SOCIETY OF ACTUARIES
Individual Life & Annuities United States – Design & Pricing

Exam DP-IU

AFTERNOON SESSION

Date: Thursday, April 26, 2012
Time: 1:30 p.m. – 4:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 9 questions numbered 7 through 15 for a total of 60 points. 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-IU.
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-IU Front Cover

****BEGINNING OF EXAMINATION****
AFTERNOON SESSION
Beginning with Question 7

7. (3 *points*) You are considering the use of underwriting predictive models similar to the models discussed in Deloitte's paper titled "Predictive Modeling for Life Insurance."

(a) (*1 point*) Describe the underwriting predictive modeling process.

(b) (*2 points*) Explain how predictive modeling can help deliver a competitive advantage.

8. (*6 points*)

(a) (*2 points*) You are developing new term products which feature a level initial premium for 10 years and then a higher ultimate premium for the remaining term of the products. You are presenting these new products to marketing and senior management.

(i) Recommend appropriate sensitivity tests for lapse and mortality assumptions for these products.

(ii) List the key areas on which agreement is needed to complete the reconciliation stage of the product development process.

(b) (*4 points*) You are given:

	Product 1		**Product 2**		**Combined Results**	
Year	Pre-Tax Profits	Distributable Profits	Pre-Tax Profits	Distributable Profits	Pre-Tax Profits	Distributable Profits
1	-100	-65	-132	-86	-232	-151
2	150	98	72	47	222	145
3	50	33	66	43	116	76
4	25	5	55	36	80	41
5	-38	-25	46	30	8	5

- Assume a hurdle rate of 12%
- Assume an after-tax discount rate of 6%

You are considering three alternatives:

Alternative A: Sell only product 1
Alternative B: Sell only product 2
Alternative C: Sell both products 1 and 2

Recommend which alternative the company should choose, using embedded value as the criterion. Show all work.

9. (*7 points*) QMD Life sells term life insurance and plans to enter the variable annuity market. QMD Life hired a consultant to design and price the new annuity product since they have no expertise in this market.

You are given:

- The product includes a Guaranteed Minimum Death Benefit (GMDB)
  - The value of an annuity of 1 per month is 45.9
  - The option cost at time 0 is 1.18
  - Initial Guarantee and Fund Value are 100
- The company's existing administrative system cannot support this annuity product.
- QMD Life is not willing to change the design of the new product.

(a) (*2 points*) Outline the costs and benefits of this new product.

(b) (*1 point*) Calculate the annual margin offset required to cover a GMDB option.

(c) (*4 points*)

(i) Propose an effective risk management strategy for this product assuming reinsurance is not available. Justify your answer.

(ii) Recommend a pricing approach to support the proposed risk management strategy. Justify your answer.

10. (*10 points*) You are evaluating the original pricing lapse assumptions for a long-term care (LTC) insurance product, based on the following experience:

Duration	Original Expected Lapse Rate by Monthly Benefit Amount	Monthly Benefit Amount Exposed (000)	Average Number Exposed (000)	Monthly Benefit Amount Lapsed (000)	Number Lapsed (000)	A/E Ratio by Monthly Benefit Amount	95% Confidence Interval for A/E by Amount
1	10%	975,000	195	65,000	13	66.67%	58% - 142%
2	8%	825,000	165	55,000	11	83.33%	48% - 152%
3	6%	725,000	145	45,000	9	103.45%	36% - 164%
4+ (Ultimate)	5%	625,000	125	5,000	1	-	-

Assume all policies are the same size.

(a) (*5 points*)

(i) Calculate the ultimate Actual to Expected (A/E) lapse rate by monthly benefit amount and the 95% confidence interval for the A/E ratio by amount for durations 4+.

(ii) Recommend adjustments to the lapse assumptions for pricing going forward. Justify your answer.

