2017 PART III EXAMINATIONS

Subject Title:	C10 Commercial Actuarial Practice
Date:	Tuesday, 17 October 2017
Time:	9:00am – 5:00pm

Time allowed:	Eight (8) hours
Instructions:	Type your answer to your chosen question using Microsoft Word and ensure that there are no links to spreadsheets. Spreadsheets must be embedded in your MS Word Document. Only your Microsoft Word document will be marked. In your answers, include your candidate number in the header and footer on each page of the document. You should save your work regularly.
Number of Questions:	Five (5)

Candidates are required to answer only **ONE** question.

This paper has **Seventeen** (17) pages (including this page).

ENTERPRISE RISK MANAGEMENT

QUESTION

Research and development (R&D) into Capland's agriculture industry is funded by a series of government levies on industry participants.

Levies are self-assessed by participants, and the Ministry of Agriculture conducts targeted inspections of industry participants to assess compliance with their levy regime/s.

The total annual levy collect is around C$700M, but the distribution is highly variable across levy group (cattle, dairy, wool, wine etc.) and business type (from large industrial processors to hobby farms).

The Ministry employs inspection agents, with a fixed budget of around C$750,000, to conduct inspections of levy payers (i.e. the industry participants) in the field and to identify and collect under-payments (or reimburse over-payments). The cost of inspections is recovered from levy groups by netting this off the levy collect for that group. This means that the cost of the inspections for members of a particular levy group is deducted from the total levy collection for that group before investing the balance into the R&D fund for that particular segment of the industry.

Non-compliance rates arising from inspections were around 30% in 2015-16 and up to 50% in 2016-17, when the Ministry made additional inspections. Net collection amounts varied considerably as well, from C$560,000 in 2015-16 up to C$750,000 in 2016-17.

The Ministry has an expert-judgement based formula for categorising participants into high/medium/low risk of non-compliance and uses this to guide selection of participants for inspection, along with a number of other criteria, dependent on current priorities.

The elements used in the current formula include levy group, business type, system type, payer type, frequency of payment and volume of levies. The current formula has been provided to you in an Excel spreadsheet.

The Ministry has approached you, an actuary with expertise in quantitative risk management, to assist them in assessing the effectiveness of their current inspection programme and improving their risk-based formula if possible. They have asked you to undertake the following:

1. Analyse the current inspection outcomes.
2. Assess and report on the effectiveness of the current formula.
3. Propose a potential alternative approach, using the data provided.
4. Assess the effectiveness of the alternative approach, and demonstrate the expected improvement in outcomes.
5. Discuss the implications for the Ministry's inspection activities.
6. Make recommendations.

In your initial meeting to understand their requirements, the manager of the levy collection and inspection section mentioned:

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1. Our inspection agents are very experienced rural people – they know who is high risk and who is low risk
2. We have had some pushback recently from some of the smaller industries, such as honey, turf and deer, who are concerned that we are charging them back too much for our inspections, more than is raised in non-compliance findings and that this taking a significant percentage away from their total collect and hence the investment in R&D in their industry

You have been provided the following information in an Excel workbook:

- The current expert judgement based formula
- A complete listing of existing levy paying industry participants
- A complete listing of inspection results for the last two financial years

Prepare your report.

Excel Workbook
C10_ERM_S2_2017_Data Provided for Analysis.xlsx

END OF QUESTION

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GENERAL INSURANCE

QUESTION

It is Thursday 19th October 2017. You are Anne Actuary FIAA, Chief Underwriting Officer of Minicap Insurance, a small insurer with a 2% market share for motor property damage insurance in Capland. In your role as the Chief Underwriting Officer, you are in charge of pricing and underwriting acceptance rules.

