Course Coverage

Question	Unit	Key performance outcomes	Learning objectives	Marks
1(a)	3	9	9.2	12
1(b)	1,2,3	2,4,5,7,8,9	2.2,2.3,4.2,5.2,5.4,7.6,8.1,8.2,8.3,9.2	12
1(c)	1,2	2,4,5,7,8	2.3,4.2,5.2,5.4,7.2,7.4,7.6	6
2(a)	1,2,3,4	1,3,5,6,9,11,14	1.1,1.2,5.4,6.1,6.3,8.3,9.2,11.3,11.6,14.2	12
2(b)	2,3,4	4,5,9,13	4.1,5.4,9.5,13.1	6
2(c)	1,2,3,4,5	1,2,4,5,6,7,9,10,11,12,13,15	1.1,1.2,1.3,2.3,4.1,4.2,5.3,6.1,6.3,7.1,7.2,7.4,7.6,9.5,10.3,11.4,12.1,12.2,12.3,13.1,12.3,15.1	12
TOTAL				**60**

COURSE 2A LIFE INSURANCE SEMESTER 2 2013 EXAMINATIONS

QUESTION 1 (30 MARKS)

You are an actuary at HiAndLo Ltd, responsible for conducting experience analyses. HiAndLo Ltd is an Australian Life Insurer that has been selling YRT insurance through a range of distribution channels for some time.

The key markets that HiAndLo focuses on are:

- high net wealth individuals - those with $2m or more in assets, predominantly serviced through several independent key broker groups , and
- the "low to middle market" – those with assets around $100,000, who purchase YRT insurance through a variety of distribution channels – independent brokers but also tied agents of HiAndLo and direct channels such as the internet.

All YRT products are subject to a full underwriting process that is similar to that of other insurers in the market.

HiAndLo has a 50/50 quota share reinsurance arrangement in place with several reinsurers, but it does not carry any stop loss or catastrophe reinsurance cover.

You have been given the attached data set ('HiAndLowData.xls') for the purposes of conducting an analysis of the mortality experience for the 2012 calendar year. This includes two worksheets: (1) the policy and claims data together on one sheet; and (2) the life table that represents the expected mortality experience on the other.

Please note the following:

- All birthdays are assumed to be on 31 December;
- The attached data only covers males aged 40-49 on 1 January 2012;
- The status at the end of each year is either IF ("In Force") or NIF ("Not In Force", which is due to being a claim during the year). Dates of claims are provided;
- All policies can be assumed to be in-force as at 1 January 2012;
- New business, lapses or policy cancellations throughout the 2012 calendar year can be ignored;
- Incurred-but-not-reported (IBNR) claims can be ignored.

a) Conduct and present an analysis of the mortality experience for the 2012 calendar year. (12 Marks)

b) The marketing manager has seen your analysis, but has not seen the underlying data. He has now asked you for additional commentary on the analysis, in particular:

   - A description of any features of the mortality experience that you feel require additional investigation and consideration, explaining your reasons;
   - A description of how you would go about those additional investigations, identifying any further data and information you would require;

- **Any further investigations you would perform or data and information you would seek out, in order to give confidence that the analysis you have done is a reasonable basis for the overall mortality experience of HiAndLo.**

- **Draft a report that you could present to the marketing manager. (12 Marks)**

c) HiAndLo is currently implementing an enterprise risk management programme. The Chief Risk Officer is conducting informal interviews with key staff to gather information on major risks that may be emerging in the business. Discuss the concerns you would raise in your interview as a result of your analysis. (6 Marks)

Attachment

C2A_Q1_Attachment_(HiAndLowData).xlsx

QUESTION 1: MARKING GUIDE

a)

A tabular presentation of results is given below.

	By policy numbers			By Sum Insured		
Age last	Expected	Actual	A/E Ratio	Expected	Actual	A/E Ratio
40	3.54	2	57%	725,014	320,775	44%
41	3.896	4	103%	799,613	1,206,569	151%
42	4.151	5	120%	853,129	2,299,834	270%
43	4.556	4	88%	939,660	1,833,318	195%
44	4.108	3	73%	844,592	1,064,706	126%
45	6.438	7	109%	1,330,008	3,535,991	266%
46	5.884	7	119%	1,217,413	3,708,436	305%
47	7.465	7	94%	1,545,559	4,334,361	280%
48	8.846	8	90%	1,822,236	4,438,105	244%
49	10.67	9	84%	2,197,549	3,865,847	176%
Overall	59.55	56	94%	12,274,772	26,607,942	217%

This is not expected to be a difficult task, but for those that do not consider the experience by sum insured, the maximum mark they should be awarded is 6. Analysis is required to assess whether overall experience being far worse than expected is due to claim volumes and/or larger issues of concern, or to a few single big (distorting) claims.