10. Continued

You are given the following for a projection of issues on the LTC product:

Target Profit Margin as a Percent of Premium	13%
PV of Premiums	10,000,000
PV of Benefits (Using Best Estimate Assumptions)	6,000,000
PV of Expenses (Using Best Estimate Assumptions)	1,500,000
PV of Investment Income on Reserve and Cash Flow	475,000
PV of Increase in Statutory Reserves	1,000,000
PV of Increase in Tax Reserves	900,000
PV of Investment Income on Required Surplus (RS)	35,000
PV of Increase in Required Surplus	500,000
PV of Taxes (Excludes Tax on Investment Income on RS)	200,000
MVM – Morbidity (Shock & Contagion)	750,000
MVM – Lapse (Shock & Contagion)	1,250,000
MVM – Investment Income Mismatch	375,000
MVM – Operational Risk	250,000
Transfer Tax on Liabilities	-50,000
Value of Tax Liability Timing Difference	25,000

Note: MVM is the Market Value Margin reflecting the effect of diversification.

All present values are discounted at a constant risk-free interest rate.

(b) (*5 points*)

(i) Calculate the Present Value of Profit as a Percent of Premium using the traditional pricing approach.

(ii) Calculate the Market Consistent Value of New Business.

(iii) Recommend whether or not to continue selling the current LTC product as priced, based on the results above.

11. (6 *points*) You are given the following information with respect to a UL policy:

- Specified Amount equals 100,000
- Base Insured Issue Age is 40
- Guaranteed Crediting Rate is 4%
- Base Policy Guideline Single Premium equals 10,000
- Base Policy Guideline Level Premium equals 1,000
- Annuity factors: $\ddot{a}_{45:\overline{10}|} = 6; \quad \ddot{a}_{45:\overline{20}|} = 10; \quad \ddot{a}_{45:\overline{50}|} = 16$
- The policy is not a Modified Endowment Contract.
- Federal Income Tax Rate equals 20%.

Year	**1**	**2**	**3**	**4**	**5**
Premium	3,000	3,000	3,000	1,000	0
Account Value	600	1,300	2,000	2,750	1,200
Cash Surrender Value	0	0	200	1,000	200

Policy A: Includes a 10-year term rider on a business partner, issue age 45, with annual rider charges of 500

Policy B: Includes a 20-year rider on a spouse, issue age 45, with annual rider charges of 1,000

The policyholder makes a partial withdrawal of 100 at the end of the fifth policy year on both Policy A and Policy B.

For each of policy A and B:

(i) Determine whether it qualifies as life insurance under Section 7702. Show all work.

(ii) Calculate the Federal Income Tax due in year five. Show all work.

12. (*8 points*) RNC Life Insurance Company has the following profile:

Goal:	Continue to grow and remain as the major competitor in the target market which provides best long-term value for customers
Main Products:	Individual Universal Life and Annuities
Target Market:	Upper-middle and high net-worth customers
Sales Force:	Captive Agents

(a) (*2 points*) Describe key elements of a product strategy that RNC should implement to achieve its goal and outline possible tactics RNC can use.

(b) *(6 points)* You are given the following information on the assets backing the Deferred Annuity policyholder account:

Asset Class	Gross Yield	Annual Default Cost	Investment Expenses	Term to Maturity
Government Bonds	5.0%	0.00%	0.02%	10
Corporate Bonds	6.5%	0.01%	0.04%	15
Junk Bonds	10.0%	1.00%	0.10%	7

In addition, the investment strategy has:

- A limit of 20% on the amount of junk bonds
- Average term to maturity of 10 years for fixed income assets
- Annuity crediting rate strategy: Net Yield – 1.25%

(i) Calculate the annuity account's crediting rate.

(ii) Discuss the purpose of the interest rate spread (i.e. 1.25%) in the crediting rate strategy.

(iii) Critique the crediting rate strategy methodology in a rising interest rate environment.

13. (*7 points*) You are given:

- You are a consulting FSA.
- You were retained by MKH Life, which markets insurance on the internet, to prepare an analysis of their marketing lead generation results with the corresponding click-through-rates.
- An ASA on your staff prepared the analysis using data provided by MKH, and e-mailed the results to MKH with no other supporting documentation.
- MKH used that analysis in its recent marketing campaign, which was a failure.
- MKH has contacted you, demanding an explanation.
- Your review determined that the data provided by MKH was faulty and that this was the primary reason for the failure of the marketing campaign.

