SOCIETY OF ACTUARIES
Individual Life & Annuities Canada – Design & Pricing

Exam DP-IC

MORNING SESSION

Date: Thursday, November 1, 2012
Time: 8:30 a.m. – 11:45 a.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 120 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 60 points).

   a) The morning session consists of 7 questions numbered 1 through 7.

   b) The afternoon session consists of 7 questions numbered 8 through 14.

   The points for each question are indicated at the beginning of the question.

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 since 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 DP-IC.

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

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Exam DP-IC Front Cover

****BEGINNING OF EXAMINATION****
Morning Session

1. (*10 points*) Live Long Life (LLL) is considering the addition of a new Long-Term Care (LTC) Accelerated Death Benefit Rider to its universal life products. The rider will be offered to new and existing policyholders.

(a) (*1 point*) List the top ten pricing mistakes made by the insurance industry as described in PD-5 Pricing Best Practices.

(b) (*6 points*) LLL wishes to target the new LTC rider to policyholders aged 50-80 and has decided not to target prospective policyholders with low and high household incomes. The rationale is that low income individuals cannot afford the product and high income individuals can afford to pay for long term care out of their current income.

(i) (*1 point*) Identify and describe this consumer market segmentation category.

(ii) (*3 points*) List the advantages and disadvantages of the primary categories of consumer market segmentation.

(iii) (*2 points*) Provide an example of how each primary category of consumer market segmentation can be used to determine the most appropriate market segment for LLL to pursue.

(c) (*3 points*) Explain the key considerations in designing and pricing the LTC rider.

2. (*12 points*) ABC Life is selling level premium whole life (WL) insurance to the middle income and high income markets through home service agents. ABC noticed that new sales have been declining for the past six quarters and decided to review its distribution strategy to minimize costs.

(a) (*1 point*) Describe the types of new agent financing plans available for ABC.

(b) (*4 points*) The current WL product pays a first-year commission only. You have been asked to add non-vested renewal commissions for newly sold policies while still meeting the after-tax stockholder earnings target (as a percentage of premium) of 6%. The new renewal commission rate should be level and paid at the beginning of years 2 through 5. Assume the commission payments do not impact investment income or taxes due. You are also given the following information:

End of Year	Cumulative Policyholder Persistency Rate	Cumulative Agent Attrition
1	95%	1%
2	90%	2%
3	85%	3%
4	80%	4%
5	75%	5%

- Discount Rate: 6%
- Reinsurance: None

	Lifetime Present Value
Premium	
1st year	1,000
Renewal	15,000
Expenses	
1st year commission	1,000
Acquisition	1,000
Maintenance	2,000
Benefits	9,000
Investment Income	1,000
Investment Income on Required Capital	500
DAC Amortization	750
Deferred Tax Provision	1,000
Tax on Earnings	500
Tax on Investment Income on Required Capital	200
Benefit Reserve Increase	500

Calculate the highest renewal commission that meets the profit objective. Show all work.

2. **Continued**

(c) (*4 points*)

(i) Evaluate the appropriateness of the current distribution method through home-service agents.

(ii) Evaluate the appropriateness of changing to a PPGA distribution system.

(d) (*3 points*) ABC provides the following agency contract to the commission-based individual insurance agents:

This contract is between Company ABC Life, hereinafter referred to as the Company and John Smith, hereinafter referred to as the Contractor. The Contractor has the authority to solicit and accept applications, issue receipts and collect initial premiums. The Contractor is not authorized to bind the Company to an insurance contract or collect renewal premiums.

The Contractor is required to act in good faith. They are to remit premiums within 24 hours of receipt; submit all reporting requirements within 3 days of the end of each month.

Compensation will be paid monthly based on all issued business that occurred in that month and will be paid one day after the end of the month. The commission schedule is as follows:

Year	*Percent*
1	*50*
2	*30*
3	*20*
4	*15*
5-10	*5*

If either party to the contract decides to terminate the contract, a minimum of 30 days notice must be given.

The Contractor must have Errors and Omissions (E&O) Insurance to protect the Company against financial liability for any negligent acts or mistakes. Intentional acts or wrong doing on the part of the Contractor will not be covered by the E&O Insurance.

Critique the terms of the agency contract and identify any contract terms that should be added. Justify your answer.

3. (*8 points*) You are the Dividend Actuary of KBL Mutual Life Insurance Company. On January 1, 2011, your company issued a block of single premium participating whole life policies, each with a death benefit equal to the original face amount of 100,000 plus the cash value, so that the Net Amount at Risk is always equal to the original face amount.

You are given:

Age	Number of Policies	Single Premium of Each Policy	Pricing Mortality Assumption
45	1,000	30,000	0.0012

- Pricing interest rate = 1.5%
- On July 1, 2011, KBL paid two death claims.
- KBL plans to pay dividends to each policyholder on December 31, 2011.
- Immediately prior to the dividend payments, the total amount of assets was 30,620,000.
- There are no lapses, commissions or expenses.

(a) (*2 points*)

(i) Calculate the actual mortality rate.

(ii) Evaluate its credibility using a 95% confidence interval (where $z = 1.96$).

(b) (*2 points*) Calculate the total profit margin from mortality and investment experience.

