All Questions pertain to the Case Study

1. **(7 points)** A NOC executive with 30 years of service plans to retire one year from now at age 62. It is important to NOC that the executive transitions to retirement over the next four years.

   (a) Describe the benefit incentives that can be offered to help retain this executive.

   (b) If you were hired by this executive, provide your recommendation regarding the negotiation of benefits.

   (c) Explain how your answer to (a) would be different if the executive had only eight years of service with NOC.

   (d) Identify the additional considerations that would exist if, instead of being hired by the executive, you were hired by NOC to provide advice to the executive.
2. *(11 points)* On June 30, 2003, NOC purchased a non-participating annuity contract to cover the obligations of all the pensioners in the Full-Time Hourly Union Pension Plan.

You are given:

- The contract cost was $125 million.
- As of June 30, 2003, NOC has recorded half of its 2003 pension expense and contributed half of its 2003 contribution.
- A discount rate of 6.0% was appropriate on June 30, 2003.
- Valuation results as of June 30, 2003, immediately before the annuity purchase:

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<th>Using a 6.5% Discount Rate</th>
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</thead>
<tbody>
<tr>
<td>PBO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active participants</td>
<td>$377,000</td>
<td>$400,000</td>
</tr>
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<td>0</td>
</tr>
<tr>
<td>Pensioners</td>
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<td>108,000</td>
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<tr>
<td>Total PBO</td>
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<td>$508,000</td>
</tr>
<tr>
<td>Service Cost</td>
<td>$24,000</td>
<td>$28,000</td>
</tr>
<tr>
<td>Market value of assets</td>
<td>$320,000</td>
<td>$320,000</td>
</tr>
<tr>
<td>Average remaining service period</td>
<td>11.5</td>
<td>11.5</td>
</tr>
</tbody>
</table>

(a) *(5 points)* Calculate the pension expense for the year 2003. Show all work.

(b) *(1 point)* Describe the additional considerations if a participating annuity contract were purchased.

(c) *(3 points)* Explain how your answer to (a) would differ under IAS 19 and the rationale for the different requirements.

(d) *(2 points)* Describe the information NOC will have to provide the insurer for the purpose of obtaining a quote for the annuity contract.
3. (6 points) NOC’s Board of Directors has established the following funding policy for NOC’s DB ERPs: annual contributions equal to normal cost plus five-year amortization of unfunded actuarial accrued liability. The CFO of NOC is concerned about the volatility of funding policy contributions.

(a) Explain the effects of different asset valuation methods on this volatility.

(b) Explain the effects of different asset class allocations on this volatility.
4. (12 points) The law in Vosne has been changed to permit voluntary employee contributions of up to 5% of pay to a DC ERP. The tax treatment of these contributions is the same as for contributions to a PPA.

NOC has decided to change the Full-Time Hourly Union Pension Plan from a flat dollar plan to a final average earnings plan, and to add a DC ERP for the union employees.

The main provisions of the new plans are:

**DB ERP**
- Normal retirement benefit: 1% of final five-year average earnings times years of service
- Post retirement indexing: 3% per year
- Optional form of benefit: Lump Sum

The other provisions of the plan are the same as those in the NOC Full-Time Hourly Union Pension Plan.

**DC ERP**
- Employee Contributions: Voluntary
- Matching Employer contributions: 100% match on the first 3% of employee contributions
- Form of Benefit: Lump sum or periodic pension

(a) Critique the design of the new plans from the perspective of NOC.

(b) Critique the design of the new plans from the perspective of the hourly union employees.

(c) Assess the current hourly plan asset allocation for the new DB plan.

(d) Describe the considerations in setting investment options to be offered to participants in the DC ERP.

(e) Predict the socio-economic effects of the change in the law in Vosne.
5. (6 points) NOC has just established a global subsidiary. Employees of the subsidiary include transferred NOC employees and third-country nationals.

(a) Explain the issues affecting a retirement benefit policy for permanent and temporary transfers between countries.

(b) Assuming that global comparability of retirement benefits is a corporate objective, describe the issues NOC must consider.
6. (10 points) NOC’s CEO has proposed an asset mix policy for the Full-Time Hourly Union Pension Plan to achieve the following objectives:

- Minimize short-term volatility of the company’s pension expense.
- Minimize the long-term cost of the plan.

**Proposed Asset Mix Policy**

- Domestic Equities (mostly oil companies) 60%
- International Equities 5%
- Domestic Fixed Income (short & medium-term treasuries) 20%
- Real Estate 15%

(a) Critique the proposed asset mix policy.

(b) You are going to perform an asset liability study for the NOC Full-Time Hourly Union Pension Plan. Describe the inputs you would need and the process you would undertake.