(a) (*2 points*) Evaluate the various Internet Lead Generation techniques and their likelihood for success.

(b) (*0.5 points*) Explain why ASOP 41, Actuarial Communications, applies.

(c) (*3 points*) Identify the requirements under ASOP 41 which should have been followed in the communication from the ASA.

(d) (*1.5 points*) Identify the data requirements from ASOP 23 Data Quality which should have been in the analysis performed by the ASA.

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14. (*7 points)*

(a) (*3 points*) IRM Life's current Variable Annuity (VA) design has the following features:

Investment Options	Fund A Fund B Fixed interest account earning 2%
Expense load	8% of deposit amount
Surrender charges	15% of the account value in year one and decreasing by 1% at the beginning of each year to 0% in year 16 and thereafter
Transfer fee	0.05% of amount transferred

You are given the following information regarding a policy purchased on January 1, 2010:

			Unit Values	
Date	**Transaction**	**Investment Option**	**Fund A**	**Fund B**
January 1, 2010	1,000 deposit	100% in the fixed interest account	8.00	20.00
January 1, 2011	1,000 deposit	50% in Fund A 50% in Fund B	9.00	21.00
January 1, 2012	200 withdrawal	100% from Fund A	10.00	21.25
January 1, 2013	None		8.50	23.00
January 1, 2014	Transfer	100% of the fixed interest account value to Fund B	9.25	20.00

Calculate the annuity account value as of January 1, 2014 after the transfer. Show all work.

14. Continued

(b) (*4 points*) IRM Life is considering adding either a Guaranteed Minimum Income Benefit (GMIB) or Guaranteed Annuity Option (GAO) to this VA product. You are given:

- The contract holder pays a single premium.
- Issue age is 55.
- In the absence of a GMIB or GAO the contract can be annuitized with annual annuity payments of 1,000 at age 65
- The assumed interest rate at annuitization is 3%.
- Actuarial Values:

$$\ddot{a}_{65} @ 2\% = 15$$
$$\ddot{a}_{65} @ 3\% = 12$$
$$\ddot{a}_{65} @ 4\% = 9$$

- The GAO provides a guaranteed annual annuity of 90 per 1000 of maturity lump sum at age 65.
- The GMIB is calculated assuming the fund grows at 5% per year during the 10-year accumulation period
- The GMIB uses 3% to calculate the guaranteed annuity payment at age 65.

(i) Outline GMIB pricing and modeling considerations.

(ii) Recommend a design for this contract that minimizes the cost of the guarantee to the company.

15. (*6 points*) You are the Illustration Actuary of a U.S. life insurance company, XYZ. Your company sells a universal life product called XYZalator. The current credited rate on their UL block is 5%.

(a) (*1 point*) List six of the requirements in the NAIC Life Insurance Illustrations Model Regulation you must perform for the Annual Certification.

(b) (*5 points*) You are given the following illustration:

Company XYZ
An Illustration of XYZalator (2009) – Universal Life

Client Name	Joe Doe	Specified Face Amount	500,000
Age	55	Death Benefit Option	A(Level)
First Payment	10,000	Premium Frequency	Annual

This is an illustration of XYZ Company's XYZalator (2009) a universal life insurance product. This illustration has been prepared to give you a better understanding of (1) the mechanics of XYZalator (2009) and (2) how the credited interest rate could affect policy values and death benefit. Unless otherwise noted, all credited rates and expenses are illustrative and are not guaranteed.

Overview of Your Policy

You chose the Specified Face Amount, the Death Benefit Option and the amount of frequency of payments.

An Expense charge is applied to each Premium paid. This change is currently 5%. This change will be determined by us from time to time based on our expectations of future expenses and taxes but cannot exceed 10%.

At the beginning of each year, we will deduct from the Account Value the cost of insurance (COI), a 100 expense charge. A current expense of 200 per thousand of a specified amount is also deducted at the beginning of each year for the first 10 policy years.

