Course Coverage

Question	Unit	Syllabus Performance Outcome	Learning Objective	Total Marks
1 (a)	3, 4	8, 9, 14	8.3, 9.2, 9.3, 9.4, 14.1, 14.2	15
1 (b)	4	13, 14	13.1, 14.1, 14.2	4
1 (c)	1, 2, 3	1, 5, 7, 9	1.1, 5.1, 7.2, 9.1	4
1 (d)	1, 2, 3, 4	2, 5, 7, 9, 10, 12	2.3, 5.1, 5.2, 7.1, 7.2, 9.5, 10.3, 12.1	12
2 (a)	1, 2	1, 2, 3, 4, 6, 7	1.1, 2.1, 3.1, 4.2, 6.1, 6.2, 7.1, 7.4, 7.5, 7.6	12
2 (b)	1, 2, 3	1, 4, 7, 9	1.1, 4.2, 7.1, 7.6, 9.5	7
2 (c)	2, 3, 4	5, 8, 9, 12, 14	5.1, 8.3, 9.2, 9.3, 12.4, 14.3	6
TOTAL				**60**

Answer two questions.

QUESTION 1 (35 Marks)

You are the pricing actuary at Another Good Idea Ltd (AGI). AGI is a large Australian life insurer which sells a range of risk products.

AGI's CEO has decided to develop a new stand-alone trauma product. This product will offer a premium which is level for 15 years (AGI retains the right to increase premiums in the light of adverse claims experience, but there will be no age-related premium increases over the 15-year term of the policy). At the end of the policy term, the policy terminates. The product pays out a lump sum benefit on the diagnosis or occurrence of one of a list of specified trauma conditions and events. Once a trauma benefit is paid, the policy terminates.

a) Based on the information provided in the attached spreadsheet (s: 'C2A_LAQ1_S1_2014_Trauma_Level_Term') and the information below, determine an appropriate premium for a 30 year old male non-smoker taking out a policy with sum insured $200,000.

Policy and pricing details:

- 15 year term, with level premiums payable annually in advance for the duration of the policy.
- The relevant expenses can be assumed to be:
  - Initial: $800 per policy plus 55% of the first year's premium.
  - Renewal (starting from the beginning of policy year 2): $65 per policy plus 7% of each annual premium.
  - Claim expenses: $350 incurred at end of year of claim.
  - Per policy renewal and claim expenses are expected to increase in line with inflation each year.
- Reserves at the end of each policy year can be established as 20% of the present value of future premiums, with the discount rate the same as that to calculate the interest rate on annual net cashflows, which is 6% per annum (effective).
- Explicit capital requirements can be ignored for the purpose of this calculation.
- AGI's principal profit requirement is that the [Expected Present Value (EPV) of (profits)] divided by the [EPV(premiums)] = 8%, with the relevant EPV's discounted at a risk discount rate which reflects expected shareholder return on capital.
- The policy cancellation experience of AGI's existing 15-year term life policies, the relevant trauma morbidity rates, and mortality rates are given in the sheet: 'Trauma level term'. All of these rates can be considered as independent of one another. You may ignore selection effects.
- You may ignore tax, and you may ignore inflation increases on the sum insured.
- No surrender values or maturity values are payable at any time.

(15 Marks)

b) **AGI does have a secondary profit requirement that each product generates the expected shareholder return on capital. Discuss the reasonableness of this profit requirement with respect to the product above. (4 Marks)**

c) **The CEO has been talking to a friend who is a consulting actuary, and this friend mentioned that a major risk in life insurance is the possibility of adverse policy cancellation (lapse) experience. The CEO is now quite worried about this issue. Describe the main risks to AGI from adverse policy cancellation experience arising from this product. (4 Marks)**

d) **The marketing manager is concerned that the premium that you determined in (a) above is too high to be a reasonable alternative to existing annually stepped premium trauma products. She thinks that potential policyholders may not perceive the value of level premiums in early years of the policy, in comparison to annually stepped premiums.**

She wants to introduce the following additional feature "Extension Plus" to make this new product more marketable and attractive to prospective policyholders. :

- **"Extension Plus" works like this: When a level premium trauma policyholder has reached the end of their 15-year policy term, they have the option to continue onto a new trauma policy without any further underwriting, and the new level premium policy will also have a term of 15 years and the same sum insured.**

Rather than price the cost of "Extension Plus" into the premium of the initial policy, the marketing manager proposes that the "Extension Plus" feature would be even more marketable , if the cost was accounted for within the premium of the subsequent policy that would be taken up.