(c) Explain how the output of your asset liability study would be used to recommend and justify an asset mix policy to the CEO.
7. (8 points) NOC is acquiring TechCo, a private company in the country of Xanadu.

Xanadu has similar tax and pension legislation rules to Vosne, with the following exceptions:

- Employees can contribute up to $5,000 per year to a DB ERP and $5,000 per year to a DC ERP.
- Employee contributions are tax-deductible to the individual.
- Investment earnings on the employee contributions are not taxable until withdrawn.
- There are no PPAs.

Xanadu sponsors the following government-provided retirement income program:

- Both employees and employers contribute 5% of pay every year.
- The pension provided at retirement is equal to 50% of the best 3-year average earnings, provided the contributory period was at least 30 years. A proportionately reduced benefit is provided if less than 30 years of contributions were made to the program.
- Eligibility for a pension is age 62.
- The pension is reduced by 5% per year that the retirement age precedes age 67.

TechCo did not provide either a DB ERP or a DC ERP.

(a) Evaluate the appropriateness of NOC establishing an ERP for the salaried employees of TechCo.

(b) NOC’s VP of Human Resources is proposing a plan with the same provisions as the Full-Time Salaried Pension Plan. Critique this proposal.

(c) Recommend an alternative program for the salaried employees of TechCo. Justify your recommendation.
8. (8 points) NOC is considering laying off part of its union workforce to reduce costs. In order to avoid layoffs, the union has agreed to discuss changes to the Full-Time Hourly Union Pension Plan.

NOC has proposed to freeze accruals in the pension plan as of September 30, 2003. Under the frozen plan, benefits would be determined for all active participants based on service earned through September 30, 2003, and no future benefits would accrue.


(a) Estimate the change in NOC’s 2003 accounting expense if NOC’s proposal is adopted.

(b) If the union proposal is adopted, estimate the change in the 2003 and the 2004 accounting expense.

(c) Describe the effect of NOC’s proposal from both the employee and the employer perspectives.
9. (15 points) NOC is purchasing a refinery from ABC Company, and will offer employment to all of the employees at the refinery. All refinery employees are members of the ABC Refinery Pension Plan and the ABC Refinery Post-Retirement Medical plan. There are no other members of these plans.

You are given:

**Provisions of the ABC Refinery Plans**

The ABC Refinery Pension Plan provisions are as follows:

- Normal Retirement Age: Age 65
- Early Retirement Age: Age 60
- Normal Retirement Benefit: 1.75% of final earnings times years of service
- Early Retirement Reduction: Actuarially equivalent
- Normal Form of Benefit: If married, 50% joint & survivor, without reduction. If not married, single life annuity
- Post-Retirement Indexing: Lesser of 1% or CPI
- Termination and Pre-Retirement Death Benefits: Lump sum value of the accrued benefit, excluding indexation.

The ABC Refinery Post-Retirement Medical Plan provisions are exactly the same as NOC’s.
9. Continued

January 1, 2003 Membership Data – ABC Refinery Plans

The membership demographics of the refinery’s employees are described in the following table:

<table>
<thead>
<tr>
<th>Age</th>
<th># Participants</th>
<th>&lt;5 years of service</th>
<th>5-10 years of service</th>
<th>&gt;10 years of service</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;55</td>
<td>Avg Salary</td>
<td>50 40,000</td>
<td>100 42,000</td>
<td>50 46,000</td>
<td>200</td>
</tr>
<tr>
<td>55-65</td>
<td>Avg Salary</td>
<td>500 44,000</td>
<td>1,500 48,000</td>
<td>2,500 50,000</td>
<td>4,500</td>
</tr>
<tr>
<td>&gt;65</td>
<td>Avg Salary</td>
<td>150 47,000</td>
<td>350 52,000</td>
<td>250 57,000</td>
<td>750</td>
</tr>
<tr>
<td>Total</td>
<td>Avg Salary</td>
<td>700 44,357</td>
<td>1,950 48,410</td>
<td>2,800 55,018</td>
<td>5,450</td>
</tr>
</tbody>
</table>

The ABC Refinery Plans have no retirees.
9. Continued

January 1, 2003 Accounting Valuation Results for the ABC Refinery Plans

<table>
<thead>
<tr>
<th>Past Event</th>
<th>Pension Plan</th>
<th>Post-Retirement Medical Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market value of assets</td>
<td>$350,000,000</td>
<td>$0</td>
</tr>
<tr>
<td>PBO/APBO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active members</td>
<td>$325,000,000</td>
<td>$280,000,000</td>
</tr>
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- Interest: 8.5%
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- Mortality: GAM83
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The main provisions of the draft purchase and sale agreement, prepared by ABC, for discussion with NOC, are:

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Analyze the terms of the agreement and recommend revisions. Justify your recommendation.
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**END OF EXAMINATION**

