# 2015 PART III EXAMINATIONS

Subject Title: **C10 Commercial Actuarial Practice**

Date: **Wednesday, 21 October 2015**

Time: **9:00 am – 5:00 pm**

**Time allowed:** Eight (8) hours

**Instructions:** Type an answer in Microsoft Word. Only your MS Word Document will be marked. Do not link data from spreadsheets. Spreadsheets must be embedded in your MS Word Document.

**Number of Questions:** **Five** (5)

Candidates are required to answer only **ONE** question.
This paper has **twenty-eight** (28) pages (excluding this page).

# ENTERPRISE RISK MANAGEMENT

## QUESTION

Big Fish Limited ("Big Fish") is a company listed on the Australian Securities Exchange which provides shipping and other supply services to the offshore oil and gas industry in Australia. Its activities are confined to Australia and centred on the North West Shelf where it supports exploration, development and production activities of the industry.

Big Fish owns and operates a fleet of ships which are leased to oil and gas companies on short and long term contracts. The ships are designed and built specifically to meet the needs of the industry. Big Fish also owns and operates two supply bases in Western Australia and a slipway for ship repairs and maintenance.

The Chief Executive Officer of Big Fish, Barry Mundy, has a finance background and many years of experience in the offshore oil and gas industry. He is very much aware of the many risks that Big Fish and the industry are exposed to.

A major risk for Big Fish is its limited geographic base of operations. For some years Barry has explored possibilities to diversify its operations to support the expanding oil and gas industry in South East Asia and further afield.

About six months ago confidential discussions began about Big Fish acquiring the operations of Little Fish Limited ("Little Fish") a company listed on the Singapore Exchange. Big Fish has used the code name "Operation Leap" for this project. The operations of Little Fish are similar to those of Big Fish. Little Fish also owns and operates a fleet of ships supporting the oil and gas industry, although the fit-out of the ships is more diverse and Little Fish operates in South East Asia, the Middle East, West Africa and the Caribbean. Little Fish also owns and operates two supply bases, one of which incorporates a shipyard for building new ships for the fleet.

The two companies have now reached agreement in principle on terms for Big Fish to acquire all the shares of Little Fish. The agreement is subject to approval by both Boards of Directors. A brief announcement has been made to the Australian Securities Exchange and the Singapore Exchange that discussions are taking place.

Barry is delighted with the price for the acquisition which reflects recent falls in oil prices and a slowing of exploration activities by the industry. Barry sees this as an opportunity to make an important strategic acquisition which will benefit the company in the long term. He recognises though that this is a large move for the company and requires substantial new equity and debt funding. He will therefore need the support of all stakeholders to make the acquisition a success.

After a round of discussions, including several discussions at Big Fish Board meetings, Barry has identified some areas of concern that need further work:

- The Chairman of Big Fish is concerned about the behaviour of oil prices in the short to medium term. "*If oil prices stay low for too long, industry demand for our ships will slow and we may not be able to lease out our existing fleet and/or achieve adequate prices.*"

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- The Chief Financial Officer of Big Fish is concerned about the company's risk management framework. "*Our current risk management framework meets all the requirements of the Australian Securities Exchange best practice principles but none of us have experience in managing the risks of international businesses.*"

- The Secretary of the major Trade Union covering employees of Big Fish is concerned about potential job losses and erosion of pay and conditions for members. "*Can you assure us that this very large acquisition will be professionally managed to avoid unexpected financial losses, so that there will be no disadvantages for the current Australian employees of Big Fish?*"

- Several Directors of Big Fish are concerned about currency risk and how it will be managed. "*Up until now we have operated in only one currency but going forward we will have to deal with contracts written in $US and the balance sheet values of our overseas assets will also be recorded in $US.*"

Barry recognises that risk management is a common theme in these concerns and he has asked you, an actuary employed by Enterprise Risk Consultants, to prepare a report which will hopefully allay these concerns. Your report should be addressed to Barry but copies will be provided to the Board and the Trade Union.