The cash Surrender value equals the Account Value less any surrender charge and less any policy loans and outstanding loan interest. Surrender charges apply for 10 years from issue and are equal to:

Year 1:	9,000	Year 2:	9,000	Year 3:	7,000	Year 4:	7,000
Year 5:	5,000	Year 6:	5,000	Year 7:	5,000	Year 8:	3,000
Year 9:	2,000	Year 10:	1,000				

Illustration and Your Policy

This illustration is not a contract and will not become part of any policy issued by us. The policy constitutes the actual agreement of coverage and contains the entire terms of the contract.

Prepared on December 1st, 2010
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15. Continued

Company XYZ
An Illustration of XYZalator (2009) – Universal Life

Client Name	Joe Doe	Specified Face Amount	500,000
Age	55	Death Benefit Option	A(Level)
First Payment	10,000	Premium Frequency	Annual

Interest Rate:	10%	5%	3%
Interest Base:			Guaranteed
COI Base	Current	Current	Guaranteed
Expense Charges	Current	Current	Guaranteed
	Basis #1	Basis #2	Basis #3

		Basis #1				Basis #2				Basis #3			
Year	Age	Premium Outlay	Cash Surrender Value	Death Benefit	Account Value	Premium Outlay	Cash Surrender Value	Death Benefit	Account Value	Premium Outlay	Cash Surrender Value	Death Benefit	Account Value
1	56	10,000	-	500,000	8,140	10,000	-	500,000	7,700	10,000	-	500,000	7,493
2	57	15,000	13,036	500,000	22,036	15,000	11,666	500,000	20,666	15,000	10,461	500,000	19,461
3	58	20,000	34,948	500,000	41,948	20,000	31,674	500,000	38,674	20,000	28,576	500,000	35,576
4	59	25,000	61,146	500,000	68,146	25,000	54,782	500,000	61,782	25,000	48,536	500,000	55,536
5	60	30,000	95,912	500,000	100,912	30,000	84,978	500,000	89,978	30,000	74,060	500,000	79,060
6	61	30,000	130,043	500,000	135,043	30,000	112,998	500,000	117,998	30,000	95,738	500,000	100,738
7	62	-	132,600	500,000	137,600	-	109,343	500,000	114,343	-	84,805	500,000	89,805
8	63	-	137,162	500,000	140,162	-	107,592	500,000	110,592	-	76,541	500,000	79,541
9	64	-	140,729	500,000	142,729	-	104,745	500,000	106,745	-	67,898	500,000	69,898
10	65	-	144,302	500,000	145,302	-	101,804	500,000	102,804	-	59,830	500,000	60,830
15	70	-	170,294	500,000	170,294	-	92,120	500,000	92,120	-	31,653	500,000	31,653
20	75	-	198,429	500,000	198,429	-	78,956	500,000	78,956	-	8,898	500,000	8,898
25	80	-	230,482	500,000	230,482	-	63,345	500,000	63,345	-	(9,460)	500,000	(9,460)
30	85	-	267,417	500,000	267,417	-	45,316	500,000	45,316	-	(24,809)	500,000	(24,809)
35	90	-	310,436	500,000	310,436	-	24,899	500,000	24,899	-	(38,098)	500,000	(38,098)
40	95	-	361,036	500,000	361,036	-	2,125	500,000	2,125	-	(49,977)	500,000	(49,977)
45	100	-	421,084	500,000	421,084	-	(22,979)	500,000	(22,979)	-	(60,890)	500,000	(60,890)
50	105	-	492,906	591,487	492,906	-	(50,382)	500,000	(50,382)	-	(71,142)	500,000	(71,142)
55	110	-	579,400	695,280	579,400	-	(80,056)	500,000	(80,056)	-	(80,943)	500,000	(80,943)
60	115	-	684,179	821,014	684,179	-	(111,973)	500,000	(111,973)	-	(90,433)	500,000	(90,433)
65	120	-	852,009	1,022,411	852,009	-	(111,103)	500,000	(111,103)	-	(62,350)	500,000	(62,350)

Prepared on December 1st, 2010
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Recommend modifications needed to make this illustration compliant with the NAIC Life Insurance Illustrations Model Regulation.

****END OF EXAMINATION****
AFTERNOON SESSION

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