

INSTITUTE AND FACULTY OF ACTUARIES



EXAMINATION

28 September 2017 (am)

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 six 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) State possible reasons why a life insurance company would analyse the surplus arising over a year on its supervisory valuation basis. [3]

A life insurance company has recently performed an analysis of surplus on its supervisory valuation basis over the previous year. It has identified a significant mortality loss on its protection business.

- (ii) Suggest actions that the company might take as a result of identifying this loss. [8]
[Total 11]

- 2 A life insurance company sells the following types of business:

- conventional with profits endowment assurances; and
- conventional without profits term assurances with level premiums.

The company uses the “additions to benefits” method to distribute profits to the with profits policyholders.

The without profits business is written in the same fund as the with profits business. The profits arising on the term assurances are added to the asset shares of the with profits business.

The company calculates actual asset shares for the with profits business. It also projects these asset shares one year forward using best estimate assumptions.

The company has just recalculated the actual asset shares and is comparing the results against the projected asset shares that were calculated one year ago.

The following experience has been observed over the past year:

1. Actual investment returns have been much higher than the best estimate rate used in the previous projection.
2. Mortality claim experience on the term assurances has been much lighter than the best estimate assumptions.
3. Lapse rates on the term assurances have been a little higher than the best estimate assumptions.
4. Surrender rates on the endowment assurances have been a little higher than the best estimate assumptions.
5. The number of endowment assurances being made paid-up (ceasing to pay premiums) has increased a little compared to the best estimate assumptions.

- (i) Assess the impact that each of these experience observations would have had on the actual asset shares compared to the projected values. [Your answer should consider each observation in isolation.] [9]

- (ii) Discuss the possible implications of the previous year’s overall experience for the future bonuses that the company could declare. [3]

[Total 12]

- 3** A life insurance company (“the company”), which is closed to new business, is about to start the process of setting per policy renewal expense assumptions for the year end supervisory valuation.

Since the assumption setting exercise was undertaken for the previous year end, the company has signed an outsourcing agreement for ten years with a third party administrator (“the outsourcer”). The agreement covers all customer service functions (including premium collection and claims management) and also covers the development and maintenance of a new administration system. The level of development is based on an agreed fixed budget each year.

All staff employed in the outsourced functions are now directly employed by the outsourcer, but currently remain located in the office occupied by the company. It is likely that, during the term of the agreement, these staff will move to a separate property owned by the outsourcer. The outsourcer will pay rent to the company whilst the transferred staff occupy part of the company’s office.

The agreement does not cover any overhead functions, and all liabilities to policyholders remain the responsibility of the company.

The company will pay an inflation-linked monthly fee to the outsourcer in respect of the ongoing costs of administering the company’s business. The policy fee is based on the number of policies in force at the beginning of each month. This fee includes the systems development costs of the outsourcer, under the agreed budget.

The agreed per policy fee will reduce after five years of the agreement, anticipating efficiencies being implemented by the outsourcer.

The process for setting the company’s per policy renewal expense assumptions for the supervisory valuation will need to change as a result of the outsourcing arrangement.

Discuss the extent to which the various elements of this process, including the underlying expense analysis, may change.

[14]

- 4 (i) Describe the general features of an internal unit-linked fund. [3]
- (ii) State the basic equity principle of unit pricing for an internal fund. [1]

The following information is available for a particular internal unit-linked fund provided by a life insurance company at a given valuation point.

The market value of assets includes the impact of all settled deals in respect of investments that have been recently purchased or sold.

	\$
Market offer price value of assets	150,000
Market bid price value of assets	148,000
Expenses that would be incurred in the purchase of assets	3,750
Expenses that would be incurred in the sale of assets	3,000
Stamp duty that would be incurred in the purchase of assets	750
Cash on deposit	1,250
Loans to the fund	575
Investments sold but not yet settled	775
Investments purchased but not yet settled	640
Accrued income	275
Accrued tax	300
	Units
Number of units in force	20,000

- (iii) Show that the appropriation price at the valuation point for units in this fund is \$7.76425. [3]

Every day the life insurance company considers whether to price on a bid or offer basis, with the decision depending on the net flows of unit creations and cancellations.

A 2% bid/offer spread is included within the pricing. The subsequent offer and bid prices are quoted to three decimal places and are rounded in favour of the customer.

At the given valuation point, unit transactions indicate that unit cancellations will exceed unit creations.

- (iv) Calculate the offer and bid prices of the units in this fund at the valuation point. [5]

The company is considering changing the methodology for rounding unit prices, so that the rounding does not favour either the company or the customer.

- (v) Discuss why the company might be considering changing the rounding methodology. [4]

The company does not always change the unit pricing calculation basis when the net flows indicate that it should.

- (vi) Suggest possible reasons for this. [3]
- [Total 19]

- 5** A recently established proprietary life insurance company sells only simple term assurance products through direct marketing.

