This exam consists of sixteen (16) multiple choice questions worth 16 points and five (5) written answer questions worth 34 points for a total of 50 points.

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SECTION 1: MULTIPLE CHOICE/GGRID QUESTIONS

Each of the 16 multiple choice questions is worth 1.0 point for a total of 16 points. Circle the right answer on the multiple-choice question answer sheet.

Question 1
Which of the following dynamic capital adequacy testing (DCAT) scenarios would have the most severe impact on the surplus of the group insurance line of business? Assume the products in this line of business are all yearly renewable term insurance (YRT). Volume of group life premium is $10 M/year, reserves for long-term disability (LTD) benefits are $40 M, and reserves for waiver of premiums are $15 M.

A. A 25% permanent increase in the active life mortality rates.
B. A 25% permanent decrease in group LTD termination rates.
C. A 25% permanent increase in administration expenses.
D. A 2 percentage point increase in the inflation rate.
E. A 2 percentage point increase in long-term interest rates.

Question 2
Regarding the governance of a life insurance company, which of the following are TRUE?

I. The Board of Directors is responsible for approving short-term and long-term business objectives, strategies, and plans.
II. Senior management is responsible for reviewing and discussing compliance with applicable laws, regulations, and guidelines.
III. Senior management is responsible for approving the internal control framework.

A. I only
B. II only
C. III only
D. II and III only
E. The correct answer is not given by A, B, C, or D
Question 3

Regarding the guidelines issued by the Office of the Superintendent of Financial Institutions (OSFI) as to the capital targets for an insurance company providing only group life, health, and disability insurance products, which of the following are TRUE?

I. The supervisory target is 150% of Minimum Continuing Capital and Surplus Requirements (MCCSR).

II. An insurer is expected by OSFI to set its internal target, as part of its Own Risk and Solvency Assessment (ORSA) process, based on an internal assessment of all material risk.

III. In addition to the internal target of total capital, the insurer is expected by OSFI to determine an internal target of core capital that should include only very high-quality capital elements.

A. I and II only
B. I and III only
C. II and III only
D. I, II, and III
E. The correct answer is not given by A, B, C, or D.

Question 4

Regarding the source of earnings analysis for a group life & health insurance block of business, which of the following are TRUE?

I. The best estimate assumptions are those that were used in the valuation of insurance contract liabilities at the end of the previous reporting period.

II. Experience gains and losses include the effect on net income of management actions during the year.

III. Expected profit on in-force business includes the release of provisions for adverse deviations.

A. I and II only
B. I and III only
C. II & III only
D. I, II, and III
E. The correct answer is not given by A, B, C, or D.
Question 5
Regarding the valuation of group policy liabilities for LTD coverage, which of the following are TRUE?

I. The valuation basis used in determining a group’s deficit or surplus is the same as that used for the valuation in the insurer’s financial statements.

II. When the liabilities of a particular group are valued for the purpose of setting renewal rates, discretionary adjustments to the group’s claims experience are sometimes made to mitigate volatility in rates.

III. Under the Canadian Asset Liability Method (CALM), the amount of the policy (insurance contract) liabilities for a particular scenario is equal to the amount of supporting assets at the balance sheet (calculation) date that are forecasted to reduce to zero at the last liability cash flow in that scenario.

A. I and II only
B. I and III only
C. II and III only
D. I, II, and III
E. The correct answer is not given by A, B, C, or D.

Question 6
Regarding the limited fluctuation credibility theory applied to manual ratemaking, which of the following are TRUE?

I. The procedure begins with a predetermined and subjective confidence interval.

II. The minimum number of claims required for the experience to be credible for manual rate development increases as the $\sigma / \mu$ ratio increases, where $\sigma$ and $\mu$ are respectively equal to the standard deviation and the mean of the claim amounts.

III. When the experience is not considered fully credible for ratemaking, the credibility weight can be determined as $\sqrt{(NE / NF)}$ where $NE$ is the number of expected claims in the experience and $NF$ is the number of claims required for full credibility.