(c) (*4 points*)

(i) Describe considerations you should make in setting a dividend scale.

(ii) Recommend a dividend scale to be paid on December 31, 2011. Justify your recommendation.

4. (*6 points*)

(a) (*3 points*) Describe the factors that affect lapse rates for term insurance products, including industry trends that have impacted term lapse rates over the last 20 years.

(b) (*3 points*) Your company currently sells a 20-year Level Term Product through brokers. Annual Renewable Term (ART) premiums follow the initial level term period. The brokers would like you to add a 10-year Level Term product to target older individuals.

(i) Describe how the lapse assumptions used for the 10-year term product should differ from those used for the 20-year term product.

(ii) Describe changes which could be made to the 10-year term product or actions which could be taken to improve lapse rates.

5. (*9 points*)

(a) (*4 points*) Describe the impact the following would have on your choice of discount rates used in measuring the profitability of an insurance company:

(i) Whether the company is stock or mutual

(ii) Current interest rate levels

(iii) Tax rate

(iv) Product design

(v) Negative profits after the first year

(b) (*2 points*) Explain the impact of lowering the discount rate on the following profit measures:

(i) Value of New Business (VNB)

(ii) Internal Rate of Return (IRR)

(iii) Profit Margin (PM)

(c) (*3 points*) Explain what could cause two life products with identical VNBs to have different PMs.

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6. (*6 points*) You are the pricing actuary for XYZ, a BBB-rated company that writes universal life (UL) products, including those with secondary guarantees, and variable annuity (VA) products with living benefits. Your actuarial specialist has prepared a memo for senior management which discusses ways to reflect required capital and conditional stochastic pricing techniques in the pricing of these products.

Critique the specialist's memo below.

To: XYZ Executive Team
From: J. Brown, Actuarial Specialist
Re: Reflecting Capital in Product Pricing

Hi Everyone,

I've completed draft pricing results of both our Power Protector UL product, which includes a lifetime secondary no-lapse guarantee, and our Income Protector VA product, which includes both GMAB and GMWB riders. These pricing results reflect a provision for required capital in excess of reserves to cover the risk that reserves may not be adequate in isolation.

I have incorporated required capital into the pricing projections as follows:

- *Although most of our competitors target 300% of regulatory required capital as the appropriate level needed, I believe it is prudent to target 450% for these products.*
- *Since required capital is an additional buffer over reserves to meet our obligations, I have assumed assets backing required capital can be invested in a common stock portfolio to enhance the assumed investment return on capital and allow us to be more competitive.*
- *It is typical to reflect required capital for asset default risk on the assets backing required capital (i.e., "capital on capital"). For this component, I have assumed a required capital factor equal to the average asset default factor on assets backing reserves.*
- *Distributable earnings (DE) have been adjusted for required capital (RC) as follows:*

$$DE[t] = AfterTax\ Profit[t] - \left(RC[t] - RC[t-1] * (1 + InterestOnRC[t])\right) * (1 - TaxRate)$$

- *I have assumed that the company first injects required capital to support the products at the end of the first policy year.*
- *Lastly, due to modeling complications I have not reflected the impact of hedging or ALM strategies in the calculation of required capital.*

6. **Continued**

I considered using economic required capital instead of regulatory required capital. However, even at the 450% target, regulatory required capital was consistently lower than economic required capital, so I thought that would be too conservative and make the products uncompetitive. In particular, the economic required capital for the hedgeable risks in the VA product were substantial. Also, the covariance adjustment in the regulatory formula, which is not applicable to economic required capital, was another advantage.

I also incorporated a technique called "conditional stochastic pricing" which considers the adequacy of our capital in tail scenarios. This approach proved to be fruitful and allowed us to show attractive profitability at reasonably competitive prices.

Please contact me if you have any questions about this work.

7. (*9 points*) You are the pricing actuary for DVD Life that writes a universal life (UL) product with a lifetime secondary no-lapse guarantee, and a variable annuity (VA) product with both GMAB and GMWB riders.

(a) (*6 points*) For the UL and VA products:

(i) Identify the relevant risk components common to required capital frameworks.

(ii) Outline the various risks DVD may face due to changing interest rates.

(b) (*3 points*) You are given the following data for the UL product for the purpose of calculating Economic Required Capital:

	Best Estimate	**Shocked + 30% Mortality**	**Shocked +/−50% Lapse**
PV Charges	1,000,000	975,000	1,025,000
PV Benefits & Expenses	1,500,000	1,590,000	1,550,000
Fund Value	500,000		
Cost of Capital Rate	12%		
Operational Risk Charge	2%		
Investment Mismatch Charge	5%		
Diversification Factors			
Mortality	80%		
Lapse	90%		
Investment Mismatch	25%		
Operational	75%		

Assume there are no requirements for contagion risk for mortality and lapses.

Additionally, you are given the following data for the purpose of calculating Regulatory Required Capital under the U.S. Risk Based Capital (RBC) formula:

Asset Default (C-1) Risk Component	3,000
Insurance (C-2) Risk Component	5,000
Interest Rate (C-3) Risk Component	1,000
Other Risk (C-4) Component	500

Determine which of these two required capital formulas produces the higher diversification benefit. Show all work.

****END OF EXAMINATION****
Morning Session

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