In this way, she believes that the cost of the feature is still accounted for, but it is shared amongst those who exercise the option rather than all original policyholders, therefore making it a more equitable proposition to all policyholders. In addition, she has highlighted that this will also provide a larger policy base over which to spread the cost of the feature, as new business sales of the initial policy will be enhanced with an extra benefit for no extra cost.

Draft a response to the marketing manager's proposal above. Your response should include the following:

- **The main risk(s) to AGI associated with offering the "Extension Plus" feature;**
- **Potential ways that these risk(s) can be mitigated;**
- **A discussion of her pricing proposal, particularly in terms of risk, equity, marketability and administrative efficiency;**
- **Your recommendation as to whether this feature should be offered, as is or with changes, giving reasons for your recommendation and a recommended approach to pricing if appropriate.**

(12 Marks)

Spreadsheet: C2A_LAQ1_S1_2014_Trauma_Level_Term.xlsx

SOLUTIONS: QUESTION 1

(a)

See spreadsheet for suggested pricing solution (s: 'Sample solution'). This particular solution gives a level annual premium of $815.

In this sort of question, a range of minor and major errors are possible.

Examples of minor errors include:

Incorrect values entered (for example, the wrong $ amount for initial expenses);

A single cell with a formula with an incorrect reference, where other similar cells are correct;

Basic formulaic errors that are minor in terms of materiality.

Examples of major errors include:

Significant pricing factors incorrectly incorporated or omitted, e.g. claims, expenses;

Poor choice of inflation assumption;

Not accounting for multiple nature of decrements;

Substantial formulaic errors, such as looking up incorrect morbidity rates per age;

Poor choice of a risk discount rate to reflect expected shareholder return on capital (range of 10-18% nominal considered reasonable);

Not setting the premium to obtain the required profit measure;

Exact approach taken to reserving (eg PV of decremented or undecremented premiums) is not important, but fundamentals such as establishment at end of year one and release to zero, sum of reserve changes being zero, are important points.

In terms of overall mark awarded:

Mark range	**Criteria (each line is a combination)**	
	Minor errors	**Major errors**
13-15	2 or less	0
10-12	More than 2	0
10-12	2 or less	1
7-9	More than 2	1
7-9	2 or less	2
4-6	More than 2	2
4-6	2 or less	3
0-3	More than 2	3
0-3	Any number	More than 3

(b)

This question has been left deliberately open. Students may struggle to make sensible points in which case a maximum of 1 mark can be awarded.

Any answer must specifically discuss the features/characteristics of the level term policy. A discussion not including any specific features cannot earn any marks.

Students may compare it to other measures (eg the principal profit requirement) or to its use in products other than a level risk product.

However, marks can be awarded for a reasonable discussion, regardless of whether the conclusion is that it is a good measure or a poor one.

Example of approach 1

Arguments could be made that this is a reasonable measure, because it explicitly reflects the required return of shareholders.

When compared to savings policies (conventional or unit-linked or investment account), the capital requirements are more significant due to the relatively higher risk exposure.

Hence, capital requirements are likely to be comparatively higher for this policy, and hence the requirement to explicitly measure profit against capital becomes more important.

Award mark of 1-4 depending on strength of argument made.

Example of approach 2

The approach might be taken to compare it to annually stepped premium risk policies. If so, for the level term policy, the premiums are higher in earlier years hence, capital requirements are likely to be relatively lower for this policy when compared to yearly stepped risk policies.

This makes a profit measure based on capital not as robust or useful as it would be for products with higher capital requirements, as it may be highly sensitive to small changes in premium rates

Award mark of 1-4 depending on strength of argument made.

(c)

Adverse lapses can impact profitability for two major reasons with level term risk policies.

The first is when policy cancellations are higher than expected in early years of a policy. This might mean that the significant initial costs associated with underwriting and commission are not recouped, leading to a loss or impaired levels of profit. (1 mark)

This risk is exacerbated when the product is a new product such as this one where significant development costs are likely to have been expended. (1 mark)

For level term policies, in later years (beyond year 6 or so, in this case) however it is the risk of lapses being too low that can lead to adverse outcomes. The level premium nature of the contract means that premiums exceed claims in earlier years, and once initial costs have been recouped, if policies are not cancelling when the cost of claims relative to premiums is increasing, this can lead to losses or impair the emerging profit. (2 marks)

Anti-selective lapse less of an issue for level than YRT

Candidates must recognize the duration dependent nature of lapse risk in level premium business, if not, 1 mark maximum.

