COURSE COVERAGE

Question	Unit	Key performance outcomes	Learning objective	Marks
1a	2, 3, 4	1, 2, 5, 9	2.4, 2.5, 5.3, 5.4, 9.1, 9.2, 12.2	8
1b	1, 2, 3, 5	2, 3, 5, 6, 8, 9, 10, 11, 15	2.3, 3.1, 5.1, 5.2, 5.4, 6.1, 8.2, 8.3, 9.1, 9.2, 9.3, 9.4, 10.3, 11.4, 15.2	4
1c	1, 2, 3, 5	2, 3, 5, 6, 7, 8, 9, 10, 11, 15	2.3, 2.4, 3.4, 5.1, 5.2, 5.3, 5.4, 6.1, 6.3, 7.2, 8.3, 9.1, 9.2, 9.3, 10.3, 11.3, 11.7, 15.1	8
2a	1, 4	1, 14	1.1, 14.3	7
2b	2, 3, 4	4, 5, 6, 7, 9, 11, 12, 13	4.1, 4.2, 5.4, 6.1, 6.2, 6.3, 7.1, 7.6, 9.2, 11.2, 12.2, 12.3, 13.1, 13.2	13
3a	2, 3, 4	5, 10, 12	5.4, 10.3, 12.3	6
3b	2, 3	4, 5, 7, 9	4.1, 4.2, 5.4, 7.6, 9.2	6
3c	1, 2, 3, 4	1, 2, 4, 5, 6, 7, 11, 13	1.1, 1.2, 1.3, 2.1, 4.2, 5.4, 6.1, 6.2, 6.4, 7.1, 7.6, 11.5, 13.1	5
3d	1, 2, 3	2, 4, 5, 9	2.2, 4.1, 5.1, 5.2, 5.4, 9.2	3

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QUESTION 1 **(20 marks)**

Cover It Ltd is an Australian life insurance company which offers a decreasing term insurance product. The decreasing term insurance pays an amount upon death of the policyholder, with that amount equal to the principal outstanding on a home loan that is also held by the policyholder.

(a) Given the following assumptions, estimate the expected present value of claims (net of reinsurance) under this policy. (8 marks)

Age of policyholder at inception of policy and home loan	30 years exact
Term of home loan	25 years
Size of home loan at commencement	$500,000
Loan payments	$3,221.51 per month, with first payment due in exactly 1 month after policy / loan inception
Loan interest rate	A fixed rate of 0.50% per month (effective) applies for the duration of the loan.
Fees on home loan	Assume no fees are payable.
Mortality of policyholder	Given in the attached spreadsheet, tab 'decreasing term'
Mortality selection effect	A reduction in standard mortality of 75% in year 1, 25% in year 2, 0% thereafter
Reinsurance	A reinsurance arrangement is in place whereby the reinsurer will pay 40% of any death claim, subject to a maximum reinsurance payment of $50,000 on any one claim
Interest rate for expected present value calculations	5% per annum (effective)
Policy cancellation	Upon death, or upon loan being paid off

You may also assume that a reasonable approximation is that the monthly mortality is equal to 1/12 of the annual mortality.

(b) Describe the additional assumptions you need to make in order to estimate a reasonable single premium for the policy described in (a) above. (4 marks)

(c) Now consider an individual, regular-premium YRT policy of sum insured $500,000.

For each assumption you have made in (b) above, state whether its magnitude is likely be to larger, equal to, or smaller for the YRT product compared to the decreasing term product.

Justify each statement that you make.

You may assume that the volume of in force business and new business sales is the same for both the decreasing term and YRT product. (8 marks)

MARKING GUIDE

(a) Assuming that claims are paid at the end of month of claim, see the spreadsheet, tab 'decreasing term' for a suggested solution. The following provides an indicative marking guide:

- Correct setup/projection of loan schedule (monthly loan interest, payments and balance). This should ensure that the home loan is amortised exactly after 300 monthly payments. (2 marks)
- Mortality corrected accounted for and applied: the correct rate adopted at each age; a reasonable application of the given approximation that monthly mortality is equal to 1/12 of annual mortality; selection effects correctly accounted for; and survival probabilities from month to month calculated in a reasonable manner. (3 marks)
- Calculation of expected claim amount net of reinsurance done correctly, correct incorporation of discount/valuation interest rate, overall net claims summed to give reasonable answer ($5,037 in the suggested solution). (3 marks)

Marks as above to a maximum of 8 marks.