A. I and II only
B. I and III only
C. II and III only
D. I, II, and III
E. The correct answer is not given by A, B, C, or D.
Question 7

Regarding disability termination rates (mortality and recovery combined), which of the following are TRUE?

I. Termination rates in the CIA Group Long-Term Disability Termination Study are generally higher in the second to fifth year of disability than those of the Canada Pension Plan.

II. For males, expected termination rates are generally higher for the Canada Pension Plan than for the Québec Pension Plan (excluding the QPP flexible disability benefits) during the first four years following disablement.

III. The probability that a LTD claim under a private plan be approved by the Canada Pension Plan or the Québec Pension Plan increases with the duration since disablement.

A. I and II only
B. I and III only
C. II and III only
D. I, II, and III
E. The correct answer is not given by A, B, C, or D.

Question 8

Regarding the coordination of benefits under group insurance plans, as recommended by the Canadian Life and Health Insurance Association (CLHIA), which of the following are TRUE?

I. When a person is covered by an insured plan and a healthcare spending account, the insured plan is first payor.

II. Where the eligible expense for a submitted claim is paid in full by the first payor, the claim can still be submitted to the second payor if the covered person wishes to count that expense towards any applicable deductibles or maximums.

III. Where a person is covered as an employee under a prescription drug plan with manual (paper) claims processing and as a dependent under his/her spouse’s prescription drug plan, this one with direct (electronic) payment, this person is allowed to be reimbursed first by the electronic plan and second by the employer’s plan.

A. I and II only
B. I and III only
C. II and III only
D. I, II, and III
E. The correct answer is not given by A, B, C, or D.
Question 9
Regarding group insurance in Québec, which of the following are TRUE?

I. A change of insurer does not necessarily cancel the designations of beneficiaries made to the prior insurer.
II. A civil union spouse designated as the beneficiary of a group insurance certificate is an irrevocable beneficiary unless otherwise stipulated.
III. A designation of beneficiary becomes irrevocable only when received by the insurer.

A. I and II only
B. I and III only
C. II and III only
D. I, II, and III
E. The correct answer is not given by A, B, C or D.

Question 10
Regarding self-insurance, which of the following are TRUE?

I. An employer can self-insure a non-taxable, short-term disability plan.
II. A large amount pooling provision in a group health insurance plan protects the plan sponsor from the risk of a higher frequency of claims.
III. A large amount pooling provision in a group health insurance plan protects the plan sponsor from the risk of a modest systematic increase in the severity of claims.

A. I only
B. II only
C. III only
D. II and III
E. The correct answer is not given by A, B, C, or D.
Question 11
Which of the following medications must be covered under a prescription drug plan?

I. Prescribed medical marijuana if the plan does not exclude it.

II. In Québec, substitutes of food or cosmetic products that are on the Régie de l’assurance maladie du Québec (RAMQ) list and that are prescribed by a physician.

III. In Québec, medication prescribed to treat an injury that occurred while the insured person was perpetrating a crime.

A. I and II only
B. I and III only
C. II and III only
D. I, II, and III
E. The correct answer is not given by A, B, C, or D.

Question 12
Based on decisions rendered by the Supreme Court of Canada, which of the following are TRUE?

I. There is no difference between “death resulting from accidental means” and “accidental death”.

II. A loss caused by a disease cannot be covered under an accident insurance policy even though the disease is contracted as a result of “accidental means” through the entire chain of events.

III. The “expectation test” consists of asking first what the insured, in fact, expected. If it cannot be determined then it must be asked what the insured expected, from the perspective of a reasonable person standing in the shoes of the insured.

A. I and II only
B. I and III only
C. II and III only
D. I, II, and III
E. The correct answer is not given by A, B, C or D.
Question 13
Which of the following are TRUE regarding the taxation of life insurance companies in Canada?

I. Any reserves deducted in the previous year must be included in the current year’s income.

II. The amount deductible by an insurer as a claims fluctuation reserve for a non-terminated group insurance policy is limited to 25 percent of the premium for the 12-month period ending at the end of the year.

III. Since the premium tax is payable by the insurer, the amount charged to the policyholder to fund the payment of the tax is itself taxable under this tax.

