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: 1.5% of final year’s salary times years of service  
Normal form of payment: Life only, payable monthly in advance  
Normal retirement age: Age 65  
Earliest retirement age: Age 55  
Early retirement reduction: Actuarial equivalence  
Actuarial equivalence: Based on valuation assumptions

**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: Entry Age Normal (level % of salary)

\[a_{65}^{(12)} = 9.9\]  
\[a_{60}^{(12)} = 11.2\]  
\[s\ P_{60} = 0.945\]

**Sole Participant Data as of January 1, 2004:**

Age: 59  
Years of service: 29  
2004 salary: $100,000

At January 1, 2004, the plan is amended to provide for an unreduced early retirement pension at age 60 and the retirement age assumption is changed to age 60.
1. **Continued**

(a) Assuming the participant retires on December 31, 2004, determine the increase in the retirement pension as a result of the amendment.

(b) Calculate the change in the accrued liability and normal cost at January 1, 2004.

Show all work.
2. **(4 points)** You are the actuary for a company that sponsors a non-contributory defined benefit pension plan for one of its executives. You are given:

**Plan Provisions:**

Normal Retirement Benefit: 2% of final year’s earnings times years of service, less the pension that can be provided with the balance in a notional account.

Normal Retirement Age: Age 65

Normal form of payment: Life only, payable monthly in advance

Early retirement age: Age 55

Early retirement reduction: 3% per year for benefit commencement prior to age 65

Ancillary benefits: None

**Actuarial Assumptions and Method:**

Retirement age: Age 65

Interest rate: 6.5% per annum

Pre-retirement decrements: None

Salary increases: None

Rate of annuitization of notional account: 6.5% per annum

Actuarial cost method: Projected Unit Credit (linear pro-ration)

\[ a_{65}^{(12)} \text{ at } 6.5\% = 9.55 \]
\[ a_{65}^{(12)} \text{ at } 6\% = 9.87 \]
\[ a_{62}^{(12)} \text{ at } 6.5\% = 10.32 \]
\[ a_{62}^{(12)} \text{ at } 6\% = 10.69 \]
2. Continued

**Sole Participant Data as of January 1, 2004:**

- Age: 61
- Years of service: 25
- 2003 earnings: $400,000
- Projected value of notional account at age 65: $1,450,000

**Additional Data as of January 1, 2005:**

- 2004 earnings: $400,000
- Value of notional account on January 1, 2005: $1,150,000

(a) Determine the plan’s actuarial liability as at January 1, 2004.

(b) Using a valuation interest rate of 6% per annum, calculate the actuarial gain or loss on liabilities on January 1, 2005 assuming the executive retires at that time.

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: $M per month per year of service
- Normal form of payment: Life only, payable monthly in advance
- Bridge benefit: $100 per month, payable monthly in advance until age 65
- Normal Retirement Age: Age 62
- Actuarial equivalence: Based on valuation assumptions

**Actuarial Assumptions and Method:**

- Interest rate: 6.0% per annum
- Retirement age: Age 62
- Pre-retirement decrements: None
- Mortality: Unisex (50% male/50% female)
- Actuarial cost method: Unit Credit
3. Continued

Factors Based on Post-Retirement Assumptions:

\[
\begin{align*}
\overline{a}_{60}^{(12)} &= 12.0783 \\
\overline{a}_{62}^{(12)} &= 9.8213 \\
3p_{62} &= 0.9733 \\
\overline{a}_{62}^{(12)} &= 11.6067 \\
\overline{a}_{65:65}^{(12)} &= 9.0345 \\
3p_{65} &= 0.9619 \\
\overline{a}_{65} &= 10.8657
\end{align*}
\]

Sole Participant Data as of January 1, 2004:

- Age: 60
- Years of service: 10
- Spouse’s age: 60
- Accrued liability before plan change: $1,400M

Plan Provision Changes on January 1, 2004:

- Normal form of payment for married members: J% joint and survivor annuity without reduction
- Bridge benefit: None

(a) Calculate M.

(b) Determine J such that the accrued liability remains unchanged at January 1, 2004.

(c) J is set to 50% and the change in liability is amortized over expected years until retirement. Calculate the normal cost and amortization for 2004 at January 1, 2004.

