EXAMINATION

12 November 2010 (am)

Subject F102 — Life Insurance Principles

Time allowed: Three hours

INSTRUCTIONS TO THE CANDIDATE

1. *Enter all the candidate and examination details as requested on the front of your answer booklet.*

2. *You have 15 minutes at the start of the examination in which to read the questions.*
   You are strongly encouraged to use this time for reading only, but notes may be made.
   You then have three hours to complete the paper.

3. *You must not start writing your answers in the booklet until instructed to do so by the supervisor.*

4. *Mark allocations are shown in brackets.*

5. *Attempt both questions, beginning your answer to each question on a separate sheet.*

6. *Candidates should show calculations where this is appropriate.*

AT THE END OF THE EXAMINATION

Hand in BOTH your answer booklet, including any additional sheets firmly attached, and this question paper.

In addition to this paper you should have available the 2002 edition of the Formulae and Tables and your own electronic calculator from the approved list.

Question 1

Discuss how a life company would ensure that its exposure to longevity risk on non-profit immediate annuities remains within its risk limits.

[Total 6]

Question 2

A life insurance company sells compulsory purchase unit-linked living annuities where a policyholder chooses the portfolios in which to invest and the income to be received every month. The income is specified at the start of the year and can only be changed at each anniversary date. Dividends and interest earned on the unit fund are reinvested. The company charges a fee of $1/12^{th}$ of 1% of the value of the assets per month.

(i) List the advantages and risks of this product to the policyholder.

[2]

(ii) Briefly discuss the appropriate investments to back the liabilities.

[2]

(iii) The total market value of all the life assurance company's equity assets has fallen by 25%. Briefly discuss the effect on the solvency of the company.

[3]

The company is considering offering an option where the policyholder at the start of each year chooses a monthly income based on the value of a selected number of units to be realised each month. The pension payable each month is equal to the value of this number of units at the date of the relevant monthly payment. The company will offer a guarantee that the pension in a particular month will not be less than the amount payable in the first month of the year. The cost of the guarantee will be recovered from the assets at the start of the year.

(iv) Describe how you will calculate the price of this guarantee.

[5]
[Total 12]

Question 3

A small mutual life insurance company sells without-profits unit linked endowments and conventional with-profits policies. Reversionary and terminal bonuses are declared on the with-profits products using the addition to benefits method. The country in which the company operates is recovering from a harsh recession and unit-linked new business sales have started to increase. The with-profits policies, however, are becoming unpopular in the country and sales on these products have been poor with the result that the size of this book of business is diminishing. In an effort to stimulate the economy the government has reduced the repo rate and the economy has shifted into a low interest environment. The company has reduced its reversionary bonus rates.

(i) The embedded value of the company is reflecting improving profitability as the country is emerging from the recession and unit linked new business sales are increasing. Discuss why this improved profitability may have not resulted in an increase in the reversionary bonus rates.

[6]

(ii) The director of the company has made two suggestions:

(a) Demutualising the company. Discuss possible reasons for this suggestion.

[6]

(b) Closing to new business and distributing the current free surplus and the present value of future income from the unit-linked business to the remaining with-profit policyholders. Discuss how the company could distribute these sources of surplus to the with-profit policyholders.

[5]

[Total 17]

Question 4

In respect of a without profit regular premium endowment assurance contract:

(i) The policyholder is considering making the policy paid-up. State the factors that you as actuary to the insurer would consider when determining the basis and method for altering the policy to paid-up status.

[4]

(ii) Describe the proportionate method and equating policy values method and compare both methods.

[6]

(iii) Assume the equating of policy values method is used. Discuss the profit emerging from the contract assuming the surrender value and the policy value after the alteration are calculated using a realistic prospective value.

[2]

[Total 12]

Question 5

You are the actuary of a new life company in a developing country. The life insurance industry has not yet been established and there are no specific regulations for life insurance business although you expect them to be introduced in the medium term. Your first task is to design a low sum assured life policy with limited underwriting.

(i) Explain your considerations to determine your company's underwriting approach and how this may influence the product desigin.

[5]

(ii) Explain how you would use a reinsurer to price and design the product and the likely types of reinsurance that you may require.

[6]

(iii) You have decided to produce a valaution to serve in place of a statutory valuation until regulations are introduced. Discuss your approach and the issues you may face.

[7]

(iv) After a few successful years, your company decides to launch a new product range with high sum's assured payable on death or disability. Discuss the likely differences of your answers in (i) and (ii) to

- the underwriting approach; and
- the reinsurance requirements;

for this new product.

[7]

[Total 25]

Question 6

You work for a life office that sells retirement savings products. Individuals receive a cash lump sum retirement benefit that is linked to the performance of the underlying investments that are selected by the policyholder. Policyholders pay a single premium at entry. The maximum age for new policyholders is 50.

Individuals can elect to receive their retirement benefit at any time between 55 and 70. It has been proposed that a minimum retirement benefit is introduced on new business. The minimum benefit will be equal to a multiple of the single premium where the multiple is determined by the policy duration at retirement.

(i) List the factors to be considered when amending the design of this product.

[6]

(ii) Describe how you would use option pricing techniques to price this guarantee

[4]

(iii) The company decides to charge an initial fee for providing the guarantee and apply the guarantee to the premium net of this guarantee charge. Describe the cashflow model that you would use to estimate the distribution of the return on capital for the product with the guarantee

[4]

[Total 14]

Question 7

A life insurance company has a large, well-established book of term assurance business and is concerned about deteriorating persistency, particularly among female policyholders.

(i) Discuss how you would carry out a withdrawal investigation to ascertain if there is a trend in withdrawal rates and a difference in persistency by gender.

[8]

(ii) A significant gender effect is detected and you are asked to carry out a mortality investigation to assess if the pricing basis may require adjustment. List the variables that you would use for this analysis and explain how would you use the results of the mortality investigation to set the pricing basis?

[6]

[Total 14]

[GRAND TOTAL 100]