A. I and II only
B. I and III only
C. II and III only
D. I, II, and III
E. The correct answer is not given by A, B, C or D.

Question 14
Which of the following statements are TRUE for determining the liability for experience rating refunds (ERR)?

I. The liability for experience rating refunds is established on past experience as well as projected future experience.

II. Policyholder liabilities are set to be at most as large as statutory liabilities.

III. Determining accrued ERR liability involves no assumptions because it looks at past experience only and so may not even be part of the actuary’s responsibilities.

IV. Net positive contributions to ERR cash flows in a particular duration would be first applied to deficit reduction before becoming refund cash flow for addition to a claims fluctuation reserve (CFR) or refunding to the policyholder.

A. All but I
B. All but II
C. All but III
D. All but IV
E. All
Question 15
Which of the following statements are TRUE regarding reinsurance as a risk management tool for insurers?

I. Reinsurance exposes an insurer to other risks, including operational, legal, counterparty, and liquidity risks.

II. The Office of the Superintendent of Financial Institutions (OSFI) expects a higher level of due diligence by a federally regulated insurer in respect of any current or prospective reinsurance arrangement with an unregistered reinsurer or with a cedant that is not regulated by the OSFI.

III. Generally, a reinsurance contract should stand on its own, providing the necessary clarity and legal certainty on reinsurance cover.

IV. Reinsurance contracts can contain other types of terms or conditions that may limit a troubled or insolvent cedant’s ability to enforce the contractual obligations of a reinsurer.

A. All but I
B. All but II
C. All but III
D. All but IV
E. All
Question 16
Which of the following statements are FALSE regarding standards of practice to establish valuation reserves?

I. As per the Standard, the statement of income should account for the total change in the policy liabilities, consisting of the insurance contract liabilities and the liabilities for policies other than insurance contracts, during the reporting period.

II. Under Canadian asset liability method, the actuary should calculate insurance contract liabilities for multiple scenarios and adopt a scenario whose insurance contract liabilities make sufficient but not excessive provision for the insurer’s obligations in respect of the relevant policies.

III. Concerning non-economic assumptions, if the assumption concerning adverse deviation is not specified directly in the Standards of Practice, the margin for adverse deviations should be selected between 5 percent and 20 percent (or -5 percent to -20 percent).

IV. The rate of inflation should be determined for all the interest rate scenarios and not vary for each scenario.

V. Under dynamic capital adequacy testing (DCAT), the insurer’s financial condition would be satisfactory only if throughout the forecast period, the insurer meets the supervisory target capital requirement under the base scenario.

A. II only
B. IV and V
C. III, IV, and V
D. All but I
E. All
SECTION 2: WRITTEN ANSWER QUESTIONS

Answer five mandatory questions:

(Total of 34 points)
- Question 17  8 points
- Question 18  6 points
- Question 19  6 points
- Question 20  7 points
- Question 21  7 points
Question 17 (8 points)

Calculate a reserve for a life insurance waiver of premium for a disabled employee who has the following probabilities of death and recovery:

<table>
<thead>
<tr>
<th>Year following disablement</th>
<th>Probability of death ($q_x^{\text{death}}$)</th>
<th>Probability of recovery ($q_x^{\text{recovery}}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>0.20</td>
<td>0.50</td>
</tr>
<tr>
<td>2nd</td>
<td>0.15</td>
<td>0.40</td>
</tr>
<tr>
<td>3rd</td>
<td>0.10</td>
<td>0.30</td>
</tr>
<tr>
<td>4th</td>
<td>0.10</td>
<td>0.20</td>
</tr>
<tr>
<td>5th</td>
<td>0.10</td>
<td>0.90</td>
</tr>
</tbody>
</table>

a) Calculate the reserve for a $1,000 death benefit assuming that
   - The probabilities of death and recovery are mutually exclusive, hence $p_x = 1 - q_x^{\text{death}} - q_x^{\text{recovery}}$
   - The interest rate is 5%
   - Deaths occur at mid-year

b) You perform 10 simulations using a Monte Carlo technique. The results of these simulations are as follows:

<table>
<thead>
<tr>
<th>Trial</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Continues</td>
<td>Recovers</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
</tr>
<tr>
<td>2</td>
<td>Dies</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
</tr>
<tr>
<td>3</td>
<td>Continues</td>
<td>Recovers</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
</tr>
<tr>
<td>4</td>
<td>Recovers</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
</tr>
<tr>
<td>5</td>
<td>Recovers</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
</tr>
<tr>
<td>6</td>
<td>Continues</td>
<td>Recovers</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
</tr>
<tr>
<td>7</td>
<td>Continues</td>
<td>Continues</td>
<td>Recovers</td>
<td>N / A</td>
<td>N / A</td>
</tr>
<tr>
<td>8</td>
<td>Continues</td>
<td>Continues</td>
<td>Dies</td>
<td>N / A</td>
<td>N / A</td>
</tr>
<tr>
<td>9</td>
<td>Recovers</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
</tr>
<tr>
<td>10</td>
<td>Continues</td>
<td>Dies</td>
<td>N / A</td>
<td>N / A</td>
<td>N / A</td>
</tr>
</tbody>
</table>

i. Calculate the average reserve for a $1,000 death benefit based on these simulations assuming that:
   - The interest rate is 5%
   - Deaths occur at mid-year

ii. Calculate the standard deviation of the reserve.

c) Without performing any further calculations, describe any differences that you would expect between the standard deviation of the total reserve obtained by applying the Monte Carlo technique to a group of 50 disabled employees all having the same probabilities as the person valued above, and the standard deviation calculated in b) ii) above.
Question 18 (6 points)

ABC Life, a US company, has decided to set up a Canadian branch that will be active in group insurance (Life, AD&D, STD, LTD, health & dental) only. They have heard that Canadian requirements include dynamic capital adequacy testing (DCAT), a procedure that does not exist in the US. As their Canadian consulting actuary, they ask you to explain how a DCAT would be performed for a branch that transacts only group insurance in Canada.

a) Explain the role of DCAT within the company’s risk management framework.

b) Briefly describe the steps followed in a DCAT.

c) Describe the five types of deterministic scenarios and risks that you would recommend testing to the Appointed Actuary, considering the yearly term nature of the business.
Question 19 (6 points)
You have been asked to develop termination rates (mortality and recovery) for group life insurance waiver of premium products, using the CIA Group Life Waiver Study (document 20184) and the CIA Group LTD Termination Study (document 211103).

a) Compare and contrast the main results of both studies regarding mortality and recovery.

b) Identify aspects or elements that deserve particular attention in preparing your termination rates.
Question 20 (7 points)

You are the consulting actuary to the Lonely Toon Corporation (Lonely), a large Canadian company specializing in animated cartoons. The group insurance plan of Lonely Toon is insured by the Alphabetical Life Insurance Company (ALIC).

Currently, ALIC estimates incurred but not reported (IBNR) for the dental plan of Lonely at 15 percent of the premiums paid during the last four quarters. ALIC justifies this approach by saying that they validated their 15% factor by comparing the actual claims that were incurred but not paid at the end of the third quarter of 2016 (2016-03) with the premiums paid during the last four quarters ending with the 2016-03 quarter.