It is now considering selling a new regular premium unit-linked endowment assurance product that enables the customer to add further additional options and benefits to the product at an additional cost throughout the policy's lifetime.

The basic benefit payable for the endowment is the greater of the unit value or a guaranteed minimum benefit on death or maturity. On surrender the benefit is the unit value of the policy.

The additional options and benefits available are as follows:

- waiver of premium on sickness or redundancy;
- additional accidental death benefit; and
- a guaranteed income based on the value of the units at the maturity date, using a guaranteed annuity rate which is set at the time when this option is added to the policy.

Underwriting is performed at the start of the policy, but is not performed again when an option is added.

There are no similar products, benefits or options in the market in which the company operates.

- (i) Explain why the company may need to raise additional capital to support the introduction of the new product. [6]
- (ii) Describe the risks arising for the company in relation to the new product. [18]
- [Total 24]

- 6** A twenty year regular premium term assurance policy with a sum assured of \$50,000 is to be issued to a person aged 40 exact.

The policy has an option that at the tenth policy anniversary the policyholder may increase the sum assured to \$100,000 for the remaining ten year term without providing evidence of health. The extra regular premiums payable for the additional \$50,000 cover will be set using the company's standard premium rates at that time.

Standard premium rates use Select mortality. All premiums are payable annually in advance and death benefits are payable at the end of the year of death.

The tables below are provided for use in parts (ii) and (iii) of this question. They are based on a defined mortality table and 4% per annum interest.

<i>Factor</i>	<i>Value</i>
$A_{40:\overline{10} }^1$	0.01151
$A_{[40]:\overline{10} }^1$	0.01132
$A_{40:\overline{20} }^1$	0.03429
$A_{[40]:\overline{20} }^1$	0.03411
$A_{45:\overline{10} }^1$	0.01946
$A_{[45]:\overline{10} }^1$	0.01915
$A_{45:\overline{20} }^1$	0.05923
$A_{[45]:\overline{20} }^1$	0.05894
$A_{50:\overline{10} }^1$	0.03423
$A_{[50]:\overline{10} }^1$	0.03367
$A_{50:\overline{20} }^1$	0.10162
$A_{[50]:\overline{20} }^1$	0.10109
$A_{55:\overline{10} }^1$	0.06037
$A_{[55]:\overline{10} }^1$	0.05925
$A_{55:\overline{20} }^1$	0.16871
$A_{[55]:\overline{20} }^1$	0.16773

<i>Factor</i>	<i>Value</i>
$\ddot{a}_{40:\overline{10} }$	8.393
$\ddot{a}_{[40]:\overline{10} }$	8.395
$\ddot{a}_{40:\overline{20} }$	13.927
$\ddot{a}_{[40]:\overline{20} }$	13.930
$\ddot{a}_{45:\overline{10} }$	8.366
$\ddot{a}_{[45]:\overline{10} }$	8.368
$\ddot{a}_{45:\overline{20} }$	13.780
$\ddot{a}_{[45]:\overline{20} }$	13.785
$\ddot{a}_{50:\overline{10} }$	8.314
$\ddot{a}_{[50]:\overline{10} }$	8.318
$\ddot{a}_{50:\overline{20} }$	13.518
$\ddot{a}_{[50]:\overline{20} }$	13.525
$\ddot{a}_{55:\overline{10} }$	8.219
$\ddot{a}_{[55]:\overline{10} }$	8.228
$\ddot{a}_{55:\overline{20} }$	13.073
$\ddot{a}_{[55]:\overline{20} }$	13.088

<i>Factor</i>	<i>Value</i>
D_{40}	2,052.96
$D_{[40]}$	2,052.54
D_{45}	1,677.97
$D_{[45]}$	1,677.42
D_{50}	1,366.61
$D_{[50]}$	1,365.77
D_{55}	1,105.41
$D_{[55]}$	1,104.05

The company has decided to calculate the expected present value of the option cost using the conventional method. The assurance and annuity factors used are the relevant factors from the tables above, and it is assumed that there are no expenses.

- (i) State the two assumptions used in calculating option costs under the conventional method. [2]
- (ii) Determine the expected present value of the option cost using the conventional method. [5]

The company has also decided to calculate the expected present value of the option cost using the North American method and the following assumptions:

Standard mortality:	Defined mortality table Select
Interest:	4% per annum
Expenses:	None
Proportion exercising option:	50% of all eligible customers
Mortality after taking the option:	Defined mortality table Ultimate with five years added to the actual age

It is assumed that those who do not take up the option continue to experience Ultimate mortality with no adjustment.

- (iii) Determine the expected present value of the option cost using the North American method. [5]
- (iv) Explain which two of the above assumptions have been most responsible for the significant difference between the cost calculated under the North American method and that under the conventional method. [2]
- (v) Outline the circumstances under which the actual cost would be higher than the value calculated by the North American method. [4]
- (vi) Suggest possible reasons why a policyholder may choose to exercise the option. [2]

[Total 20]

END OF PAPER