To a maximum of 4 marks.

(d)

Major points to be covered as part of a reasonable response are given in the table below

Aspect of response	Main points to be made	Background/other discussion	Maximum mark
Risks with option	The main risk arises from adverse selection. This means that the likely mix of risks for those exercising the option will be far greater than those that do not. Candidates may raise other reasonable risks – eg benefit definition creep – ½ mark maximum	This option presents an example of information asymmetry between the policyholder and the insurer. Those at the end of the policy term who either perceive themselves to be, or are in poor health, are more likely to exercise the option.	2
Potential ways to mitigate these risks	Additional parameters around the exercising of the option can be considered, such as: Limiting the sum insured of the new policy to a reasonable % of the original sum insured; Having a no-claim period of 3-9 months after the option has been exercised; Pricing appropriately for the risk; Some limited underwriting could be considered in the form of exclusions for conditions known to have developed during the term of the first policy, though diluting the benefit of the option too much renders it less useful and marketable.	Suggesting that underwriting be carried out again at the time of the option being exercised is not sensible, as it is then essentially a new policy [1 mark to be deducted if this point is made]. Similarly, mentioning 'reinsurance' is not sufficient, as the reinsurer would charge a premium based on their perception of the higher risk involved for this option, and doesn't mitigate the underlying risk of adverse experience (in terms of [net claims]:[net premium]) with those that exercise the option.	4

Implications of pricing proposal	Risk: The proposal will exacerbate the inherent risk of adverse selection. : As the converted product essentially becomes a new product in itself with higher morbidity and premiums than the regularly-underwritten product, those in good health have no incentive to utilize the option as they could take out a new and otherwise identical policy with lower premiums. Only those in poor health would be incentivized to exercise the option, making it a difficult option to price as part of a converted policy. Equity: Seems reasonable at face value, but it is the option that has a cost which must be allowed for. It is more equitable for all holders of the option to pay for that cost, not just those that exercise it, as those that exercise it will pay the relevant premium later on for that cover. Candidates who state that this is an equitable arrangement: maximum of 1 mark for this section Marketability: The principle of extra benefit for no additional cost clearly enhances the marketability of the product. However it may be required to also state in sales brochures and product information that the converted policy would have higher premiums that a regularly-underwritten product, to make the distinction clear to policyholders. Administrative efficiency: The converted product essentially becomes a new product in itself, but with higher morbidity than the regularly-underwritten product. Maintaining and reviewing the claims experiences, premium scales and other risk management systems in place for 2 separate products is unlikely to be an efficient approach.	4 (1 mark per aspect)
Recommendation	Example: These options can be a useful marketing feature. However there are risks, so many of the risk mitigation aspects above should be adopted. The pricing must be accounted for within all policies that have this option. Proceeding on this basis is recommended. Marks to be awarded for any reasonable recommendation, with justification / reasons given.	2

Question 2 **(25 Marks)**

You recently joined PQR Insurance Ltd as an actuarial analyst. PQR is a large Australian life insurer that has significant capital reserves, but in recent years it has struggled with low levels of new business sales across its range of risk and savings policies.

PQR's chief actuary has two tasks for you.

Task One:

PQR has a large book of a single generation of participating conventional life policies. These policies have been very profitable over the years and a significant surplus in respect of these policies has emerged.

PQR has also sold a number of unit-linked savings policies. PQR's CEO, who is new to life insurance, is concerned with the impact of recent volatility in equity markets. The CEO feels that significant falls in the values of individual policies could have a detrimental impact on the reputation of PQR. The CEO is worried that this could further adversely impact the already low levels of new business sales across all of PQR's business.

