

INSTITUTE AND FACULTY OF ACTUARIES



EXAMINATION

5 October 2016 (pm)

Subject ST2 – Life Insurance Specialist Technical

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 must not start writing your answers in the booklet until instructed to do so by the supervisor.*
3. *You have 15 minutes of planning and reading time before the start of this examination. You may make separate notes or write on the exam paper but not in your answer booklet. Calculators are not to be used during the reading time. You will then have three hours to complete the paper.*
4. *Mark allocations are shown in brackets.*
5. *Attempt all five questions, beginning your answer to each question on a new page.*
6. *Candidates should show calculations where this is appropriate.*

AT THE END OF THE EXAMINATION

Hand in BOTH your answer booklet, with 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.

- 1**
- (i) Write down the formula used to perform a data reconciliation check. [1]
 - (ii) List four examples of data items that might be validated using a data reconciliation check. [2]
 - (iii) Outline six examples of data consistency checks. [3]
 - (iv) List six examples of unusual data values. [3]
- [Total 9]
- 2**
- (i) Suggest possible reasons why a life insurance company would offer guarantees or options on its products. [4]
- Offering an investment guarantee on a product introduces further risks to the life insurance company, which are in addition to those risks that already relate to the underlying product.
- (ii) Describe these additional risks. [7]
- [Total 11]
- 3**
- A life insurance company is considering changing its sales distribution approach. The current approach is to use a direct salesforce, which provides advice to clients.
- The company is considering moving to a direct marketing approach and ceasing to sell policies through the direct salesforce. No advice will be provided by the company when selling through direct marketing.
- Assess the impact this change will have on the risk profile of the company, including on its demographic and expense experience. [14]

4 A proprietary life insurance company has historically only written unit-linked business using a direct salesforce. The company is considering developing and launching a new conventional without profits immediate annuity product. It intends to sell this product using direct marketing.

(i) Describe the factors that the company should consider in determining a suitable design and price for the annuity product. [20]

(ii) Suggest ways in which the new product could be marketed. [6]
[Total 26]

- 5 A proprietary life insurance company is about to sell a tranche of a conventional with profits immediate annuity product. It can be assumed that all policies will commence on the same date (1 January).

The product is written on a single life basis, does not pay any additional benefit on death and does not pay any surrender value.

The insurance company uses the following definitions:

<i>Item</i>	<i>Definition</i>
t	Time measured in years from the inception of the tranche, with the first policy year being denoted as year $t = 1$.
$A(t)$	The annuity benefit payable to the policyholder at the start of year t .
G	The single premium payable by the policyholder aged x .
$B(t)$	The bonus rate applicable for year t . The bonus rate is guaranteed to be not less than zero. $B(1) = 0$.
\ddot{a}_x	The present value of an annuity of 1 payable annually in advance, allowing for expected mortality and a discount rate of 2.8% per annum.
$AS(t)$	The aggregate asset share at the end of year t for the tranche of with profits immediate annuity policies.

Each year, there is a one-off bonus paid at rate $B(t)$. This does not form a guaranteed addition to the benefits payable, and is paid out in cash as part of the annuity benefit payment. There is no terminal bonus.

Under this product, the guaranteed level of annuity benefit starts at $A(1)$ and then reduces each year by 3%.

The following table summarises other relevant information about this product:

Benefit frequency	Annuities are payable annually in advance
Calculation of initial annuity payable, $A(1)$	$0.95 \times G = A(1) \times \ddot{a}_x$
$A(t)$	$(A(1) / 1.03^{(t-1)}) \times (1 + B(t))$
Guarantees	<p>The guaranteed annuity payable at the beginning of year t is $A(1) / 1.03^{(t-1)}$.</p> <p>The cost of the guarantee (i.e. that $B(t)$ is not negative), if it bites, is borne by the shareholders.</p>
Calculation of $B(t)$	$B(t)$ is set so that $AS(t - 1) = \sum \{A(t) \times \ddot{a}_{x+t-1}\}$ where this is summed across the tranche of in-force with profits annuity policies at the end of year $t - 1$ (for $t > 1$).

Commission	5% of G . This is directly chargeable to asset shares.
Expense charges	0.2% of the asset share is taken as renewal expense charges each year, where this is implemented as a deduction from the investment return.
Shareholder profits	Any difference between the renewal expense charges taken from the asset shares and the actual expenses incurred in respect of this business will accrue as profit or loss to the shareholder. The shareholders do not receive any proportion of the bonus distribution. However, as noted above, the shareholders bear the cost of the guarantee, if it bites.
Mortality	The aggregate asset share calculation allows for actual mortality experience across the tranche of with profits immediate annuity business.
Tax	No tax is payable by the policyholder or the insurance company.

- (i) Explain how the aggregate asset share would be determined for this product immediately after the tranche has been written. [1]
- (ii) Explain how the aggregate asset share at the end of year t would be determined for this product. [3]
- (iii) Describe the risks of this product for the policyholder. [5]
- (iv) Describe the risks of this product for the insurance company and its shareholders. [17]

For the purpose of the following calculations, it can be assumed that actual mortality is as expected in the first year.

- (v) Determine the investment return that the company needs to earn in year 1 to ensure that the annuity benefit payable at the start of year 2 is the same as that paid at the start of year 1.

[Hint: It is not necessary to calculate any annuity factors. You should consider the recursive formula $\ddot{a}_{x+t} = (\ddot{a}_x - 1) (1 + i) / (1 - q_x)$.] [5]
- (vi) Determine $A(2)$ if $A(1) = 10,000$ and the investment return earned during year 1 was +5%. [4]
- (vii) Determine $A(2)$ if $A(1) = 10,000$ and the investment return earned during year 1 was -5%. [1]
- (viii) Comment on whether additional charges should be deducted from the asset shares. [4]

[Total 40]

END OF PAPER