Marking Guide:

- **Exposure calculations (by count and by sum insured): 4 marks**
- **Expected claim outcomes: 2 Marks**
- **Actual claim outcomes: 2 Marks**
- **A/E ratios: 2 Marks**
- **Presentation of results by age : 2 Marks**
- **Presentation graphically: up to 2 Marks**

To a maximum of 12 marks overall.

Marks to be awarded for the various ways results can be presented and any reasonable summaries / assessment / commentary on the data.

b)

Needs to be suitably worded and appropriate in language for the marketing manager.
1 Mark

Credit should be given here for relevant discussion that is raised in part (a)

A description of any features of the mortality experience that you feel require additional investigation and consideration, explaining your reasons;

The standout feature is the A/E ratio for the experience by sum insured.

The fact it is far higher than the experience by claim numbers is concerning.

Would usually expect the reverse to be true, to reflect higher underwriting standards for policies with higher sums insured.
3 Marks. **

Also of interest is the aggregation of claims on one single day - 12 claims totaling $7.2m occurred on 3-June-2012. If these all arose from a single claim, that would be a distorting factor in the overall analysis.
1 Mark

A description of how you would go about those additional investigations, identifying any further data and information you would require;

We would want to ascertain whether those 12 claims were all from one event/source – need to talk to claims team and check claims files as needed.
1 Mark

We would want to review the underwriting process for larger sums insured – the unusual experience indicates something is going awry.
1 Mark **

It may be a process issue, a personnel issue, or an issue of pressure on some key underwriters from some key brokers or sales managers – need to check all these aspects of operational risk.
1 Mark **

Would also need to check mortality experience by key broker groups or individuals – has one broker had a series of policyholders in ill-health and as such represents a major source of claims and adverse selection via lax underwriting standards for some brokers?
2 Marks

Would also check whether the validity of claims is being appropriately checked before payments are being made – though this possibility is mitigated somewhat by the strong reinsurance quota share support and therefore stake, and that we might expect such deficiencies to be reflected in claims experience by both numbers and sum insured.
1 Mark

Any further investigations you would perform or data and information you would seek out, in order to give confidence that the analysis you have done is a reasonable basis for the overall mortality experience of HiAndLo.

The two major additional investigations are by duration and whether this experience has been repeated in other years.
A suitable discussion of each aspect is 2 marks each, for 4 marks overall. **

Other points raised and discussed such as mortality experience for other ages, clarity and analysis of smoker/non-smoker experience, and by gender,

Also other reasonableness checks such as:

- Check that the claims data reconciles with the P&L or general ledger
- Check that the exposure data reconciles with other sources (eg MIS data)
- Check that the expected mortality basis is consistent with best estimate assumptions.

each worth 0.5 Marks

Marking Guide:

- **9 Marks in total to come from the points above marked ****
- **3 marks in total from other points made.**

To a maximum of 12 marks overall.

c)

Key aspects of risk concern:

Clear evidence for the cohort studied of unusual and counterintuitive outcomes in respect of mortality experience worsening with sum insured.

Reflects either an underwriting process or personnel that are compromised, or inappropriate pressure being exerted through key sales personnel (independent brokers and/or HiAndLo sales staff), or both.
3 Marks

Lack of catastrophe reinsurance for possibility aggregation of risk.

This is particularly a concern for HiAndLo's circumstances because of the reliance on "several independent key broker groups" who service the high net wealth market, which may mean individuals who are connected and work or spend leisure time together.

As such the underlying assumption of independence between lives is likely to be less tractable here than for other policies and distribution channels.
3 Marks

Could also reflect poor claims processes.
1 Mark

Other valid points.
0.5 Marks each, to a maximum of 3 Marks

To a maximum of 6 marks overall.

QUESTION 2 (30 MARKS)

You recently commenced as the Appointed Actuary at LiveWell Ltd, an Australian-based life insurance company.