(b) The major assumptions required to be made are as follows.

Assumption	**Importance**
Policy lapses	Part (a) assumes that lapses for the single premium decreasing term policy are 0% by virtue of the policy only stopping if the loan is paid off or the policyholder dies. This is unrealistic – home loans might not stay intact for the duration of the loan and can be moved to other loan providers, which could also cancel the attached life policy. So a lapse assumption should be built in which in turn gives rise to the need for assumptions around surrender values.
Acquisition expenses	Acquisition expenses such as the cost of new business admin and acquisition overheads need to be allowed for.
Underwriting expenses	Significant for the decreasing term policy, concerning health status as well as financial underwriting.
Claim expenses	Important to make a reasonable estimate of the likely costs incurred in ascertaining the fidelity of any death claim.
Maintenance expenses	An important expense, although there are no ongoing expenses for Cover It Ltd in respect of premium collection.
Investment returns	As all premium is received up front for the entire duration of the policy, significant reserves need to be held. In addition, an investment horizon beyond the short-term can be taken with the single premium decreasing term policy because the premium received is covering the cost of a claim that could occur within a 30 year time frame.

Tax	Tax needs to be allowed for in profit testing.
Levels of commission	Likely to just be an initial commission for the single premium decreasing term policy of perhaps 0% - 10%.
Reinsurance costs	Need to be factored in, not just the amounts of reinsurance recoveries.
Surrender values	A reasonable basis for appropriate surrender values needs to be made for the single premium decreasing term policy.
Inflation	An inflation assumption should be applied for future maintenance and claims expenses.
Profit criteria	The profit criteria or pricing hurdles set by the company would have a significant impact on pricing.
Sales volumes and mix	These can have a significant impact on expected profitability. Volumes drive expense assumptions (eg how overheads are spread) while the assumed sales mix will highlight the impact of cross subsidies.

0.5 marks to be awarded for each assumption described well.

To a maximum of 4 marks.

(c) A discussion of the major differences between each product type follows:

Assumption	**Importance**
Policy lapses	Lapse assumptions, by duration of policy, will be required for the YRT policy and are a critical assumption. Likely to be larger for the YRT policy, though it depends on duration and also economic factors (unemployment, interest rates) in terms of the pattern that emerges for decreasing term.
Underwriting expenses	These will likely be lower for the single premium decreasing term policy than for the YRT policy, as someone taking out a home loan already includes an element of financial underwriting that does not need to be necessarily be re-captured within the assumption for the single premium decreasing term policy as well.
Claim expenses	Likely to be of higher magnitude for the YRT policy. For the single premium decreasing term policy, the sum insured decreases over time in line with the decrease in the outstanding balance of the home loan, so for a claim that occurs in later years when the claim amount is small, this will not justify large investigative/claim costs to verify its credibility. For the YRT policy whereby the sum insured remains at a minimum of $500,000, some degree of investigative costs will be justified by the higher associated financial impact of a higher claim payment.
Maintenance expenses	Will likely be lower for the single premium decreasing term policy than the YRT policy because there are no ongoing expenses for Cover It Ltd in respect of premium collection.
Investment returns	Not of high importance for the YRT policy. Far more significant for the single premium decreasing term policy due to the single premium. A longer investment horizon

	can be taken with the single premium decreasing term policy because the premium received is covering the cost of a claim that could occur within a 30 year time frame, whereas each YRT premium is covering the cost of a claim of (more or less) over a 1-year time frame.
Tax	Likely to be equivalent for both product types.
Levels of commission	Likely to just be an initial commission for the single premium decreasing term policy of perhaps 0% - 10%. For the YRT policy commission will be more significant – upwards of 100% of first year's premium and then a smaller ongoing commission. Some candidates may refer to fees now rather than commissions, which should be given credit.
Reinsurance costs	Important to both policies. The relative importance to each depends on the extent to which Cover It Ltd would require reinsurance support on the YRT policies, which is unknown.
Surrender values	A reasonable basis for appropriate surrender values needs to be made for the single premium decreasing term policy. No surrender value basis needed for the YRT policy.
Inflation	Likely to be equivalent for both product types.
Profit criteria	Can vary by product type, depending on risk appetite, perceived risk and capital requirements.
Sales volumes and mix	These could be the same or different for the two product types, depending on the distribution and marketing strategies for each product. For example, if the target market is the same, there may not be much difference, but if YRT was sold to a different market segment or through a different distribution channel, volumes and mix may be very different.