To assist in your work, Barry has provided you with a note on the key features of Project Leap, including summarised financials for the two companies before the acquisition and the combined entity after the acquisition. This is contained in Appendix 1.

Barry has also provided in a spreadsheet a history of oil prices since 1946. Barry said that day to day fluctuations in oil prices do not have much effect on Big Fish but average prices over longer periods and expectations about future prices are very important because they directly affect the level of activity in the industry and the demand for the services provided by Big Fish.

So in order to help you answer the Chairman's question, Barry has provided annual averages of historic oil prices. Barry asked if you could build a model of oil price behaviour from just this historic data and use the model to generate 95% confidence intervals around average oil prices in the next 1, 3 and 5 years, explaining the limitations of your model and any further data / analysis you would suggest.

**Your brief**

Prepare your report as requested addressed to Barry Mundy.

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## APPENDIX 1

# Project Leap

**Key Features of Project Leap**

Big Fish operates only in Australia. Little Fish operates mainly in South East Asia but with some operations in the Middle East, West Africa and the Caribbean. Geographically the two companies are a good fit and the combined company has the scale to compete and grow its business internationally.

As shown by the table below the acquisition will almost double the size of Big Fish's fleet and bases.

**Assets owned and operated by the companies**

| Number of | Big Fish | Little Fish | Combined |
|---|---|---|---|
| Ships | 34 | 27 | 61 |
| Supply bases / ship construction and servicing bases | 2 | 2 | 4 |

The acquisition is compelling for Big Fish because it is acquiring the profitable business of Little Fish for a price equal to its net asset value, mainly the depreciated cost values of its fleet and bases.

The benefits of the acquisition are seen to be:

- Expands the business geographically with more diverse operations and a more diverse fleet. This should reduce risk by allowing surplus ships in one area to be deployed to another area where there is more demand
- The Big Fish fleet has different characteristics to the Little Fish fleet so the portfolio is complementary
- The combined company can provide a more complete service to its larger oil industry customers
- The supply bases and shipyards are complementary
- Reduces the negotiating power of the militant Australian maritime trade union.

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The financials of the acquisition are summarised in the following tables.

Note that the Income Statement and Balance Sheet of Big Fish is recorded in $A. The Income statement and Balance Sheet of Little Fish is recorded in $US. In the tables below the Little Fish financials have been converted to $A at current exchange rates.

In future it is expected that Australian contracts will continue to be written in $A while other contracts will continue to be written in $US. On the balance sheet the value of the Australian assets will continue to be recorded in $A while the international assets will continue to be recorded in $US.

**Pro Forma Combined Income Statement Year Ending 30 June 2015**

| SA millions | Big Fish Y/E 30/6/15 | Little Fish Y/E 30/6/15 | Adjustments | Pro Forma after acquisition |
|---|---|---|---|---|
| Sales | 481.0 | 120.9 | | 601.9 |
| EBITDA | 123.5 | 56.5 | 3.0 | 183.0 |
| EBIT | 78.4 | 31.7 | 5.0 | 115.1 |
| PBT | 70.3 | 31.7 | (2.7) | 99.3 |
| NPAT | 52.0 | 33.1 | (7.3) | 77.8 |

The adjustments in the above table reflect some cost savings for the combined group, higher interest costs because of the acquisition financing and the impact of Australian tax.

The pro forma balance sheets of each company as well as the combined company are shown in the following table.

