BEGINNING OF EXAMINATION 8
PENSION FUNDING MATHEMATICS SEGMENT

1. (*7 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:	2% of final year's salary 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
Salary increases:	4% per annum
Retirement age:	Age 60
Pre-retirement decrements:	None
Actuarial cost method:	Entry Age Normal (level % of salary)
Asset method:	Market value of assets

$\ddot{a}_{60}^{(12)} = 12.0$

Participant Data as of December 31, 2004

Employee	Age	Years of Service	2005 Salary
A	42	14	$50,000
B	59	24	$80,000

Active Participant Data as of December 31, 2005

Employee	Age	Years of Service	2006 Salary
A	43	15	$70,000

Retired Participant Data as of December 31, 2005

Employee	Age	Annual Pension
B	60	$40,000

1. **Continued**

Financial Information

Market value of assets at December 31, 2004: $525,000
Contribution made on January 1, 2005: $25,000

(a) Calculate the unfunded accrued liability and normal cost at January 1, 2005.

(b) On December 31, 2005 employee B retires. Assuming the fund earns an annual return of 4% for 2005, calculate the unfunded accrued liability and normal cost at January 1, 2006.

(c) Reconcile the change in the unfunded accrued liability from January 1, 2005 to January 1, 2006.

Show all work.

2. (*7 points*) You are the actuary for a company that sponsors a non-contributory, defined benefit pension plan for its union employees. In 2006, the company and its union representatives reached a deal that would improve certain benefits under the pension plan. You are given:

Plan Provisions

	Before Negotiations	After Negotiations
Normal Retirement Benefit	\$50 per month per year of service	Effective January 1, 2006: \$54 per month per year of service Effective January 1, 2007: \$57 per month per year of service Effective January 1, 2008: \$60 per month per year of service
Normal form of payment	Life only, payable monthly in advance	Life only, payable monthly in advance
Normal Retirement Age	Age 65	Age 65
Earliest retirement age	Age 55	Age 55
Early retirement bridge benefit	None	\$10 per month per year of service, payable to earlier of death and age 65
Early retirement reduction	Actuarial equivalence	4% per year that retirement precedes age 62, applied to both normal and bridge benefits
Other ancillary benefits	None	None

Actuarial Assumptions and Method

	Before Negotiations	After Negotiations
Interest rate	6.5% per annum	6.5% per annum
Retirement rates	100% at age 65	25% at age 55, otherwise 100% at age 62
Pre-retirement decrements	None	None
Actuarial cost method	Projected Unit Credit (pro-rated on service)	Projected Unit Credit (pro-rated on service)

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

$\ddot{a}_{62}^{(12)} = 10.3$

$\ddot{a}_{\overline{62:3}|}^{(12)} = 2.7$

$\ddot{a}_{\overline{55:10}|}^{(12)} = 7.2$

$\ddot{a}_{55}^{(12)} = 11.8$

2. Continued

Participant Data as of January 1, 2006

Age:	54
Years of service:	25

(a) Determine the increase in the accrued liability and normal cost as at January 1, 2006 as the combined result of the negotiated benefit improvements and assumption changes.

(b) The participant decides to retire on January 1, 2007. Calculate the experience gain or loss caused by the retirement of this member.

Show all work.

3. (*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:	1.75% of final year's salary times years of service
Normal form of payment:	Life only, payable monthly in advance
Normal Retirement Age:	Age 65

Actuarial Assumptions and Method

Interest rate:	7.00% per annum
Salary increases:	4.00% per annum
Retirement age:	Age 65
Pre-retirement decrements:	None
Actuarial cost method:	Aggregate
Asset method:	Market value of assets
$\ddot{a}_{65}^{(12)} =$	10

Financial Information

Market value of assets at January 1, 2006: $300,000

Participant Data as of January 1, 2006

	Age	Years of Service	2006 Salary
Participant A	55	20	$120,000
Participant B	30	5	$30,000

(a) Determine the normal cost as of January 1, 2006.

(b) Calculate the January 1, 2006 normal cost under the Individual Aggregate method assuming that assets for active participants are allocated in proportion to the present value of their future benefits.

Show all work.

4. (*5 points*) You are the actuary for a company that sponsors a non-contributory, defined benefit pension plan established on January 1, 2006. You are given:

Plan Provisions

Normal Retirement Benefit:	1.5% of final year's salary times years of service from date of entry
Waiting period to join plan:	3 years from date of hire
Normal form of payment:	Life only, payable monthly in advance
Optional forms of payment:	Actuarial equivalent of normal form
Normal Retirement Age:	Age 65
Earliest retirement age:	Age 55
Early retirement reductions:	4% per year that retirement precedes age 65
Other ancillary benefits:	None

Actuarial Assumptions and Methods

Interest rate:	6.0% per annum
Salary increases:	4.0% per annum
Retirement age:	Age 60
Pre-retirement decrements:	None
Actuarial cost method:	Projected Unit Credit (pro-rated on service)
Asset method:	Market value of assets

Annuity factors

Male Factors	Female Factors	Joint Factors (Male:Female)
$\ddot{a}_{65}^{(12)} = 10.1$	$\ddot{a}_{62}^{(12)} = 12.0$	$\ddot{a}_{65:62}^{(12)} = 9.1$
$\ddot{a}_{60}^{(12)} = 11.4$	$\ddot{a}_{60}^{(12)} = 12.5$	$\ddot{a}_{62:60}^{(12)} = 9.9$
$\ddot{a}_{57}^{(12)} = 12.1$	$\ddot{a}_{57}^{(12)} = 13.1$	$\ddot{a}_{57:55}^{(12)} = 11.2$
$\ddot{a}_{55}^{(12)} = 12.6$	$\ddot{a}_{55}^{(12)} = 13.5$	

Participant Data as of January 1, 2006

Employee	2006 Salary	Age	Spouse Age	Date of Hire	Gender
Rick	$50,000	57	55	January 1, 1983	M

4. Continued

On January 1, 2006, the market value of assets is $117,500. The company's funding policy is to contribute the Normal Cost each year, plus, if the ratio of assets to accrued liabilities (the "funded ratio") falls below 95%, the company will remit an additional contribution at the beginning of the year to bring the plan to a 100% funded ratio.

(a) Determine the annual pension payable to Rick if he was to retire effective January 1, 2006 and elect to receive his pension as a joint and survivor pension with 75% continuing to his female spouse on his death.

(b) Determine the difference in the 2006 company contribution assuming:
   (i) Rick retires (as described in (a) above); and
   (ii) Rick does not retire and continues to accrue service in 2006.

Show all work.

5. (*6 points*) You are the actuary for a company that sponsors a non-contributory, defined benefit pension plan established on January 1, 2006. You are given:

Plan Provisions

Normal Retirement Benefit:	\$50 per month per year 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
Pre-retirement decrements:	None
Actuarial cost method:	Frozen Initial Liability
Asset method:	Market value of assets
Amortization of unfunded actuarial liability:	15 years

$\ddot{a}_{60}^{(12)} = 12.0$

Financial Information

There are no assets in the plan at January 1, 2006.

Contributions equal to the normal cost plus the amortization are made at the beginning of each year.

Participant Data as of January 1, 2006

Employee	Age	Years of Service
J	30	10
K	40	20

(a) Calculate the contribution at January 1, 2006.

(b) Assuming that the client makes the contribution in (a) and the fund earned a return of 15% during 2006 and all other assumptions were realized during 2006, determine the contribution at January 1, 2007.

Show all work.