A maximum of 1 mark for each assumption being given an appropriate discussion/description in terms of the differences between products.

To a maximum of 8 marks.

QUESTION 2 **(20 MARKS)**

An Australian life insurer sells two types of annuities: immediate lifetime, and deferred lifetime.

The immediate lifetime annuities have the following features:

- Annuities can be purchased by individuals between the ages of 60 and 100.
- Each annuity pays out a constant monthly amount (i.e. it is not adjusted for inflation) until the policyholder dies.
- The monthly payments are limited to a maximum of $10,000.
- The first monthly payment is made one month after the start date of the policy.

The deferred lifetime annuities have the following features:

- Annuities can be purchased by individuals between the ages of 50 and 60.
- Each annuity pays out a constant monthly amount (i.e. it is not adjusted for inflation) from age 65 exact until the policyholder dies.
- The monthly payments are limited to a maximum of $10,000.

In the attached spreadsheet there is a tab named 'annuity data'. This gives the list of all annuities that are currently receiving monthly payments.

(a) Describe the checks you would make when verifying the accuracy of the data provided in the attached spreadsheet. For each check that you describe:
- Carry out that check; and
- List the policy number of each policy with a particular error. (7 marks)

(b) Suppose that this life insurer now plans to sell both types of annuities above with the additional policy feature that payments increase over time, at a constant rate of 4% per annum. Describe in detail:

- the major, specific risk(s) that this additional feature introduces for the insurer;
- the specific actions you would recommend that a life insurer should take to manage these risks;
- why your suggested action(s) above are reasonable, including a discussion of the downside or disadvantage of each action you suggest. (13 marks)

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MARKING GUIDE

(a) See the solutions spreadsheet, tab 'annuity data' for an overview of the main checks that can be conducted. A description is given below.

Description of check	Number of errors	Policy numbers of those in error
Both types of annuity policy		
Start date of policy okay? Not future dated, not hundreds of years ago?	0	
Monthly payments outside allowable limits? All between 0 and 10,000?	2	11951711 (payment is negative) 59373795 (payment is 275,000 per month)
Check gender code – male or female? (not too material here as premium already charged, but still a worthwhile check)	0	
Checks specific to immediate lifetime annuities		
Ages at policy commencement? All between 60 and 100?	3	77162755 (aged < 60) 69912284 (aged < 60) 59104298 (aged > 100)
Total payments made to date – Do they match monthly payment x months in force?	3	32510411 57900328 60531643
Checks specific to deferred lifetime annuities		
Age at policy commencement between 50 and 60?	2	69942125 (aged < 50) 66411398 (aged < 50)
Total payments made to date – Do they match monthly payment x months in force since age 65 exact? Checking if payments have been made before age 65.	2	52869563 70636501

0.5 marks for each sensible check (including general data cleansing, ie checking duplicates, missing data, checking total policy no. against alternate source) that has been described.

To a maximum of 3 marks.

12 policies have errors, as per the table above. 0.5 marks awarded overall per error,

To a maximum of 4 marks.

Maximum of 7 marks.

(b) Major risks

- the major risk is that the liability arising from future payments which are increasing at 4% per year can be very significant (1 mark)
- which when combined with uncertainties in future mortality / longevity for the immediate lifetime annuity in particular, can lead to great uncertainty in the amount of future payments that may be required to be paid (1 mark)
- the liability is highly likely to be higher than what can be supported through inflation-linked assets (1 mark)
- or what might be considered more 'standard' investment strategies (1 mark)
- Hence, there is a real risk of an asset / liability mismatch (1 mark)
- Specific operational risks (e.g. system upgrades) (0.5 mark)

