1. **(9 points)** A pension committee member at your U.S. based client believes that the interest rate for the defined benefit plan valuations is too low. He supports his view by stating that a higher interest rate would lower the cost of the plan. A second committee member argued against raising the assumption.

The chairman of the pension committee has asked you to lead a discussion at the next pension committee meeting regarding the interest rate assumptions for funding purposes and for accounting purposes, and their effect on the interested parties.

Outline your discussion.
Questions 2 – 6 pertain to the Case Study

2. (12 points) The CFO of NOC has decided to take a more active role in managing NOC’s pension plan assets. In reviewing the performance of the National Oil Full-Time Hourly Union Pension Plan, he is disturbed by the recent absolute performance. He proposes that the assets should be moved to 100% domestic fixed income because that asset class has outperformed the other asset classes in 2 of the last 3 years.

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<td>5%</td>
<td>-5%</td>
<td>0.85</td>
</tr>
<tr>
<td>2001</td>
<td>4%</td>
<td>1%</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Additional Information for 2003

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(a) Describe the features in a Statement of Investment Policies and Procedures that could help the CFO in his evaluation of the Plan’s performance.

(b) Calculate the 2001, 2002 & 2003 Risk Adjusted Rate of Return for the fund.

(c) Calculate the 2001, 2002 & 2003 Treynor Measure for the fund.

(d) Evaluate the investment performance of the fund during 2003.

(e) Critique the CFO’s proposal.
### Questions 2 – 6 pertain to the Case Study

3. **(8 points)** The government of Vosne is concerned that workers are harmed by switching companies periodically throughout their careers. The government has asked for your assistance in understanding this issue.

   (a) Describe the implications of switching employers on workers’ retirement benefits.

   (b) Suggest policies that could be adopted by the government of Vosne to improve the portability of private retirement benefits.

   (c) Describe how these policies address the issues identified in (a).

   (d) Describe the impact of these policies on NOC.

4. **(10 points)** Auditors in Vosne have criticized its current pension accounting standards as being misleading to readers of financial statements and contrary to the teachings of financial economics.

    The Department of Accounting Standards is considering changes to the current accounting rules to achieve the following goals:

    - Increased transparency;
    - Improved consistency with how financial economics measures “risk”; and
    - More practical and usable information for financial statement readers.

    (a) Critique the current accounting rules in light of the Department’s goals.

    (b) Recommend changes to the accounting rules to meet the Department’s goals.
Questions 2 – 6 pertain to the Case Study

5. (9 points) In order to attract and retain employees in senior positions, NOC wants to introduce terminal funding by providing the options of an insured annuity or a lump sum benefit for the National Oil Full-Time Salaried Supplemental Retirement Plan (SRP).

The lump sum will be equivalent to the net present value of the after-tax annual SRP benefit. The after-tax payment from the insured annuity will be equal to the after-tax annual SRP benefit. NOC will reimburse the member for any immediate taxes payable under both options.

You are given:

- Pat, a senior executive of NOC, will retire with an annual pension under the SRP of $100,000.
- The before-tax discount rate used by NOC to calculate lump sum benefits is 10%.
- Lump sum annuity factors at Pat’s retirement date are:
  - At a discount rate of 10%: 9.5
  - At a discount rate of 6%: 13.5
- The cost of buying Pat’s annuity at retirement is $10 for every $1 of annual benefit purchased.

Vosne’s tax rules for single premium annuity contracts are:

- The employer obtains a deduction for any premiums it pays;
- The executive is immediately taxed on the full purchase price of the annuity;
- A proportionate part of each annuity payment would be deemed a tax-free return of the premium (“exclusion ratio”) and the balance is taxable at the individual tax rate. For this purpose, a life expectancy of 20 years is used.

(a) Describe the issues that NOC must address in adopting a terminal funding approach.

(b) Calculate the cost differential between the two terminal funding options. Show your work.
Questions 2 – 6 pertain to the Case Study

6. **(12 points)** NOC is proposing the following changes to the Retiree Health Benefit program of its salaried employees:

- Effective January 1, 2004, the program will be closed to new employees;
- Salaried employees with less than 20 years of service at January 1, 2004 who do not retire before January 1, 2005 will not be eligible for the benefit after that date; and
- For all other salaried employees, effective January 1, 2005, the portion of the premium paid by the program will be in accordance with the following schedule:

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<th>Years of Service at Retirement</th>
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<td>20-24</td>
<td>50%</td>
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</tr>
<tr>
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</table>

NOC wants an analysis of the proposed changes, in respect of the following groups of employees:

- **Group A** – the salaried employees who are currently eligible for the benefits but who lose the benefits if they do not retire in the next year;
- **Group B** – the salaried employees other than those in Group A who are no longer eligible to receive benefits under the program;
- **Group C** – the salaried employees who are eligible, under current assumptions, to receive reduced benefits under the program; and
- **Group D** – the salaried employees not affected by the proposed changes.