Minicap is listed on the Capland Stock Exchange and has a 30th June financial year. Under the management of CEO, Kon Surf, business had been going well until 2016. Until 2017, Minicap's share price has been tracking similarly to the Capland All Ordinaries Index. Gross written premiums rose steadily each year, although market share has remained stable. Profit rose steadily from 2000 to 2014, but was stagnant in 2015 and 2016. The latest company annual report, released on 21st July 2017, was not received well by the market. Gross written premium dropped by 15% year-on-year, while profit dropped by 4% year-on-year. Despite the objections of the Board of Directors, who are loyal to the CEO, shareholders successfully demanded that Kon be sacked. A new CEO, Catherine Everton-Overton, was appointed effective from Monday 16th October 2017. Catherine was headhunted from CIG, the third largest insurer in Capland, where she earned a reputation for change management, and for being a winner at office politics. Catherine had quickly risen up the corporate ladder at CIG to become Deputy CEO.

Catherine has been tasked with quickly regaining the profit and market share that Kon lost over the past year. As part of her changes, she has decided to override your decision and reverse the underwriting acceptance changes that were made in December 2016. She believes that this will regain the lost market share and give economies of scale. Catherine wants you to write a report that she can show to the Board. She tells you that your report must explain what went wrong under Kon's leadership, and it should also justify Catherine's decision to reverse the restrictive underwriting acceptance rules you introduced in December. Catherine wants that report today. She tells you that this is a make or break moment for your career with Minicap.

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Appendix A: Anne Actuary's File Note – Underwriting Recommendations 15th December 2016

- Kon wants to increase profitability because profits haven't been increasing in the past two years. This isn't a problem specific to Minicap. For the past two years market rates haven't been increasing as much as claim inflation. I believe that the best way to respond to this weaker market pricing is with better risk selection, to improve profitability by only accepting profitable insurance policies – those where the premium received is greater than or equal to the sound premium.
- Using my latest technical pricing model, which uses GLM models that have proven to be reliable and stable over many years
- Claim frequency and severity relativities have remained stable for more than a decade
- Claim frequency has remained stable for the past several years
- Claim inflation has been steady at 3% pa for the past several years
- Sound premium assumptions
    - Risk premium comes from GLM models
    - Net reinsurance cost (premiums less recoveries) is 1% of risk premium
    - Claim expenses are 4.2% of risk premium
    - Fixed costs are 3% of gross premium, and other expenses are 13% of gross premium (as advised by the CFO, and consistent with 30th June 2016 annual report)
    - Required profit margin is 6% of gross premium (target set by the Board and stated in Minicap's Risk Appetite Statement)
- We have no appetite for pricing that is out of line with the market in either direction, due to the risks it creates. The motor insurance market in Capland is very price sensitive. Furthermore, in the past when small insurers have tried to price below the large insurers, the large insurers started a price war. As a result, Minicap is a price-taker, charging market rates, following the market leaders. I cannot set prices that are any different to the market.
- I did an analysis in Excel on a random sample of 10,000 policies. I tried to put all the policies into Excel but it was too slow.

Excel Workbooks

C10_GI_Sem_2_2017_CAP General Insurance Data.xls

END OF QUESTION

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GLOBAL RETIREMENT INCOME SYSTEMS

QUESTION

Winnie is the HR Executive of a large food processing company, Honey Co ('Bring sweetness into your life'). Honey Co is in a developed country, very similar to Australia. Similarities include the introduction of a default low cost MySuper product a few years ago. Employees have the right to choose a fund to receive their employer contributions, as well as the right to roll over their superannuation balance to another fund. If an employee does not choose a fund, their compulsory employer contribution must be made to a MySuper product.

Honey Co's default superannuation (i.e. for employees who do not elect choice of fund) is currently provided through a dedicated sub-Plan in a large superannuation fund used by many employers. The majority of Honey Co's employees are members in this Plan.

Due to a number of problems in recent years, including poor servicing and comparatively low investment return, Honey Co is in the process of reviewing their superannuation arrangements through a tender process. Winnie is the chair of the selection committee. Refer to Appendix A for a summary of the membership of the Plan.

