November, 2001- Course 8P
Society of Actuaries

****BEGINNING OF EXAMINATION****

1. (*8 points)* A new Company has established a contributory pension plan on January 1, 2001. You are given:

Plan Provisions

Retirement benefit:	The greater of: (i) 2% of career average earnings, or (ii) actuarial equivalent of 200% of employee contributions accumulated at the fund rate of return
Normal form of payment:	5 years certain and life thereafter, payable monthly in advance
Normal retirement age:	65
Employee contributions:	4% of annual earnings, payable at the beginning of the year
Termination or death benefit:	Lump sum payment of 200% of employee contributions accumulated at the fund rate of return
Actuarial equivalence:	At valuation assumptions

Actuarial Assumptions and Methods

Interest rate:	6.5% per annum	
Retirement age:	65	
Salary increases:	4.0% per annum	
Termination rates:	Attained Age	Year-end rates
	Up to 34	10%
	35 and over	0%
Other pre-retirement decrements:	None	
Actuarial cost method:	Unit Credit	
Actuarial value of assets:	Market value	

$\ddot{a}^{(12)}_{\overline{65:5}|} = 10.4$

1. (CONTINUED)

Participant Data

	Group J	Group K
Number of employees	30	30
Age at 1/1/2001	30	50
2001 earnings per employee	$40,000	$60,000

(a) Calculate the employer normal cost for 2001.

(b) The employer contributes the employer normal cost on January 1, 2001. The fund earns 8% during 2001. At December 31, 2001, 6 employees in Group J terminate and 1 Group K employee dies.

Determine the plan's assets and accrued liability at January 1, 2002.

(c) Calculate the gains and losses by source for 2001.

Show all work.

2. (*4 points)* The CEO of ABC Company will receive a pension on retirement at age 65.

You are given the following as at January 1, 2001:

CEO's Age:	50
CEO's Service:	10 years
CEO's Salary:	$300,000 per annum
Pension Benefit:	2% of final year's salary times years of service
Form of Payment:	Life only, payable monthly in advance

The pension is paid from a basic plan and a supplemental executive plan. The maximum annual pension payable under the Basic Plan is $2,000 times years of service. The remainder is paid from the Supplemental Plan. ABC pre-funds the CEO's entire pension.

Actuarial Assumptions and Method

	Basic Plan	Supplemental Plan
Interest rate:	8% per annum	6% per annum
Salary scale:	5% per annum	5% per annum
Normal retirement age:	65	65
Pre-retirement decrements:	None	None
Actuarial Cost Method:	Projected Unit Credit (prorated on service)	Entry Age Normal (level % of pay)
$\ddot{a}_{65}^{(12)}$	9.0	11.0

(a) Calculate the normal cost for the Basic Plan at January 1, 2001.

(b) Calculate the normal cost for the Supplemental Plan at January 1, 2001.

Show all work.

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3. *(8 points)* You are the actuary for a company that sponsors a non-contributory defined benefit pension plan.

You are given:

Plan Provisions

Retirement benefit:	$20 per month, per year of service
Normal form of pension:	Life only, payable monthly in advance
Normal retirement age:	60
Early retirement reduction:	5% per year that retirement precedes age 60
Other ancillary benefits:	None

Actuarial Assumptions and Method

Interest rate:	7.0% per annum
Retirement rates:	10% per annum, at the beginning of each year, from age 57 through 59; 100% at age 60
Pre-retirement decrements:	None
Actuarial cost method:	Unit Credit

$\ddot{a}_{57}^{(12)} = 10.0$
$\ddot{a}_{58}^{(12)} = 9.0$
$\ddot{a}_{59}^{(12)} = 8.0$
$\ddot{a}_{60}^{(12)} = 7.0$

Financial Information

Assets at January 1, 2001:	$100,000
2001 employer contribution:	None
Fund rate of return in 2001:	2%

Participant Data as at January 1, 2001

Member	Age	Service
Jean	57	25
Kelly	58	29

3. (CONTINUED)

(a) Calculate the unfunded accrued liability and normal cost as at January 1, 2001.

(b) On December 31, 2001, Kelly retires. On December 31, 2001, Pat transfers into the plan at age 45 and $10,000 is transferred to recognize 10 years of Pat's prior service.

Calculate the unfunded accrued liability as at January 1, 2002.

(c) Calculate the gains and losses by source for 2001.

Show all work.

4. *(4 points)* You are the actuary for a company that sponsors a defined benefit pension plan.

You are given:

Plan Provisions

Retirement benefit:	\$30 per month, per year of service
Normal form of payment:	Five years certain and life thereafter, payable monthly in advance
Optional form of payment:	Actuarially equivalent 75% joint and survivor annuity
Normal retirement age:	65
Early retirement reduction:	Actuarial equivalence
Other ancillary benefits:	None
Actuarial equivalence:	Based on valuation assumptions

Actuarial Assumptions and Method

Interest rate:	7.0% per annum
Retirement age:	65
Pre-retirement decrements:	None
Actuarial cost method:	Entry Age Normal

Member	Spouse	Member: Spouse
$\ddot{a}_{60}^{(12)} = 10.8387$	$\ddot{a}_{57}^{(12)} = 12.5296$	$\ddot{a}_{60:57}^{(12)} = 9.7460$
$\ddot{a}_{65}^{(12)} = 9.7004$	$\ddot{a}_{62}^{(12)} = 11.6834$	$\ddot{a}_{65:62}^{(12)} = 8.5126$
$\ddot{a}_{70}^{(12)} = 8.4642$	$\ddot{a}_{67}^{(12)} = 10.6379$	$\ddot{a}_{70:67}^{(12)} = 7.1863$
${}_5p_{60} = 0.9446$		
${}_5p_{65} = 0.9039$		

The following member retires on January 1, 2001:

	Data as at January 1, 2001
Member's age:	60
Spouse's age:	57
Years of service:	35

4. (CONTINUED)

(a) Calculate the experience gain or loss on January 1, 2001 caused by the retirement of the member.

(b) Calculate the member's pension under the optional form of payment.

Show all work.

5. *(6 points)* Your client sponsors a non-contributory defined benefit pension plan.

You are given:

Plan Provisions

Retirement benefit:	1.5% of career average earnings
Normal form of payment:	Life only, payable monthly in advance
Normal retirement age:	65
Earliest retirement age:	55
Early retirement reduction:	3% per year that retirement precedes age 65

Actuarial Assumptions

Interest rate:	6.5% per annum
Salary increase rate:	4.0% per annum
Retirement age:	60
Pre-retirement decrements:	None
Actuarial value of assets:	Market value

$\ddot{a}_{60}^{(12)} = 11.4$

Assets at January 1, 2001 equal the January 1, 2001 Unit Credit accrued liability.

Participant data as at January 1, 2001

Members	Age	Service (Years)	2001 Earnings	Accrued Benefit
J	41	11	$50,000	$6,000
K	53	18	60,000	12,000

(a) Determine the normal cost under the Frozen Initial Liability method given that this method was adopted on January 1, 2001.

(b) Determine the normal cost under the Individual Aggregate cost method, assuming that assets allocated to each member equal their respective Unit Credit accrued liability.

Show all work.

****END OF EXAMINATION****