Actions to limit risk

Asset / liability

- Although assets can be held that could give income and growth of a magnitude that may be similar to the liability for a period of time, it is not as close a match as if the assets and liabilities were on the same basis with respect to inflation. For example, if a bond was held with payments linked to CPI inflation and it was used to back an annuity that had payments increase in line with CPI inflation, then this is a close match of assets / liabilities. It is unlikely that many liquid assets of a long term nature would exist that will move in line with the exact nature of the liabilities in this case. (2 marks)
- Asset-liability matching would be critical, through purchasing inflation-linked bonds of various durations, if these assets are available. A disadvantage is that assets of sufficiently long duration may be difficult to obtain. (1 mark)

Premium

- Any guarantees involve a cost, so price for the risk – clearly a much higher price would need to be charged. (1 mark)
- Any marketable premium though may still not prove sufficient to meet the future liability, due to the uncertainties involved (1 mark)
- A downside of higher pricing is that only those who consider themselves to be a very good 'risk' would consider the policy, i.e. only those in very good health. This leads to potentially strong adverse selection, increasing the liability risk, pushing up premiums further, and so on. (1 mark)

Product design

- Only limit to new policies, not existing ones. (1 mark)
- If there is potential to limit the increase, to a maximum number of increases over a lifetime, or to not have it applicable in the deferment period, then these product design options could be investigated – the purpose of these is to limit the future liability. (1 mark)
- Have a feature where increases can occur, but are discretionary and depend on profitability of the insurer such as with a variable annuity. This has the advantage of having a better asset / liability match but has the downside of greater management expense, potential for some policyholder discontent if their expectations are different to the resulting increases, and so on. (2 marks)

Capital management

- Reinsurance is possible but would likely be expensive, and would likely be limited to 'tail risk' – covering those policies which live beyond, for example, 125% of life expectancy or something similar. (1 mark)
- Hold extra capital, but this will lead to a higher premium. (1 mark)
- Use of derivatives/longevity swaps as a risk mitigant (1 mark)

Marks as indicated above or for other reasonable points that are explained well.

To a maximum of 13 marks.

QUESTION 3 **(20 MARKS)**

You are the Appointed Actuary for Live Life Ltd (LLL), a large and long-standing Australian life insurance company.

LLL sells a range of risk products and has also has large volumes of whole of life and investment account policies in force.

LLL reinsures its YRT policies under an obligatory treaty arrangement. All policies under the obligatory treaty are reinsured on a 40%/60% quota-share basis (40% ceded, 60% retained by LLL), with original terms premium rates applying. The reinsurance commission payable to LLL is 25% in all years of the policy. No selection discount applies.

The reinsurer has also agreed to accept YRT policies that fall outside the underwriting terms of the obligatory treaty, on a facultative basis. For any such policies insured facultatively, the reinsurer will take on 90% of the total risk on that particular policy and reinsurance premiums will be based on the reinsurer's risk rates (with both reinsurance commission and selection discount = 0%).

The CEO of LLL is new to life insurance and she has sent you an email with four questions. Draft your answer to each of these questions.

(a) I note that the current arrangements with the reinsurer do not include a selection discount. Does this mean it is appropriate for LLL to consider looking for another reinsurer that might offer more favourable reinsurance terms for LLL? (6 marks)

(b) I am aware that, in addition to the current quota share agreement, there is a Catastrophe reinsurance cover in place. Why is Catastrophe reinsurance needed? I think a similar level of protection could be obtained by increasing the amount ceded under the quota share agreement, without having a Catastrophe cover at all. Isn't this a better approach to pursue? (6 marks)

(c) The whole of life and investment account business that LLL has in-force appears to have no reinsurance support in place at all. I am surprised as I thought reinsurance support would be a part of all life insurance products, such as it is with YRT. For each of the two products whole of life and investment account, I would like to know:

- A short description of what (if any) reinsurance arrangements could be feasible; and
- Any probable reasons why there is no reinsurance support in place for each.

(5 marks)

(d) Lastly, in regards to the facultative arrangement, I am not sure what is meant by "the underwriting terms of the obligatory treaty". Can you describe an example of these underwriting terms that might typically apply in the Australian context?

(3 marks)

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MARKING GUIDE

For this question, language and description needs to clear, concise and free of as much jargon as possible, as appropriate for communicating to a CEO (1 mark if this is the case).

(a) See chapter 9, p.177 of textbook.