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</tr>
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You are given:

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- Early Retirement Reduction: Actuarially equivalent
- Normal Form of Benefit: If married, 50% joint & survivor, without reduction. If not married, single life annuity
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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<td>2,500 50,000</td>
</tr>
<tr>
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<td></td>
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<td></td>
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9. Continued

January 1, 2003 Accounting Valuation Results for the ABC Refinery Plans

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<tr>
<th></th>
<th>Pension Plan</th>
<th>Post-Retirement Medical Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market value of assets</td>
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<td>$0</td>
</tr>
<tr>
<td>ABO</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>$325,000,000</td>
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</tr>
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<tr>
<td>Service Cost</td>
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<td>$15,000,000</td>
</tr>
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Assumptions and Methods

- Interest: 8.5%
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- Mortality: GAM83
- Turnover: None
- Retirement: 100% at age 62
- Asset valuation method: Market Value
- Actuarial cost method: Projected unit credit
9. Continued

Provisions of the Draft Purchase and Sale Agreement

The main provisions of the draft purchase and sale agreement, prepared by ABC, for discussion with NOC, are:

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Analyze the terms of the agreement and recommend revisions. Justify your recommendation.
10. (7 points) The CEO of NOC is targeting a substantial reduction in operating expenses. Three alternatives are being considered:

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(ii) A temporary early retirement pension enhancement.
(iii) Phased-retirement.

(a) Describe advantages and disadvantages of each alternative.
(b) Describe the accounting implications of each alternative.

**END OF EXAMINATION**

AFTERNOON SESSION
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)

\[
\bar{a}_{63}^{(12)} = 10.0  \\
\bar{a}_{65}^{(12)} = 9.0
\]

**Participant Data as of January 1, 2003**

<table>
<thead>
<tr>
<th>Employee</th>
<th>Age</th>
<th>Service</th>
<th>Normal Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giles</td>
<td>62</td>
<td>22</td>
<td>$35,320</td>
</tr>
<tr>
<td>Faith</td>
<td>43</td>
<td>13</td>
<td>$2,780</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Member</th>
<th>Spouse</th>
<th>Member: Spouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a_{57}^{(12)} = 11.9558$</td>
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<td>$a_{62,57}^{(12)} = 10.0844$</td>
</tr>
<tr>
<td>$a_{62}^{(12)} = 10.7330$</td>
<td>$a_{60}^{(12)} = 12.6869$</td>
<td>$a_{65,60}^{(12)} = 9.2251$</td>
</tr>
<tr>
<td>$a_{65}^{(12)} = 9.9166$</td>
<td>$a_{62}^{(12)} = 12.2459$</td>
<td></td>
</tr>
<tr>
<td>$s P_{57} = .9229$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$s P_{62} = .9631$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. **Continued**

The following member retires on January 1, 2003:

<table>
<thead>
<tr>
<th>Data as of January 1, 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Member’s age:</td>
</tr>
<tr>
<td>Spouse’s age:</td>
</tr>
<tr>
<td>Years of Service:</td>
</tr>
<tr>
<td>62</td>
</tr>
<tr>
<td>57</td>
</tr>
<tr>
<td>35</td>
</tr>
</tbody>
</table>

(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

\[
\dd{a}{58}^{(12)} = 10.36 \\
\dd{a}{60}^{(12)} = 10.11 \\
\dd{a}{65}^{(12)} = 9.22
\]
3. Continued

Valuation Results as of January 1, 2002

<table>
<thead>
<tr>
<th></th>
<th>Employee X</th>
<th>Employee Y</th>
<th>Employee Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant status:</td>
<td>Active</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>Accrued liability:</td>
<td>$50,000</td>
<td>$5,000</td>
<td>$100,000</td>
</tr>
<tr>
<td>Normal cost:</td>
<td>$5,000</td>
<td>$1,250</td>
<td>$8,333</td>
</tr>
<tr>
<td>Age:</td>
<td>45</td>
<td>35</td>
<td>57</td>
</tr>
<tr>
<td>Years of service:</td>
<td>10</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Earnings:</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
</tr>
</tbody>
</table>

You are also given the following 2002 experience:

- Employee Y terminated on December 31, 2002.
- 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
\(a_{60}^{12} = 12.7\)

**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.
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

<table>
<thead>
<tr>
<th></th>
<th>$\ddot{a}_x^{\text{(12)}}$</th>
<th>$10P_x$</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>11.0</td>
<td>0.91</td>
</tr>
<tr>
<td>70</td>
<td>9.0</td>
<td>0.88</td>
</tr>
</tbody>
</table>

**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)

\[ \overline{\ddot{a}}_{65}^{(12)} = 9.9166 \]

**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**