The CEO has asked the chief actuary whether they can apply some surplus funds from the participating conventional policies to the unit-linked business, in order to limit reported investment losses on the unit-linked policies. The CEO perceives that this would limit the reputational damage associated with investment losses, prevent new business volumes from falling further, and therefore keep PQR more financially viable overall.

a) The chief actuary has asked you to prepare a draft response to the CEO's concerns, outlining benefits and/or risks with his suggested proposal, and if relevant, any alternatives or modifications to his proposal that you consider reasonable. You should justify all points made. (12 Marks)

Task Two:

The second task relates to PQR quoting for a group insurance scheme. A large fast-food chain, Hungry Jill's, is seeking insurance cover for all of its employees. The characteristics of Hungry Jill's business are as follows:

- It has approximately 300 fast food restaurants around Australia.
- It employs 6,500 workers, with the vast majority employed on a casual, part-time basis, with hours of work for each employee varying from month to month.
- Most workers are either under the age of 20 or over the age of 60.
- The profile of the workers (date of birth, gender, description of occupation, and annual earnings for each of the last two calendar years) is given in the sheet: 'Hungry Jills'.

Hungry Jill's requires both a death product and a group salary continuance (income protection) product for its employees. Hungry Jill's has proposed that all employees have a death cover of $200,000, and an income protection cover of $20,000 per year, with a 2 year benefit period. It wants these covers to be in place for 3 years, with an annual premium payable at the start of each of the next three years to cover the risk of each respective year ahead.

Hungry Jill's has argued that these fixed benefits of $200,000 death cover and $20,000 annual income protection cover per employee is advantageous because it is administratively convenient and straightforward, and that all parties (Hungry Jill's, employees and PQR) know at any point in time what their insured cover is.

b) Describe any risks to PQR that arise from Hungry Jill's preferred level of insurance benefits for each employee. Recommend any alternative benefit structure that you consider reasonable in the light of the risks you described. (7 Marks)

The sheet 'Death and IP risk rates' contains the risk rates relevant to the pricing of this group scheme, and the following assumptions are also relevant:

- **Profit criteria for PQR: 10% of each annual premium**
- **Expenses:**
    - **Initial: $5,000 for the scheme**
    - **Renewal (at time of second and third premiums being paid): $1,000 for the scheme**
    - **Claim: 11% of the total amount of death claims in any one year is estimated to approximate the total expenses associated with managing both death and income protection claims in that year (death claims can be assumed to occur at the end of each relevant year)**
    - **Annual commission: 5% of each annual premium**
    - **You may ignore tax**

c) Assuming that no new employees join, and that no employees leave the group scheme over the next three years (for reasons other than death), calculate the total expected premiums payable for each of the next three years, based on Hungry Jill's preferred benefit levels. The date that the group cover would commence is 1 July 2014. (6 Marks)

Spreadsheet: C2A_LAQ2_S1_2014_Hungry Jills_and_Death and IP rates.xlsx

SOLUTIONS: QUESTION 2

(a)

Major points to be covered as part of a reasonable response are given in the table below

Issue	Main points to be made	Max mark
CEO's concerns	A concern with previous and potential market volatility is fair enough. However the participation in such volatility is a rationale for individuals to choose a unit-linked policy – they can benefit from market upswings as much as they can be negatively impacted from market downturns. It is also arguable whether any reputational damage would be excessive– the products of competitors would be experiencing similar losses. PQR also sells risk products and sales of these products are unlikely to be impacted by investment losses on unit-linked policies – in fact demand for risk products can increase in times of economic difficulty.	2
CEO's proposal: Risks	Two major points to be made are: - the surplus belongs to both policyholders and shareholders - a minimum of 80% of profit arising from these policies belongs to the policyholders (if not mentioned, minus 2 marks, with a floor of zero on this issue); - PQR cannot just 'apply some funds' from one statutory fund to another. If a candidate's answer indicates or infers that this is allowed without any further explanation or proviso, then this is a major error, and the maximum mark that can be awarded for this question (2a) is 5/12 (i.e. it makes this part of the question an automatic below-pass standard on raw marks)	3
CEO's proposal: Benefits	The benefits are probably quite limited. A lowering of fees can be used to promote PQR more for increased sales and better retention, but this is possibly only limited to the unit-linked business. Wider reputational enhancement might occur, but the risks of such practices being unsustainable with potential future backtracks on any fee reductions are not minor.	1