The selection committee has narrowed their choice to a shortlist of three superannuation providers, including the incumbent. The selection committee's view is that the key differentiating factor is the investment option that will be provided as the default. All other product characteristics (e.g. other investment option choices, product options on retirement, fees) are considered to be similar across the three providers.

A summary of the proposed default investment options is as follows:

- PDL Superannuation (Incumbent): current default option is a diversified investment option (70/30 growth/defensive). The provider has offered either the current diversified investment option or a new Lifecycle investment option (that was introduced recently for some other plans' MySuper members) as the new default at the choice of Honey Co. Honey Co currently does not have any members invested in this Lifecycle option;
- NFP Superannuation (Industry Fund): their diversified investment option (70/30 growth/defensive) which has a long-term history as the default option for their Fund;
- WRB Superannuation (corporate master trust): lifecycle type investment option, with gradual change between two single diversified investment options.

More details are provided in Appendices B to D, including historical investment returns (net of tax and investment fees), summary comments from the superannuation providers and asset allocations.

You are a partner in an actuarial consulting firm and have been appointed to provide advice to the committee.

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At a minimum, your report should cover the following topics:

- Explanation of lifecycle investment strategies and their relevance to Honey Co's employees
- Discussion on the different lifecycle designs offered by PDL and WRB, including key differences in practical implementation
- Example projections under the different investment options proposed for a range of members and scenarios
- Comparison of the historical investment returns for the four investment options
- A recommended default investment option.

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Appendix A – Membership Summary of Honey Co Plan as at 30 June 2017

	Blue Collar (honey collecting, processing and packaging)	White Collar (i.e. finance, distribution, marketing, etc)
Number of Members	2,000	1,000
Average Account Balance in the Plan	$20,000	$150,000
Average Salary	$50,000	$110,000
Average Service with Honey Co	1.5 years	10 years
Average Age	30	45

There is a very high turnover of Blue Collar staff, especially those involved with honey collecting. Honey Co believes in natural processing techniques, including collecting honey from bee hives without protective equipment. Honey Co provides generous death and TPD cover through an external insurance policy.

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Appendix B – PDL Superannuation

Annual Returns, for year ending 30 June (net of tax and investment fees)

Annual Return	Balanced (70/30) – Current Default	Lifecycle – 1950s*	Lifecycle – 1960s*	Lifecycle – 1970s*	Lifecycle – 1980s*	Lifecycle – 1990s and onwards*
2009	-14.0%					
2010	8.8%					
2011	9.2%					
2012	-1.0%					
2013	13.0%					
2014	11.5%					
2015	9.0%	3.0%	6.1%	7.9%	9.0%	9.0%
2016	2.5%	4.0%	3.8%	2.5%	1.5%	1.5%
2017	10.2%	4.3%	7.5%	14.0%	15.5%	15.5%

*This refers to the decade in which a member was born (i.e. someone born in 1955 is allocated to the 1950s Lifecycle option)

Current Strategic Asset Allocation

	Balanced (70/30) – Current Default	Lifecycle – 1950s	Lifecycle – 1960s	Lifecycle – 1970s	Lifecycle – 1980s	Lifecycle – 1990s and onwards
Aus Eq	30	4	12	32	39	39
Intl Eq	30	4	12	32	39	39
Property	10	2	6	11	12	12
Unlisted Alternatives	0	0	0	0	0	0
Fixed Income	20	50	40	18	6	6
Cash	10	40	30	7	4	4
Total Growth	**70**	**10**	**30**	**75**	**90**	**90**
Total Defensive	**30**	**90**	**70**	**25**	**10**	**10**

PDL Summary Comments

We are pleased to offer our new MySuper Lifecycle product as the default investment option for Honey Co members. While longer-term historical investment returns are not available, we understand that the investment performance of the Lifecycle option has significantly outperformed peers recently. The Lifecycle options also have low investment fees, due to the use of passive equity investments to provide the best value to members.