(a) **(7 points)** Based on the age and service distribution of the NOC Full-Time Salaried Pension Plan at January 1, 2004, estimate the number of salaried employees in Groups A, B, C and D. Identify any assumptions you used in your estimate.

(b) **(3 points)** Describe any special accounting treatments that are applicable for Groups A, B, C and D.

(c) **(2 points)** Describe the consequences to NOC of the proposed changes.

**END OF EXAMINATION**
MORNING SESSION
Questions 7 – 9 pertain to the Case Study

7. **(8 points)** Your client NOC is budgeting for fiscal year 2005 in June of 2004. They have asked you to estimate the fiscal year 2005 pension expense for the National Oil Full-Time Hourly Union Pension Plan.

You are given (all numbers in $000’s):

- Projected Benefit Obligation at January 1, 2004 with 6% discount rate = 560,919
- Service Cost at January 1, 2004 with 6% discount rate = 27,169
- 2005 Estimated Employer Contributions = 38,000
- 2005 Estimated Benefit Payments = 12,100

(a) Describe the considerations for selecting the return on assets during 2004 and the discount rate for 2005 for budgeting purposes.

(b) Estimate the 2005 pension expense using a discount rate of 6% and assuming no other gains or losses.

(c) Describe and estimate the effect of a change in the economic environment on each component of your estimate of the 2005 pension expense.
Questions 7 – 9 pertain to the Case Study

8. (12 points) The Vice-President of Human Resources of NOC (VP of HR) is concerned about the increased level and volatility of the National Oil Company Full-Time Salaried Pension Plan costs over the past few years.

The VP of HR has proposed the following new cash balance design:
- Interest rate credit: 6% per annum
- Annual contribution credit: 5% of earnings

You are the actuary for NOC and have been hired by the VP of HR to assist with implementing the new plan design. For purposes of this question, assume that regulations governing pension plan benefits in Vosne are identical to those in the United States.

(a) Identify the key plan design features that will need to be addressed in the proposed design pertaining to retirement and ancillary benefits.

(b) Propose two options for transitioning current plan participants to the new design.

(c) Describe the effect that each of your proposed options is expected to have on the benefits of current participants.

(d) Describe the effect that each of your proposed options is expected to have on the 2004 expense.
9. (10 points) Vosne is proposing the introduction of a defined contribution (DC) social insurance program (SIP) effective January 1, 2004. Benefits would be funded by employee and employer contributions, as follows:

- Employees and employers both contribute 5% of pay on earnings up to $45,000 (the “Wage Base”).
- The Wage Base changes in line with changes in the average wage in Vosne.
- Contributions are invested at the direction of the employees by privately managed investment companies selected by Vosne.
- Account balances are available to provide death, disability and retirement benefits.
- Account balances must be used to purchase annuities no later than age 65.

(a) Describe the challenges that other countries with DC based social insurance systems have faced.

(b) Recommend changes to the proposed program. Justify your recommendation.

(c) In order to maintain an employee’s total benefit (DC SIP plus current plan) at a level equivalent to that provided under the current salaried plan provisions, the CFO of NOC is proposing to amend the National Oil Full-Time Salaried Pension Plan benefit to 0.5% of best average earnings up to the Wage Base, plus 2.0% of best average earnings in excess of the Wage Base.

Critique this proposal.
1. *(9 points)* A pension committee member at your Canadian based client believes that the interest rate for the defined benefit plan valuations is too low. He supports his view by stating that a higher interest rate would lower the cost of the plan. A second committee member argued against raising the assumption.

The chairman of the pension committee has asked you to lead a discussion at the next pension committee meeting regarding the interest rate assumptions for funding purposes and for accounting purposes, and their effect on the interested parties.

Outline your discussion.
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(e) Critique the CFO’s proposal.
Questions 2 – 6 pertain to the Case Study

3.  (8 points) The government of Gevrey is concerned that workers are harmed by switching companies periodically throughout their careers. The government has asked for your assistance in understanding this issue.

   (a) Describe the implications of switching employers on workers’ retirement benefits.

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You are given:

- Pat, a senior executive of NOC, will retire with an annual pension under the SRP of $100,000.
- The before-tax discount rate used by NOC to calculate lump sum benefits is 10%.
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Questions 2 – 6 pertain to the Case Study

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- Effective January 1, 2004, the program will be closed to new employees;
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**END OF EXAMINATION**

MORNING SESSION

COURSE 8: Fall 2004 - 5 - STOP
Retirement Benefits,
Comprehensive Segment - Canada
Morning Session
7. (8 points) Your client NOC is budgeting for fiscal year 2005 in June of 2004. They have asked you to estimate the fiscal year 2005 pension expense for the National Oil Full-Time Hourly Union Pension Plan.

