Show all work.

2. (*7 points*) You are the actuary for a company that sponsors a non-contributory, defined benefit pension plan established on January 1, 2005. You are given:

Plan Provisions

Normal Retirement Benefit:	3% of final year's salary times years of service from date of hire
Normal Retirement Age:	Age 65
Normal form of payment:	Life only, payable monthly in advance
Ancillary benefits:	None

Actuarial Assumptions and Methods

Interest rate:	7% per annum
Retirement age:	Age 65
Salary Scale:	5% per annum
Pre-retirement decrements:	None
Actuarial cost method:	Entry Age Normal
Asset method:	Market value of assets

$\ddot{a}_{65}^{(12)} = 9.6$

Participant Data as of January 1, 2005

	Age	Years of Service	2004 Salary
Participant X	50	10	$150,000

The company's funding policy is to contribute the normal cost as of the beginning of the year plus a ten-year amortization of the initial accrued liability plus a five-year amortization of any subsequent actuarial gains or losses.

(a) Calculate the accrued liability and normal cost as of January 1, 2005.

(b) Participant X receives a 10% salary increase effective January 1, 2005. The 2005 funding policy contribution is made on January 1, 2005 and the fund earns 15% during 2005. Calculate the 2006 funding policy contribution that will be made on January 1, 2006.

Show all work.

3. (*6 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:	\$20 per month per year of service to a maximum of 30 years
Normal form of payment:	Ten year certain and life, payable monthly in advance
Normal Retirement Age:	Age 65
Other forms of payment:	None

Actuarial Assumptions and Methods

Interest rate:	7% per annum
Retirement age:	Age 65
Pre-retirement decrements:	None
Actuarial cost method:	Individual aggregate
Asset method:	Market value of assets

$\ddot{a}_{75}^{(12)} = 7.5$

${}_5p_{70} = 0.89$

${}_{10}p_{65} = 0.83$

Participant Data as of January 1, 2005

	Alvin	Simon	Theodore
Age	30	55	70
Years of Service	5	32	35
Age at retirement	N/A	N/A	65
Status	Active	Active	Retired

For valuation purposes, assets are first allocated to inactive participants in an amount equal to their accrued liability. Remaining assets are allocated to all active participants in proportion to their accrued liability plus normal cost, as determined under the unit credit cost method.

The market value of plan assets as of January 1, 2005 is \$100,000.

Calculate the January 1, 2005 employer normal cost.

Show all work.

4. (*5 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% of final year's salary times years of service from date of hire
Normal form of payment:	Five year certain and life, payable monthly in advance
Optional form of payment:	Actuarially equivalent 60% joint and survivor "pop-up" annuity, where • a reduced amount X is paid while both member and spouse are alive • 60% 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:	3% per year that retirement precedes age 65
Other ancillary benefits:	None

Actuarial Assumptions and Methods

Interest rate:	6% per annum
Salary increases:	3% per annum
Retirement age:	Age 62
Pre-retirement decrements:	None
Actuarial cost method:	Projected Unit Credit

Factors Based on Post-Retirement Assumptions

Member	Spouse	Member: Spouse
$\ddot{a}_{67}^{(12)} = 10.2489$	$\ddot{a}_{57}^{(12)} = 13.3128$	$\ddot{a}_{60:57}^{(12)} = 11.0728$
$\ddot{a}_{65}^{(12)} = 10.7670$	$\ddot{a}_{60}^{(12)} = 12.7081$	$\ddot{a}_{65:62}^{(12)} = 9.7050$
$\ddot{a}_{60}^{(12)} = 11.9995$	$\ddot{a}_{62}^{(12)} = 12.2743$	
${}_5p_{60} = 0.9600$		
${}_5p_{62} = 0.9487$		

4. Continued

The following member retires on January 1, 2005

	Data as of January 1, 2005
Member's age:	60
Spouse's age:	57
Years of Service:	22
2004 Salary:	$80,000

(a) Calculate the experience gain or loss on January 1, 2005, caused by the retirement of the member under the normal form of payment.

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

Show all work.

5. (*6 points*) You are the actuary for a company that sponsors a non-contributory defined benefit pension plan. You are given:

Plan Provisions

Retirement benefit:	2% of career average earnings
Normal form of payment:	Life only, payable monthly in advance
Normal Retirement Age:	Age 65
Optional form of payment:	Lump sum

Actuarial Assumptions and Method

Interest rate:	6% per annum
Retirement age:	Age 65
Salary increases:	4% per annum
Pre-retirement decrements:	None
Actuarial cost method:	Projected Unit Credit

$\ddot{a}_{65}^{(12)} = 11.2$

Employee	Age	Years of Service	Accrued Benefit	2005 Earnings
A	45	15	$12,000	$50,000
B	60	30	$15,000	$50,000

As of January 1, 2005, the unfunded accrued liability equals $10,000. On January 1, 2005, a contribution equal to the January 1, 2005 normal cost is made. The fund earns 5% during 2005. On December 31, 2005, employee A terminates and receives a lump sum payment of $62,000.

(a) Calculate the unfunded accrued liability at January 1, 2006.

(b) Calculate the gains and losses by source for 2005.

Show all work.

****END OF EXAMINATION****