We acknowledge that the performance of the Balanced option has not been strong historically, although, as discussed, we have recently changed a number of staff in the investments management division, including the CIO, and expect the comparative return to improve in the near future. Honey Co could choose to use either the Balanced option or the Lifecycle option as the default.

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Appendix C – NFP Superannuation

Annual Returns, for year ending 30 June (net of tax and investment fees)

Annual Return	Balanced (70/30)
2009	-13.0%
2010	10.0%
2011	10.3%
2012	1.0%
2013	15.6%
2014	13.9%
2015	10.9%
2016	4.5%
2017	12.0%

Asset Allocation

	Balanced (70/30) – Strategic	Balanced (70/30) – Tactical as at 1 July 2017
Aus Eq	25	27.5
Intl Eq	25	27.5
Property	5	12
Unlisted Alternatives	15	15
Fixed Income	20	15
Cash	10	3
Total Growth	**70**	**82**
Total Defensive	**30**	**18**

NFP Summary Comments

We are pleased to offer our Balanced option as the default for Honey Co members. This has been our flagship investment option for the last 20 years, and the majority of our Fund's considerable assets are invested in this option. Our Balanced return has consistently been ranked in the top quartile of comparative superannuation fund returns.

NFP's Balanced option utilises a wide strategic asset allocation. The investment committee meets monthly, together with our external investment advisors, to consider whether any tactical shifts should be implemented. Given current investment markets, we are in the process of reducing our equity exposure, along with moving the fixed income allocation to shorter duration stocks. We would be pleased to discuss our dynamic investment approach with you in more detail.

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Appendix D – WRB Superannuation

Annual Returns, for year ending 30 June (net of tax and investment fees)

Annual Return	Balanced (75/25)	Conservative (50/50)
2009	-15.0%	-10.0%
2010	12.0%	7.0%
2011	10.0%	7.2%
2012	1.5%	0.5%
2013	17.0%	11.0%
2014	14.0%	10.0%
2015	10.0%	7.6%
2016	5.5%	3.2%
2017	13.0%	9.0%

Asset Allocation

	Balanced (75/25)	Conservative (50/50)
Aus Eq	30	19
Intl Eq	30	19
Property	10	7
Unlisted Alternatives	5	5
Fixed Income	17.5	30
Cash	7.5	20
Total Growth	**75**	**50**
Total Defensive	**25**	**50**

WRB Summary Comments

We are pleased to offer our individually tailored lifecycle default for Honey Co members. Default members are invested 100% in WRB's Balanced option until age 50. Between ages 50 and 60, 10% of the account balance is moved from the Balanced option to the Conservative option once annually. By age 60, the individual will be invested 100% in WRB's Conservative option.

Our lifecycle approach combines two of our diversified options and provides a simple and effective glidepath for members. We believe it is important to maintain a material growth allocation at retirement, as the superannuation savings will be utilised over a number of decades.

END OF QUESTION

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INVESTMENT

QUESTION

Capland is a well-developed first world country with a complete investment and financial services market. Capland has a very generous pension system, where every individual at the point of turning 65 receives C$50,000 per annum from the government. However, due to the ballooning cost of the pension and its impact on the government budget, the government has recently passed legislation which will reduce this pension amount to C$20,000 and increase the pension access age to 67. This change is legislated to take effect in five years' time. The pension will continue to be indexed to Capland Consumer Price Index.

SmallTrust is a not-for-profit non-governmental organization (NGO), that provides financial assistance to disadvantaged women in Capland in the form of interest-free loans. It raises its funding from large corporations and charitable individuals. The major decisions are made by the Board of Advisors who provide their expertise on a volunteer basis, and the actual vetting and loan extensions are performed through a mutual agreement with Capland's Salvation Army outlets. SmallTrust also has five employees to assist in its day-to-day organisation and co-ordination activities. One of SmallTrust's major brand value lies in the fact that it has the lowest expense rate (compared to total funds raised) in all of Capland.