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**Pro Forma Combined Balance Sheet at 30 June 2015**

| $A millions | Big Fish at 30/6/15 | Little Fish at 30/6/15 | Adjustments | Pro Forma Balance Sheet |
|---|---|---|---|---|
| Cash | 64.2 | 101.7 | | 165.9 |
| Trade & other receivables | 131.3 | 35.1 | | 166.4 |
| Inventories | 17.9 | 29.3 | | 47.2 |
| Property plant & equipment | 482.7 | 445.1 | | 927.8 |
| Goodwill | 20.7 | 0.0 | | 20.7 |
| Other assets | 10.7 | 7.9 | | 18.6 |
| Total assets | 727.5 | 619.1 | | 1346.6 |
| Trade & other payables | 57.7 | 44.2 | | 101.9 |
| Borrowings | 199.9 | 0.0 | 247.1 | 447.0 |
| Other liabilities | 48.4 | 24.7 | | 73.1 |
| Total Liabilities | 306.0 | 68.9 | 247.1 | 622.0 |
| Net assets / total equity | 421.5 | 550.2 | (247.1) | 724.6 |

**Notes on Balance Sheet**

- Property plant and equipment is predominantly the cost price of ships in the fleet, depreciated over the expected useful lives of the ships. Also included is the cost of freehold land and the depreciated value of buildings and equipment
- Goodwill is the excess of the purchase price over the net assets of businesses acquired in the past by Big Fish less amortisation

**Equity Capital**

Big Fish has agreed to pay $A 550.2 million for Little Fish. This purchase price is funded by borrowings of $A 247.1 million and an equity raising (rights issue) of $A 303.1 million. So the equity capital of Big Fish after the acquisition is

| | |
|---|---|
| Equity capital of Big Fish before acquisition | $A 421.5 |
| + Capital raised | $A 303.1 |
| = Equity capital of Big Fish after acquisition | $A 724.6 |

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Because the purchase price of Little Fish is exactly equal to the net assets of Little Fish, the acquisition of Little Fish does not increase the Goodwill of Big Fish.

**Borrowings**

After the acquisition, the borrowings of the combined entities ($A 447.0 million) will be provided by a banking syndicate and secured against the property plant and equipment of the combined entity ($A 927.8 million). The average interest cost on borrowings is expected to be 3.7% p.a.

## END OF QUESTION

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# GENERAL INSURANCE

## QUESTION

It is October 2015. You are Anne Actuary, a partner in CAP Consulting, a multinational actuarial consulting firm, and you are in charge of all of their general insurance actuarial consulting within Capland. One of your largest clients is Broadsure, an insurance joint venture between the Capland government (70%) and Angmo (30%). Broadsure has the second highest market share in Capland (21% in total for its entities), and writes all of its business directly to customers. Broadsure's general insurance business is entirely in private motor, householders, personal accident and travel insurance. Angmo is a multinational insurance conglomerate, headquartered in London UK. Both shareholders wish Broadsure's growth to be self-funding i.e. they won't inject extra capital, but they will sacrifice a proportion of their dividends to fund growth. Broadsure is made up of two licensed entities:

1) Broadsure General: which carries out conventional general insurance business
2) Broadsure Takaful: which carries out general takaful business

Capland has a majority Muslim population, and the Capland government has an agenda of supporting shariah compliant business practices. Over the past decade, the Capland government has strongly encouraged the growth of takaful business (see Appendix 1 for some background reading about takaful). Some of the ways the government has done this are to:

- legislate for a common definition of takaful practice within Capland (see appendix 2),
- make takaful attractive to insurers via simple and low minimum fund surplus requirements of 1% of written premiums (without any capital requirements from the administrative company), and
- make takaful attractive to the public by requiring that takaful contracts must be priced the same as conventional insurance, and must have the same benefits, plus they must also have mudharabah (profit-sharing).

Growth rates in takaful business have exceeded 50% pa over the past three years, most of which is from policyholders transferring from conventional contracts to takaful. The takaful market share for the minority non-Muslim population is the same as for the general population, as they too find the takaful offering quite attractive. Some policyholders have stayed with conventional insurance because the renewal process is much simpler than the new business process of applying for a brand-new takaful contract, but the momentum to switch is building. In order to attract more market share, some of Broadsure's more aggressive competitors started to advertise the level of mudharabah payments that they have paid to policyholders, which have been higher than Broadsure's payouts. Subsequently, Broadsure has been losing takaful market share to these competitors with more aggressive mudharabah strategies, and is in danger of losing its second place market ranking.