You are given (all numbers in $000’s):

Accrued Benefit Obligation at January 1, 2004 with 6% discount rate = 560,919
Service Cost at January 1, 2004 with 6% discount rate = 27,169
2005 Estimated Employer Contributions = 38,000
2005 Estimated Benefit Payments = 12,100

(a) Describe the considerations for selecting the return on assets during 2004 and the discount rate for 2005 for budgeting purposes.

(b) Estimate the 2005 pension expense using a discount rate of 6% and assuming no other gains or losses.

(c) Describe and estimate the effect of a change in the economic environment on each component of your estimate of the 2005 pension expense.
Questions 7 – 9 pertain to the Case Study

8. (12 points) NOC’s Vice-President of Human Resources has asked you to propose changes to NOC’s Full-Time Salaried Pension Plan in order to reduce cost. She believes that the pension plan is too generous for participants who retire before age 60, and she wants plan participants to retire later in the future.

(a) Describe the process you would undertake in performing a plan design project.

(b) Recommend possible plan design changes to meet the goals of the Vice-President of Human Resources. Provide support for your recommendation.

(c) The government of Gevrey is proposing introducing a pension adjustment system similar to that defined by the Canadian Income Tax Act. Describe how your response to (b) would change as a result of this proposal.
9. \textit{(10 points)} Gevrey is proposing the introduction of a defined contribution (DC) social insurance program (SIP) effective January 1, 2004. Benefits would be funded by employee and employer contributions, as follows:

- Employees and employers both contribute 5% of pay on earnings up to $45,000 (the “Wage Base”).
- The Wage Base changes in line with changes in the average wage in Gevrey.
- Contributions are invested at the direction of the employees by privately managed investment companies selected by Gevrey.
- Account balances are available to provide death, disability and retirement benefits.
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(a) Describe the challenges that other countries with DC based social insurance systems have faced.

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(c) In order to maintain an employee’s total benefit (DC SIP plus current plan) at a level equivalent to that provided under the current salaried plan provisions, the CFO of NOC is proposing to amend the National Oil Full-Time Salaried Pension Plan benefit to 0.5% of best average earnings up to the Wage Base, plus 2.0% of best average earnings in excess of the Wage Base.

Critique this proposal.

**END OF EXAMINATION**

AFTERNOON SESSION
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)

\[
\bar{a}_{65}^{(12)} \text{ at } 6.5\% = 9.55 \\
\bar{a}_{65}^{(12)} \text{ at } 6\% = 9.87 \\
\bar{a}_{62}^{(12)} \text{ at } 6.5\% = 10.32 \\
\bar{a}_{62}^{(12)} \text{ at } 6\% = 10.69
\]
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:

\[ \ddot{a}_{60}^{(12)} = 12.0783 \quad \ddot{a}_{62:62}^{(12)} = 9.8213 \quad 3 \, p_{62} = 0.9733 \]
\[ \ddot{a}_{62}^{(12)} = 11.6067 \quad \ddot{a}_{65:65}^{(12)} = 9.0345 \quad 3 \, p_{65} = 0.9619 \]
\[ \ddot{a}_{65}^{(12)} = 10.8657 \]

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:**

<table>
<thead>
<tr>
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<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest rate</td>
<td>6% per annum</td>
</tr>
<tr>
<td>Salary increases</td>
<td>3% per annum</td>
</tr>
<tr>
<td>Retirement age</td>
<td>Age 60</td>
</tr>
<tr>
<td>Pre-retirement decrements</td>
<td>None</td>
</tr>
<tr>
<td>Actuarial cost method</td>
<td>Frozen Initial Liability</td>
</tr>
<tr>
<td>Amortization of unfunded actuarial liability</td>
<td>5 years</td>
</tr>
</tbody>
</table>

\[
\overset{(12)}{a}_{65} = 10 \\
\overset{(12)}{a}_{60} = 11 \\
5P_{60} = 0.95
\]

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

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<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>
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(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)

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

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

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<td>X</td>
<td>45</td>
<td>15</td>
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<tr>
<td>Y</td>
<td>30</td>
<td>0</td>
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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)

\[
\begin{align*}
\bar{a}_{65}^{(12)} &= 10.1 \\
\ddot{a}_{67}^{(12)} &= 7.0 \\
\bar{a}_{67}^{(12)} &= 9.6 \\
\ddot{a}_{68}^{(12)} &= 7.6 \\
\bar{a}_{68}^{(12)} &= 9.4
\end{align*}
\]

**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**