Issue	Main points to be made	Max mark
Alternatives / modifications	Although funds cannot be 'applied' directly, through the portion of profits (maximum 20%) that can be assigned to shareholder's retained profits, this can be used in a manner that PQR decides. So there is some scope for some profit to emerge and be used more widely. However limiting losses for unit-linked policies must be done with care: PQR cannot simply 'prop up' investment losses on the unit-linked business It can however choose to lower fees which increases the net returns to policyholders (if this is not mentioned as the mechanism to assist the unit-linked business, minus 2 marks) Any lowering of fees though, should account for: The sustainability of this practice – fees will currently be set at a level to at least recoup expenses, so any cross-subsidisation of that needs to be carefully considered Once fees are lowered, that sets new policyholder expectations, to raise them again presents a new set of problems Issues of equity across different policyholders will be important – existing versus new policies, different generations of policyholders, different investment sizes and the relationship of fees to investment size. If shareholder's share of profits from the conventional business are to be used within the business, and if the concern is the level of new business sales, then other more constructive ways may exist to address this concern. Rather than propping up the unit-linked business, for which the CEO's concerns may be overstated, such profits could for example, be used to develop a new range of risk products, or conduct a new marketing campaign, or raise commissions to assist sales. Also, the reasons for low levels of new business sales should be explored. Are the pricing and features of products currently being offered competitive? Are service levels adequate? Do reinsurance arrangements need to be tendered out again? Are underwriting standards too high? These could all be investigated, and any resulting costs of solutions or changes in strategic direction could be supported via the retained profits.	6

(b)

The main overall risk is that of over-insurance for many employees.

This gives rise to the potential of moral hazard and/or deliberate fraudulent activity.

<u>For death covers:</u>

The benefit will likely exceed the needs of many employees aged under 20, and the mortality risk presented by those aged over 65 or 70 with a sum insured of $200,000 is not insignificant.

For Income Protection covers:

The $20,000 benefit provides a far higher income than that earned by a large proportion of workers, and so this benefit in particular presents risks of higher claims than would otherwise be the case.

Not just the benefit amount in relation to earnings, but also the age demographic poses risks here also. For older workers, the benefit amount is higher than the age pension, and for younger workers, it exceeds most employees' earnings in recent years. And having an income protection benefit in place for those over the age of 65 is particularly risky.

A maximum of 4 marks to be awarded for covering the major points above.

Alternatives

If level death benefits are desired, it will be required to have some limits on age / sum insured combinations.

It may be more suitable to have death benefits as a multiple of earnings for salaried workers, and a far lower level amount (for example, $20,000) for those casual employees with volatile working hours and earnings. Simply having all employees having death covers as a multiple of earnings is, as Hungry Jill's points out, likely to generate some confusion and uncertainty.

For Income protection, a similar approach can be adopted but no employee should have a benefit amount greater than a reasonable measure of their earnings . For example, salaried employees could have a benefit equal to 50-70% of their annual salary. For casual workers, it may be best to avoid this cover altogether as any smaller level benefit introduces high expenses of claim management relative to claim size, some workers will still be incentivized to claim, and any benefit set as a proportion of earnings is liable to manipulation or gaming at certain times.

As an alternative to Income protection benefits, a TPD benefit is a more tractable product offering, with an approach to benefit size similar to that for death covers.

1 mark for a reasonable alternative benefit levels for each cover type, plus 1 mark for suggesting an alternative benefit like TPD, to a maximum of 4 marks, to an overall maximum of 7 marks for question (2b).

(c)

See spreadsheet C2A_LAQ2_S1_2014_Solution (s: 'Hungry Jills (c)') for determination of premium.

Total for all 3 years

15,028,124

The maximum mark available is 6. 0.5 (minor error) or 1 (major error) mark to be deducted from a score of 6 for each independent error made.

Examples of independent parts of a good solution include:

Determination of expected claims:

Calculation of the correct ages as at 1-July-2014;

Advancing the ages by 1 and 2 in years 2 and 3;

Referencing the correct age-rate as part of a lookup formulae;

Referencing the correct gender;

Using the death rate correctly in a formula;

Incorporating individual survivability over the 3 years of cover (the inclusion or otherwise of this does not have a material impact, but if it is not accounted for or the process of doing that is in error, then 0.5 mark is deducted);

Using the IP rates correctly as risk rates per $1000 of cover;

Adjusting correctly for occupational loadings on the IP cover; ...

Determination of premium:

Incorporating profit criteria correctly;

Incorporating commission correctly;

Incorporating initial and renewal expenses correctly;

Incorporating claim expenses correctly.

END OF PAPER