LiveWell promotes itself as Australia's leading insurer of living benefit 'wealth-protector' products. It has sold significant levels of Trauma, TPD and Disability Income (DI) policies (with 2-year and 5-year benefit periods only), as well as Investment-linked savings products. Approximately 25% of the TPD and Trauma policies are sold as riders to an underlying YRT policy, and approximately 75% are sold as standalone policies.

LiveWell sells mainly through its own agency sales team as well as through independent brokers. The average age of a risk policy policyholder is 37.

The management and Board have historically taken a relatively conservative approach to growing the business, and the overall volume of in-force policies across all products has built up slowly over time. LiveWell currently faces relatively tight capital constraints, and does not have access to significant extra capital.

Nevertheless, the Board is keen to explore how it can take advantage of several recent changes in the Australian financial context to grow the business further. The Board has noted that in recent times:

- The age to which Australian employees can have compulsory superannuation contributions paid by employers into their superannuation accounts has increased;
- Such compulsory superannuation contributions are increasing from 9% of wages to 12%, suggesting much higher balances for retiring workers in the future;
- There is greater appreciation amongst everyday workers of their vulnerability to losses in income, both whilst working and in retirement.

The Board has also appointed a new CEO to LiveWell. The CEO is new to life insurance, but has had significant success in sales in the pharmaceutical industry. She has instructed the sales and marketing team to consider the development and offering of two products as follows:

1) A DI product which has a benefit period that pays to age 70.
2) An inflation-linked deferred lifetime annuity, which is purchased at age 60 by individuals being able to access their superannuation balances at that time. The deferment period is 10 years, so that the first payment occurs at age 70.

The CEO and Board are seeking reinsurance support for the annuity product, as they are very concerned with the possibility of long tailed claims. Two reinsurers have responded:

Reinsurer A will reinsure 25% of all claims paid; whereas

Reinsurer B will reinsure 90% of all claim payments that are incurred beyond 120% of the life expectancy at age 70.

Suppose both reinsurers assume the following:

- **When the annuity is purchased by a single premium at age 60, the reinsurer receives a single reinsurance premium per policy;**
- **At this time of the policy commencing, there is a one-off expense of $500 per policy incurred by the reinsurer;**
- **Each reinsurer factors in a profit margin of 4.5% of the reinsurance premium;**
- **Expected investment returns in the foreseeable future are 11% per annum for equities, 8% for bonds, and 5% for cash.**

Further assumptions for the annuity product are as follows:

- **Payments are made annually from age 70, based on an average annual payment of $50,000 inflated in line with Consumer Price Inflation (CPI) from age 60;**
- **Expected mortality and historical CPI levels are provided in the attached spreadsheet 'LiveWell.xls'**

a) Estimate the reinsurance premium per policy charged by each reinsurer, assuming the average annual benefit payment above. Show all working, stating and justifying any additional assumptions that you make. You may ignore tax.

(12 Marks)

[Reminder: life expectancy at age x is given by:

$$e_x = E[K_x] = \sum_{j=1}^{\infty} {}_j p_x \text{ where } K_x \text{ is the curtate future lifetime for someone aged } x.]$$

You are also aware that Reinsurer A currently reinsures the 2-year and 5-year DI benefits for LiveWell. Reinsurer A has indicated that it would be happy to discuss terms for reinsurance support on the DI Age 70 benefit feature.

Reinsurer B has indicated it cannot support the DI product.

From her previous working experience, the CEO believes that there is benefit in enhancing business relationships with key suppliers. She prefers working with one reinsurer for both new products, rather than a different reinsurer for each.

The CEO is due to discuss options regarding reinsurance support with the Board in one hour's time and has asked you for your views on potential options with regard to reinsurance support.

b) Draft a response to the CEO, discussing these options, giving pros and cons of potential reinsurance arrangements from the point of view of LiveWell and making your preferred recommendation clear. (6 Marks)

The marketing strategy being considered is to target mature workers who are intending to work until age 70. LiveWell would promote both products concurrently to the same individual, and therefore have the benefit of regular premiums under the DI policy, as well as a significant single premium at age 60 for those who are interested in ensuring a lifetime income from age 70.

You note that this marketing strategy is merely an intended strategy, as each product will still be sold independently.