Show all work.
4. (4 points) You are the actuary for a company that established a non-contributory defined benefit pension plan as at January 1, 2004. You are given:

**Plan Provisions:**

- Normal Retirement Benefit: 1% of final salary times years of service
- Normal form of payment: Five year certain and life, payable monthly in advance
- Normal Retirement Age: Age 65
- Early retirement age: Age 55
- Early retirement reduction: 5% per year for benefit commencement prior to age 65
- Other ancillary benefits: None

**Actuarial Assumptions and Method:**

- Interest rate: 6% per annum
- Salary increases: 3% per annum
- Retirement age: Age 60
- Pre-retirement decrements: None
- Actuarial cost method: Frozen Initial Liability
- Amortization of unfunded actuarial liability: 5 years

\[
\begin{align*}
\overline{a}_{65}^{(12)} &= 10 \\
\overline{a}_{60}^{(12)} &= 11 \\
sP_{60} &= 0.95
\end{align*}
\]

**Participant Data as of January 1, 2004:**

<table>
<thead>
<tr>
<th>Employee</th>
<th>Age</th>
<th>Service</th>
<th>2004 Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>42</td>
<td>12</td>
<td>$40,000</td>
</tr>
<tr>
<td>B</td>
<td>30</td>
<td>2</td>
<td>$25,000</td>
</tr>
</tbody>
</table>

(a) Determine the normal cost and amortization for 2004 as at January 1, 2004.

(b) Assuming the company contributed $15,000 as at January 1, 2004, the fund earned 10% during 2004 and all other assumptions were realized in 2004, determine the normal cost as at January 1, 2005.

Show all work.
5. (4 points) You are the actuary for a company that sponsors a non-contributory defined benefit pension plan established on January 1, 2004. You are given:

**Plan Provisions:**

- Normal Retirement Benefit: $30 per month per year of service
- Normal form of payment: Life only, payable monthly in advance
- Normal Retirement Age: Age 65
- Ancillary benefits: None

**Actuarial Assumptions and Method:**

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

\[ a_{65}^{(12)} = 10.5 \]

**Participant Data as of January 1, 2005:**

<table>
<thead>
<tr>
<th>Employee</th>
<th>Age</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Y</td>
<td>30</td>
<td>0</td>
</tr>
</tbody>
</table>

On January 1, 2005, the Normal Retirement Benefit is changed to $32 per month per year of service.

Calculate the employer Normal Cost for 2005 as at January 1, 2005.

Show all work.
6. *(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: 2% of final year’s earnings times years of service  
Normal form of pension: Life only, payable monthly in advance  
Normal Retirement Age: Age 65  
Vesting schedule: 100% vesting after 5 years of service

**Actuarial Assumptions and Method:**

Interest rate: 7.0% per annum  
Salary increases: None  
Retirement age: Age 65  
Pre-retirement decrements: None  
Actuarial cost method: Projected Unit Credit (linear pro-ration)

\[
\bar{a}_{65}^{(12)} = 10.1 \quad \bar{a}_{67}^{(12)} = 7.0 \\
\bar{a}_{67}^{(12)} = 9.6 \quad \bar{a}_{68}^{(12)} = 7.6 \\
\bar{a}_{68}^{(12)} = 9.4
\]

**Financial Information:**

Assets at January 1, 2004: $1,000,000  
Fund rate of return in 2004: 10.0%
6. Continued

Participant Data as of January 1, 2004:

<table>
<thead>
<tr>
<th></th>
<th>Participant A</th>
<th>Participant B</th>
<th>Participant C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age:</td>
<td>67</td>
<td>52</td>
<td>41</td>
</tr>
<tr>
<td>Service:</td>
<td>N/A</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>2003 Earnings:</td>
<td>N/A</td>
<td>$100,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>Date of Retirement:</td>
<td>January 1, 2002</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Monthly Retirement Benefit:</td>
<td>$10,000</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Form of Benefit:</td>
<td>Five year certain and life</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

You are given the following 2004 experience:

- Participant A died on September 15, 2004.
- Participant C terminated non-vested on August 1, 2004.
- 2004 Earnings for Participant B are $105,000.

(a) Calculate the amount of the July 1, 2004 contribution.

(b) Calculate the Unfunded Actuarial Liability at January 1, 2005.

(c) Calculate the gains and losses by source for 2004.

Show all work.

**END OF EXAMINATION**