The employees are paid a salary. Since the government pension had been viewed as sufficient to meet retirement needs, SmallTrust has not made any contributions towards their retirement provisions. In response to the recently passed legislation, the Board of Advisors has unanimously agreed that the new pension amount is insufficient to meet the retirement needs of the employees of SmallTrust. They have decided to start a fund that will ensure that the employees continue to receive C$50,000 (at current prices) in retirement, i.e. the fund will make annual "top-up" payments to the government pension.

The fund will receive contributions for a maximum period of five years, by imposing a special levy set as a percentage of the funds raised by SmallTrust. The fund will be invested through BigBank in Capland, who are one of the major funding sources of SmallTrust. The fund will make yearly payments to each of the current five employees from the time they reach age 67. The yearly "top-up" payments to each employee are the difference between the old pension and the new pension, such that the employee receives a total income at retirement equal to the old pension. These payments will be made until each employee either dies or turns 95. No further payments will be made beyond that age.

The Board of Advisors has decided to request an actuarial report to recommend the size of the levy and the investment strategy that should be adopted for the fund. The board has prepared relevant information for the use of the actuary, which is outlined in Appendices A & B, and the spreadsheet provided as Attachment C.

You are an investment actuary, and a director in a large actuarial firm, CapActuarial. Your spouse is a member of the Board of Advisors and has volunteered your services to write the report for SmallTrust. Your spouse has provided you the brief along with the express desire of the Board of Advisors, where they prefer to ensure that the levy is below 0.1%.

Draft your report.

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Appendix A

Employee information

In order to maintain confidentiality, SmallTrust has only provided information on the ages of the five employees. These are 33, 39, 44, 48, and 51 currently (i.e. in 2017).

All employees are expected to work full time until age 67, and retire completely thereafter. You can assume that no employee will terminate employment prior to that age.

SmallTrust Financial Details

A brief excerpt from SmallTrust's financial information is provided below:

	2016 ($m)	2015 ($m)	2014 ($m)
Total Funding Raised	129.6	126.3	122.4
Administrative and Salary Costs	0.9	0.9	0.8

Appendix B

Investment Return Data and Management Fees

The fund will be invested through BigBank's investment arm. BigBank has stated that the available investment classes are Domestic Equities, 10-year Government Bonds and Cash. The annual management fees charged by BigBank, as % of FuM, are as follows:

Domestic Equities – 0.10%
10-year Government Bonds – 0.10%
Cash – 0.10%

You have also been provided with a spreadsheet of relevant historical information.

Tax

As SmallTrust is an NGO, there are no tax implications.

Fund Features

SmallTrust will contribute a yearly amount, expressed in terms of a constant levy on the total funding raised, to the fund for the first 5 years of its operation (starting next year – 2018), i.e. the fund is not expected to receive any further contributions from SmallTrust after 2022. These amounts will be invested according to the static investment strategy as determined by the actuary. The top-up pension payments will commence once the first of the five employees retires, and cease when the last of the five employees reach age 95 (or dies). The probability that the fund is able to meet all obligations should be sufficiently high. SmallTrust will receive any surplus that exists after all liabilities are extinguished, and will make good any shortfall if one arises.

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Government Pension

Given the political and social uproar over the recent changes, an amendment to the Capland constitution has been made such that the pension system cannot be changed in the future.

New Employee(s)

The retirement funding provisions of any future new employees is beyond the scope of this report.

Excel Workbooks

C10_INV_Sem_2_2017_Attachment C.xls Capland Investment & Economic Data

END OF QUESTION

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LIFE INSURANCE

QUESTION

Capland is a first world country with a fully developed financial market.

The Capland life insurance industry has a long history of profitable risk life insurance. Capland Risk Life ("CRL") is a leading company with a significant market share. It is a wholly owned subsidiary of Australian Risk Life ("ARL"). ARL has subsidiaries in a number of other countries.