Though new to life insurance, the CEO recognizes that there are risks involved in such a product development and marketing strategy. She believes that by targeting prospective policyholders with both products, the risk of long tailed DI claims is mitigated – the main risk will be with the length of claims on the annuity policies. However she is also aware that something called a 'mortality hedge' between death and survival products can mitigate risks in some way as well, but is not sure what this means.

c) The CEO is now ready to put a proposal to the Board, to concurrently launch both products in the near future. The Board and CEO have therefore asked you for a report which discusses:

- the pros and cons of the overall strategy to launch both products, including the intended marketing strategy;
- key business risks, giving due regard to market conditions in Australia today;
- changes or alternatives to the overall approach that you would recommend, if any.

Prepare a draft report to the CEO and Board regarding these matters (ignore any issues relating to reinsurance support in this part of the question). (12 Marks)

Attachment

C2A_Q2_Attachment_(LiveWell).xlsx

QUESTION 2: MARKING GUIDE

a)

There are a number of further assumptions that need to be made for pricing. These, with suggested mark allocations, are as follows.

CPI levels from age 60: A historical analysis gives an average CPI annual rate of approximately 2.5%. Candidates should be aware that anything in the region of 2-3% is reasonable, but they are also free to specify and justify a rate marginally outside this range as well.
1 Mark

Investment earnings of the reinsurer. Given the long term nature of liabilities, an asset mix that is weighted to long term growth is appropriate, but an element of cash and/or bonds is still needed.

Some candidates may even argue that a conservative approach could be taken, given the risk already resident within the longevity aspect.

Answers below assume a 10% cash / 90% equities mix to give expected annual return of 10.4%.

Any reasonable approach and explanation to be given credit.
2 Marks

Projection of annuity payments:

Correctly determining the probability of survival to each future age.
1 Mark

Correctly accounting for future inflation into each future payment.
1 Mark

Correctly accounting for PV of payments via assumed investments earnings
1 Mark

Summing total payments to an EPV calculation measure
0.5 Marks

Correctly determining Reinsurer A's share
0.5 Marks

Reinsurance charge per policy for Reinsurer A correctly accounting for expense and profit:
0.5 Marks

Correctly determining life expectancy from age 70.
2 Marks

Correctly determining commencement age (87) for Reinsurer B's payments.
1 Mark

Correctly determining Reinsurer B's share (based on survival from age 60 not 70).
1 Mark

Reinsurance charge per policy for Reinsurer B correctly accounting for expense and profit.

0.5 Marks

To a total of 12 Marks

Other variations may exist with different profit criteria – e.g. discounting at a higher rate to allow for return of capital measures, etc, which are fine as long as they are reasonable and justified appropriately.

Others may add the profit margin as 1.045 x (risk premium + expenses) or some variation of that to give the reinsurance premium.

b)

Language of report needs to account for the fact that the CEO is new to life insurance. **Minus 1 mark if not**

There are a variety of ways this could be structured. The key factors in any discussion to be raised are:

1. These are new products;
2. Each will have high capital requirements;
3. Significant expertise for the DI product in particular will be needed for underwriting and claims management, for which LiveWell has some but not substantial expertise.
4. Ease of administration, choice can impact on reinsurance relationships.

Options around reinsurance are:

Going with reinsurer A for both products

Greater capital support for the annuity;

Strong DI support gives consistency with current DI reinsurance relationships and can strengthen that relationship;

This is important for administrative reasons, especially as many policyholders are likely to change from one DI product to another (subject to underwriting) as their circumstances change over time – so there is more likely to be consistency in pricing across benefit periods, less room for errors relating to reinsurance placement, etc.

Going with reinsurer B for both products

Strong support for the long tail risk with the annuity, which has been noted as a key risk;

Less profit is 'passed on' overall as the reinsurance support is less overall;

And arguably a better use of reinsurance is made by covering just the more extreme, adverse and less manageable risk.

Going with reinsurer A for the DI product and B for the annuity product (converse not as useful)

It is worth noting that it is not a given that just one reinsurer is used – this can be explained to the CEO;

In which case utilizing the benefits of B's annuity reinsurance and A's DI reinsurance may leverage positive elements of both (as described above), though the capital support is still an important factor in A's annuity support;

The diversification of reinsurers make keep the reinsurers on their toes, and the beginning of a new relationship with B may open up new opportunities down the track but not upset A too much at the same time by working with them on the DI product.

Going without reinsurance

Not such a realistic option given the capital requirements and current restraints faced, the conservatism of the Board, and the fact that both products are new.

Not every combination has to be considered in detail for full marks but a reasonable discussion of all relevant factors is required.