- Usually a selection discount would apply but:
"The terms "reinsurance commission" and "selection discount" are often used interchangeably. This occurs because there is often a mixture of both selection discount and commission being paid under some arrangements and it is convenient to combine them in the treaty." (1 mark for describing this or a similar point)

- So having or not having a selection discount in itself is not the determinant of whether a particular reinsurance arrangement is appropriate or not. (1 mark)
- The overall financial arrangements depend on the interaction of selection discount, reinsurance commission, and the actual terms of risk- or original terms-based reinsurance pricing. (2 marks)
- There are many other factors that are important as to the right choice of a reinsurer – our overall risk appetite and how reinsurance support helps this and advice as to market opportunities, strategy, product development, underwriting and claims management. (1 mark)
- It is also not advisable to unnecessarily chop and change reinsurers too often – better to have solid relationships in the longer term where possible. (1 mark)

Marks to be awarded as above (including any other reasonable points)

To a maximum of 6 marks.

(b) The main points to raise include:

- It is true that on an expected claims basis, by increasing the amounts ceded under a Quota Share arrangement, holding a similar overall level of risk could be achieved when compared to the current arrangements. (1 mark)
- However, the purpose of a Catastrophe cover is not to protect losses that occur on an 'expected' basis – it is to cover adverse experience arising from risks falling outside of what we'd normally 'expect'. (1 mark)
- The Catastrophe cover will be triggered when losses arising from a defined event are significant and meet the threshold of lives lost under the Catastrophe treaty. So, if a Catastrophe occurs and we have no Catastrophe cover in place, then even if the QS arrangements had been increased, they may still not offer enough protection from such events. (1 mark)
- Increasing the QS would mean that we are always retaining a lower level of risk, regardless of whether a Cat occurs or not → so less profit for us as the QS reinsurer builds in their own profit as well. (1 mark)
- Therefore, a change to increase QS would be far more costly than the current 'QS + Cat arrangements'. (1 mark)
- So overall, such a change is not suitable for the management of Catastrophe risk. (1 mark)

Marks to be awarded as above (including any other reasonable points)

To a maximum of 6 marks.

(c) Reasonable points that could be made include:

- For whole of life policies, reinsurance would likely cover just the mortality risk (not the savings element of the policy if the policy was participating)
- An individual surplus arrangement might work well, where the insurer retains (pays) the first $X on the claim on any policy, and the reinsurer premiums are based on their own risk rates
- As LLL is a 'large and long-standing life insurance company' with 'large volumes of whole of life policies in force', this could suggest that LLL is also in a reasonably strong capital position. It is unlikely to be selling new whole of life policies, and because it is long-standing and whole of life policies are historically reasonably profitable, it may not be in need of large capital support for these policies.
- The ratio of capital required per dollar of premium received is far higher for YRT than whole of life, so the need for reinsurance for whole of life in LLL may be that much less than for YRT.

- For investment account policies, it would be unlikely / unusual for any reinsurance arrangements to be in place, as there is no mortality risk involved
- Notwithstanding that, there could in theory be some reinsurance support offered to the investment guarantees involved with the investment account product, though the insurer is more likely to support this guarantee through appropriate asset choices and holding appropriate capital

- Again, as for the whole of life policy, as LLL is a 'large and long-standing life insurance company' with large volumes of investment account policies in force', so it may have enough volumes in force to be able to effectively manage all investment guarantees via 'organic' mechanisms (such as asset choices and own capital) rather than needing external support.

1 mark for each reasonable point / description made, to a maximum of 3 marks for a good discussion of whole of life policies, and a maximum of 2 marks for a good discussion of investment account policies.

To a maximum of 5 marks.

(d) From page 174 of the textbook, a candidate should be able to see that 'underwriting terms' would normally address a few key aspects:

- The maximum level of cover on any one life (e.g. cover to $5m per life)
- Referral limits for the ceding company
- The position of the reinsurer with regard to following (being bound by) the insurer's underwriting decisions, or requiring all cases or only certain cases (e.g. large sums insured) to be referred to the reinsurer for underwriting

Any reasonable estimate or description of what these could be, to be given credit. Some examples are given in the textbook chapter. For example, page 182: "All sums insured exceeding $500,000 that are less than +250% substandard are to be ceded to the reinsurer."

To a maximum of 3 marks.