INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 5 questions numbered 8 through 12 for a total of 40 points. The points for each question are indicated at the beginning of the question. Question 12 pertains to the Case Study, which is enclosed inside the front cover of this exam booklet.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.

3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.

2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.

3. The answer should be confined to the question as set.

4. When you are asked to calculate, show all your work including any applicable formulas.

5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam RETFRC.

6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Canadian version of this exam is recognized by the Canadian Institute of Actuaries.

Tournez le cahier d’examen pour la version française.
CASE STUDY INSTRUCTIONS

The case study will be used as a basis for some examination questions. Be sure to answer the question asked by referring to the case study. For example, when asked for advantages of a particular plan design to a company referenced in the case study, your response should be limited to that company. Other advantages should not be listed, as they are extraneous to the question and will result in no additional credit. Further, if they conflict with the applicable advantages, no credit will be given.
8. **(5 points)** You are the actuary for a contributory defined benefit pension plan registered in Ontario. You are performing a funding valuation of the Plan as at December 31, 2018. The last valuation was performed as at December 31, 2015.

You have validated that the membership data provided is sufficient and reliable for the purpose of the funding valuation.

You are given:

<table>
<thead>
<tr>
<th>Market Value of Plan Assets ($)</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 1</td>
<td>100,000,000</td>
<td>109,000,000</td>
<td>106,000,000</td>
</tr>
<tr>
<td>PLUS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employer’s Contributions</td>
<td>4,500,000</td>
<td>5,000,000</td>
<td>5,500,000</td>
</tr>
<tr>
<td>Members’ Contributions</td>
<td>4,500,000</td>
<td>6,000,000</td>
<td>5,500,000</td>
</tr>
<tr>
<td>Investment return</td>
<td>5,000,000</td>
<td>6,000,000</td>
<td>10,000,000</td>
</tr>
<tr>
<td>LESS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pensions paid</td>
<td>4,000,000</td>
<td>5,000,000</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Lump-sums paid</td>
<td>1,000,000</td>
<td>15,000,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>December 31</td>
<td>109,000,000</td>
<td>106,000,000</td>
<td>121,000,000</td>
</tr>
</tbody>
</table>

(a) **(2 points)** Describe how you would test the sufficiency and reliability of the asset data for the purpose of the funding valuation. No calculations required.

The funding valuation was filed on April 30, 2019. On May 31, 2019, the fund custodian restates the investment return in 2018 to be a loss of $10,000,000, and the December 31, 2018 market value is restated to be $101,000,000.

(b) **(3 points)** Explain how you would proceed, taking into consideration professional standards of practice. No calculations are required.
9. (10 points) Your client sponsors a non-contributory defined benefit pension plan.

You are given:

**Plan Provisions:**
- Retirement benefit: 1% of final year’s earnings times years of service
- Termination benefit: Deferred pension payable at age 60
- Normal form of payment: Life only, payable monthly in advance
- Normal retirement age: Age 60

**Actuarial Assumptions and Methods:**
- Interest rate: 5% per year
- Salary increase rate: 3% per year
- Retirement age: Age 60
- Pre-retirement decrements: None
- Timing of decrements: Beginning of year
- Actuarial cost method: Individual Level Premium (Level % of Salary)

\[ \tilde{a}_{60}^{(12)} = 14.8 \]

**Participant Data at January 1, 2019:**

<table>
<thead>
<tr>
<th>Employee</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>34</td>
<td>44</td>
</tr>
<tr>
<td>2019 Salary</td>
<td>$50,000</td>
<td>$100,000</td>
</tr>
<tr>
<td>Service in years</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Accrued Liability</td>
<td>$20,000</td>
<td>$100,000</td>
</tr>
</tbody>
</table>
9. Continued

(a) (2 points) Calculate the total normal cost as at January 1, 2019.

You are given the following for 2019:

- The assets of the plan are equal to $120,000 as at January 1, 2019.
- At December 31, 2019:
  - Member A terminates employment and elects to receive a deferred pension.
  - Member B receives a salary increase of 10%.
- A contribution of $20,000 is made to the plan on January 1, 2019.
- The plan’s assets earn a return of 0% during 2019.