Marking Guide:

- **Factor 1 – 4 is worth 1.5 marks each**
- **Usually this will be around 0.5 marks per option, if each given suitable discussion amongst at least 3 reinsurance options.**
- **Minus 1 mark if no reasonable recommendation made**

To a maximum of 6 Marks overall.

c)

Language needs to be formal, appropriate for a report to the Board.
1 Mark

A number of things should be covered in this report. A reasonable answer should contain most of the following points.

1. The pros and cons of the overall strategy to launch both products, including the intended marketing strategy;

    - The product ideas are not unreasonable to make use of the environmental changes given, but it is a big step given a variety of constraints and market conditions.
    - The average age of policyholders currently is 37. The successful targeting of essentially a new (older market) is not straightforward, and will probably require significant attention to how this can be done.
    - The capital constraints are a significant factor. This in itself is likely to limit the ability to launch both products simultaneously, in their current form. 2 marks
    - Older workers may or may not perceive a need for the DI cover suggested. Many at older ages are likely to be working part-time, and have little debts, so may not see an additional cost of insurance premiums as worthwhile. Without specific distribution channels in place to target such workers, limited demand is a real prospect.

2. Key business risks, giving due regard to market conditions in Australia today;

    - Underwriting standards and processes, and particularly claims management, will

have to be updated to manage the longer term DI policies.
1 Mark

- Significant investment expertise will be required as well. Whilst there is some investment capability clearly available (as evidenced by the investment-linked product), the nature of asset-liability matching for both annuities and long tailed DI claims requires specific attention and strategies.
1 Mark

- For a variety of reasons annuities in many forms are not popular in Australia at the current time. This may change in the future but the perception of expense, and the lack of long-dated assets to back the resulting liabilities may not make it a value proposition worth considering for many.
1 Mark

- The long tail risk of annuity payments is not the only long tail risk – the new DI benefit feature is arguably just as risky in terms of long tailed payments, as many younger workers may purchase this, and 20-30 year claims on high sums insured are possible, particularly for white collar workers.
1 Mark

- The inflation-linked feature of annuity payments is a significant risk with a single premium contract. A low-inflation environment today may give a false picture of what the longer term prospects are. The prospect of uncertainty in this regard makes this a particularly risky proposition without suitable benefit limits in place.
1 Mark

- A mortality hedge arises when there offsetting claims experience occurs between survival- and death-based products. For example, higher mortality rates lead to higher death claims but lower annuity payments. The value of such a hedge is uncertain in this context – older ages buy annuities, younger ages buy death products, but mortality changes can differ by age.
1 Mark

3. Changes or alternatives to the overall approach that you would recommend.

A number of reasonable options are possible here. Some suggestions are:

- Given the claims, operational, investment and capital risks involved, serious consideration should be given to continue with the historical approach of conservatism, and just concentrating on one key product development at a time.
1 Mark

- Limiting the ability to claim under the DI product to an inability to carry out Activities of Daily Living (ADL) for some ages (e.g. 65-70) may limit claims risk

- Caps on the annual inflationary increases for annuity payments is essential (e.g. the lower of the actual annual CPI rate and 4%).

- A deferred lifetime annuity will carry significant capital requirements. This may be limited by offering (say) a variable-type annuity, with payments linked to some underlying investment performance. In this way it could be viewed as something that runs on from or links back to an individual's investment-linked policy (if marketed appropriately).

- Excluding mental illness will help alleviate the risk of long tailed DI claims (although there is pressure from the community (eg Beyond Blue) against this).
- Increasing the benefit period without increasing the maximum entry age and expiry age is probably not the best thing to do, as you would only extend the length of time you need to pay long term claimants without getting premium income past the current expiry age (ie active lives expire but long term claims continue).
- Rather than introducing a "to age 70" benefit period, the older customers' market can be tapped by increasing the maximum entry age and expiry age of the DI product, while maintaining the current 2 and 5 year benefit periods.

Recommending no changes is highly unlikely to be reasonable.

Marking Guide:

- **9 marks have been indicated amongst some of the points above. These points are the more obvious (essential) ones that should be made – so 9 of the 12 marks overall should come from these points.**
- **0 marks to be awarded for a point made with little explanation - there is plenty of time for a reasonable explanation to be given and this has essentially been asked for.**
- **3 marks can be awarded from other points made.**

To a maximum of 12 marks overall.

END OF PAPER