Here is the history of dental claims incurred by the employees of Lonely and their dependents since the first quarter of 2014:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Premiums paid during last four quarters *</th>
<th>Claims incurred during quarter at left and paid</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>During the quarter</td>
<td>During the next quarter</td>
</tr>
<tr>
<td>2014-01</td>
<td>$4,000,000</td>
<td>$550,000</td>
<td>$300,000</td>
</tr>
<tr>
<td>2014-02</td>
<td>$4,100,000</td>
<td>$400,000</td>
<td>$250,000</td>
</tr>
<tr>
<td>2014-03</td>
<td>$4,200,000</td>
<td>$450,000</td>
<td>$300,000</td>
</tr>
<tr>
<td>2014-04</td>
<td>$4,300,000</td>
<td>$600,000</td>
<td>$250,000</td>
</tr>
<tr>
<td>2015-01</td>
<td>$4,400,000</td>
<td>$550,000</td>
<td>$275,000</td>
</tr>
<tr>
<td>2015-02</td>
<td>$4,500,000</td>
<td>$425,000</td>
<td>$250,000</td>
</tr>
<tr>
<td>2015-03</td>
<td>$4,600,000</td>
<td>$475,000</td>
<td>$350,000</td>
</tr>
<tr>
<td>2015-04</td>
<td>$4,700,000</td>
<td>$575,000</td>
<td>$250,000</td>
</tr>
<tr>
<td>2016-01</td>
<td>$4,800,000</td>
<td>$575,000</td>
<td>$300,000</td>
</tr>
<tr>
<td>2016-02</td>
<td>$4,900,000</td>
<td>$450,000</td>
<td>$275,000</td>
</tr>
<tr>
<td>2016-03</td>
<td>$5,000,000</td>
<td>$500,000</td>
<td>$400,000</td>
</tr>
<tr>
<td>2016-04</td>
<td>$5,100,000</td>
<td>$600,000</td>
<td>$275,000</td>
</tr>
<tr>
<td>2017-01</td>
<td>$5,200,000</td>
<td>$575,000</td>
<td>$325,000</td>
</tr>
<tr>
<td>2017-02</td>
<td>$5,300,000</td>
<td>$475,000</td>
<td>$300,000</td>
</tr>
<tr>
<td>2017-03</td>
<td>$5,400,000</td>
<td>$525,000</td>
<td>$425,000</td>
</tr>
<tr>
<td>2017-04</td>
<td>$5,500,000</td>
<td>$625,000</td>
<td></td>
</tr>
</tbody>
</table>

* Including current quarter

a) Calculate the actual IBNR at the end of 2016-03 and compare it with the insurer’s IBNR factor
b) Calculate the actual IBNR at the end of 2014-04, 2015-04, and 2016-04 and express the result as a percentage of the corresponding premiums

c) Calculate the IBNR at the end of 2017-04 using the chain-ladder method.

d) Without making any further calculation, indicate how you could adapt/modify the chain-ladder method to address the seasonal pattern of claims.
**Question 21 (7 points)**

Fleur Deschamps resides in Québec and works for Les Machins Chouettes. She is a member of the following group insurance plan:

<table>
<thead>
<tr>
<th>Plan</th>
<th>Coverage</th>
<th>Annual Premium</th>
<th>Cost Sharing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Applicable to Ms. Deschamps</td>
<td>Employer</td>
</tr>
<tr>
<td>Life insurance</td>
<td>$100,000</td>
<td>$300</td>
<td>25%</td>
</tr>
<tr>
<td>Accidental death or disability insurance</td>
<td>$100,000</td>
<td>$50</td>
<td>100%</td>
</tr>
<tr>
<td>Short-term disability insurance</td>
<td>$600/week</td>
<td>$400</td>
<td>100%</td>
</tr>
<tr>
<td>Long-term disability insurance</td>
<td>$2,500/month</td>
<td>$250</td>
<td>0%</td>
</tr>
<tr>
<td>Health insurance</td>
<td>80% of eligible expenses after a $200 annual deductible</td>
<td>$800</td>
<td>75%</td>
</tr>
</tbody>
</table>

In 2017, Ms. Deschamps incurred the following expenses:

- Drugs: $2,500 (fully eligible for group insurance; the deductible is applied to the drugs)
- Chiropractic care: $900 ($500 eligible for group insurance)
- Miscellaneous medical expenses: $700 (fully eligible for group insurance)
- Laser eye surgery: $3,000 (not eligible for group insurance)

The tax credit rate is 15% for federal tax purposes and 20% for Québec tax purposes.

For purposes of calculating the tax credit, her net income is $42,000.

a) Calculate Ms. Deschamps’ taxable benefit under this plan for federal tax purposes.

b) Calculate Ms. Deschamps’ taxable benefit under this plan for Québec tax purposes.

c) Calculate the tax credit to which Ms. Deschamps is entitled for federal tax purposes.

d) Calculate the tax credit to which Ms. Deschamps is entitled for Québec tax purposes.