CRL has been focusing on disability income insurance ("DI") in recent years and has had profitable experience. Two years ago, CRL made a significant change to the way it classified applicants' occupations for DI, as described in Appendix A. Following this change, which CRL's competitors did not follow, CRL's market share of new business increased from around 13% to 18% in the last 2 years.

ARL, on the other hand, has had very poor experience with its DI in Australia and some other countries. As a result, it has been putting pressure on its subsidiaries to exit this class of business.

You are the Director of Finance and Chief Actuary of CRL. You have had long experience in DI across several countries. Several years ago, you completed a PhD examining the Capland market's DI experience.

Your CEO has reacted very angrily to the pressure being applied to exit DI business. In a recent meeting, she said;

> *"You have seen ARL's latest memo. I understand that the ARL Australian DI Actuary has not objected to the exit plan.*
>
> *Those clowns in Sydney couldn't manage anything. No wonder they don't make money from DI. Instead of pressuring us to exit the business they should give us their DI business to manage. Then they might learn something.*
>
> *I need you to provide me a report on our DI business to demonstrate that we have it under control and that exiting this business in Capland would be the stupidest decision we could ever make. You need to understand how crucial this is. If you want to keep your job, you had better produce a totally convincing report which chucks this pressure to exit in the rubbish where it belongs."*

Excel Workbooks

C10_LI_Sem_2_2017_Attachment C	CRL DI Experience
C10_LI_Sem_2_2017_Attachment D	The data from your PhD on which the new classification was based

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Appendix A

The usual Capland occupation classifications were as follows

A: Professional, technical and managerial occupations that are general office duties only

B: Supervisory and other skilled clerical and skilled technical people

C: Non-hazardous work with light manual labour

D: Hazardous work with heavy manual labour or using heavy equipment

CRL's new occupational classifications are

1A: Medical occupations – this is effectively doctors only

1: All other occupations in the current class A

2: All occupations currently included in classes B and C

3: Current occupation class D

The premiums for these new classifications were derived as follows:

These are the symbols used

P(x) premium rates for the occupation class x [current and new]

Pr(y,z) proportion of exposure of new occupation class z in old occupation class y

R(y,z) ratio of actual experience of new occupation class z to that of old occupation class y

R(A,1) = (1 – R(A,1A)*Pr(A,1A))/Pr(A,1)

P(1A) = P(A)*R(A,1A)

P(1) = P(A)*R(A,1)

For the 2 years ending 30 June 2015, CRL was able to extract data for what would become occupations 1A and 1. That data showed that Pr(A,1A) was 0.33 and Pr(A,1) was 0.67. Based on the analysis in the PhD, CRL concluded that R(A,1A) could reasonably be assumed to be 1.35. This was not inconsistent with a similar analysis of the CRL data.

The analysis in the PhD showed that the difference in experience between occupations B and C was not statistically significant. Again, this conclusion was not inconsistent with CRL's own experience. As a result, the premium rates for occupation 2 were set equal to the old class B.

As there was no difference between occupation class 3 and old class D, the premium rates for class 3 were the same as for class D.

The new classifications took effect for all new business written from 1 January 2016. Existing business was not affected.

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Appendix B

From: ARL Worldwide General Manager DI Business

To: CEO, CRL

Despite your recent communication about the profitability of your DI business, we are still of the view that the likely future results will deteriorate for CRL as they have for ARL and several other subsidiaries. In particular, we have serious doubts about your new classification system. Even though early results look positive, we note that the latest quarters clearly show some deterioration.

The system is based on the work of some academic whose connection to the real world of DI is doubtful. It may be well regarded in academic circles but is unlikely to be highly thought of in the front-line insurance world. The failure of your competitors to follow the new system is clearly based on this same view.

I also note the long-term deterioration of your termination experience with no apparent reversal of the trend.

Unless you can provide impeccable reasons and supporting evidence to the contrary, you will exit DI business over the next six months.

END OF QUESTION

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