(b) (3 points) Calculate the total unfunded actuarial liability and total normal cost as at January 1, 2020.

(c) (3 points) Calculate the liability gains and losses by source for 2019.

(d) (2 points) Calculate the gains and losses on the total normal cost by source for 2019.

Show all work.
10. (7 points)

(a) (4 points) Describe the perspectives of the following stakeholders with respect to intergenerational equity in public sector pension plans:

(i) Government budget office;

(ii) Covered employees; and

(iii) Advocates for other public services.

(b) (3 points) Compare and contrast the following cost methods with respect to intergenerational equity when funding public sector pension plans:

(i) Unit Credit; and

(ii) Entry Age Normal.
11.  (10 points) Company XYZ sponsors a defined benefit pension plan registered in Ontario that is closed to new entrants.

(a)  (3 points) Describe the two approaches that may be taken when selecting a best estimate discount rate for going concern valuations, including the steps involved for each approach.

You are given:

**Target asset allocation**

<table>
<thead>
<tr>
<th>Long-term bonds rated A or better</th>
<th>55%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian equities</td>
<td>15%</td>
</tr>
<tr>
<td>US equities</td>
<td>20%</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>10%</td>
</tr>
</tbody>
</table>

**Going concern liabilities and normal cost as at January 1, 2019:**

<table>
<thead>
<tr>
<th>(in 000s)</th>
<th>Without Indexing</th>
<th>With Indexing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Going concern liabilities</td>
<td>10,000</td>
<td>11,000</td>
</tr>
<tr>
<td>Normal cost</td>
<td>500</td>
<td>550</td>
</tr>
</tbody>
</table>

- The going concern valuation discount rate is 6.3% per year.
- The duration of the plan’s going concern liabilities is 15.

**Non-Fixed Income component of the Provision for Adverse Deviations (PfAD):**

<table>
<thead>
<tr>
<th>% Non-Fixed Income assets</th>
<th>Closed Plans</th>
<th>Open Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>20%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>40%</td>
<td>4%</td>
<td>2%</td>
</tr>
<tr>
<td>50%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>60%</td>
<td>7%</td>
<td>4%</td>
</tr>
<tr>
<td>70%</td>
<td>11%</td>
<td>6%</td>
</tr>
<tr>
<td>80%</td>
<td>15%</td>
<td>8%</td>
</tr>
<tr>
<td>100%</td>
<td>23%</td>
<td>12%</td>
</tr>
</tbody>
</table>

- Benchmark Yield of Government of Canada Long-Term Bonds (V39056) at January 1, 2019 is 2.18%.
11. **Continued**

- The formula to determine the benchmark discount rate that is used in the determination of the PfAD is:

\[
0.5\% + \\
\text{Benchmark Yield of Government of Canada Long-Term Bonds} + \\
5\% \times \text{allocation of non-fixed income} + \\
1.5\% \times \text{allocation of fixed income}
\]

(b) *(4 points)* Calculate the total going concern liabilities and the normal cost including the PfAD as at January 1, 2019 for the plan.

(c) *(3 points)* Explain how to determine a margin for adverse deviation when it is not prescribed by regulation.
12. (8 points)

(a) (1 point) Describe the requirements for there to be an available actuarial surplus for a defined benefit pension plan registered in Ontario.

(b) (1 point) Describe the possible applications of available actuarial surplus.

(c) (2 points) Calculate the minimum required and maximum permissible employer contributions at January 1, 2019 for the DPC plan.

Show all work.

You are given:

- DPC remitted a contribution equal to the wind up deficit at the end of the year.
- The net rate of return on the pension fund assets during 2019 was 20%.
- Actual benefit payments during 2019 were $31,000.
- DPC will file a funding valuation at January 1, 2020.

Assume the following:

- No Prior Year Credit Balance is established;
- No changes to the actuarial assumptions and methods; and
- All experience is as expected.

(d) (4 points) Calculate the estimated minimum required and maximum permissible employer contributions for 2020 using extrapolated liabilities.

**END OF EXAMINATION**
Afternoon Session
USE THIS PAGE FOR YOUR SCRATCH WORK
USE THIS PAGE FOR YOUR SCRATCH WORK