Catherine Everton-Overton is the new CEO of Broadsure. She has been seconded from Angmo, after Broadsure struggled to find a replacement for the previous CEO. Catherine has had a stellar career trajectory within Angmo, and rumour has it that she was sent to Capland to see whether she is worthy to become the worldwide CEO of Angmo. She has stated that her top priority is to regain the market share lost in recent times, and then to become the number 1 insurer.

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Now that Capland has the largest takaful industry in the world, the government wants to improve the risk management standards. It has legislated for new capital standards, to be phased in over three years, beginning 1st January 2016 (see Appendix 3).

Arie Gantt, the chief financial officer of Broadsure, is a former life insurance actuary. To Arie, the takaful fund is just like a life insurance statutory fund for traditional participating business, something that is quite familiar to him. Arie wants to build up capital within the takaful fund by retaining increasing surpluses each year. He likes to have tight personal control over how the results look, smoothing the reported profit and reported solvency, and he doesn't like relinquishing his power to do this. Nevertheless, at the prompting of Catherine, Arie has reluctantly asked for your advice on a general insurance strategy to meet the new regulatory requirements.

The regulator has approved Broadsure's internal model for use in assessing its capital requirements. Broadsure currently finds itself in a similar capital position to its competitors. You do not have access to Broadsure's internal model, because it is supplied and maintained by Troll Consulting, and CAP Consulting does not have a license for their software nor for their economic scenario generator. In order to protect their intellectual property, Troll will only let you see the individual simulation results for the annual loss ratio and investment returns, and that will only be for Broadsure General. You will need to do your own projections using these numbers.

Capland is an idyllic place to live. There are no natural catastrophes, and no severe weather. The economy is also relatively benign, with a stable inflationary environment, and due to its legal system, it has never had, and never will have, superimposed inflation in its insurance. All claims are paid within a year of the incident occurring. Capland has a December financial year and uses Australian dollars as its currency.

**Your Task:**

Recommend a strategy for dividend payments, mudharabah payments, and capital management that allows for the risk appetite implied by what you have been told above and in the appendices. You have a 2016-2020 projection spreadsheet which uses a VBA macro to calculate percentiles.

**Note to Candidates:**
Capland is NOT Australia. It has different regulatory accounting and a different interpretation of IFRS accounting. Just use the accounting rules implied by the spreadsheet. Your scope does not include any critique of the internal model scenarios, nor the structure of the reinsurance.

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## APPENDIX 1: Background Reading About Takaful

### Takaful

Edited from Wikipedia, the free encyclopedia

**Takaful** (Arabic: الـ تكافـ ل) is a co-operative system of reimbursement or repayment in case of loss, paid to people and companies concerned about hazards, compensated out of a fund to which they agree to donate small regular contributions managed on their behalf by a Takaful Operator.[1] It is defined as an Islamic insurance concept which is grounded in Islamic *muamalat* (Islamic banking), observing the rules and regulations of Islamic law.

### Principles

The principles of takaful are as follows:

- Policyholders cooperate among themselves for their common good.
- Policyholders contributions are considered as donations to the fund (pool)
- Every policyholder pays his subscription to help those who need assistance.
- Losses are divided and liabilities spread according to the community pooling system.
- Uncertainty is eliminated concerning subscription and compensation.
- It does not derive advantage at the cost of others.

### Takaful companies

The growth in demand for Islamic insurance over recent years (particularly within the GCC countries and other areas of the Middle East), has seen a proliferation of new companies offering Islamic insurance products in these markets. The majority of these firms are full-fledged takaful operators, but conventional insurance companies have also entered the market offering takaful "window" operations. As with the traditional forms of insurance, reinsurance of a takaful operation may be used, known as "retakaful".[6]

### The *Mudharabah* model (profit-sharing)

According to this principle the takaful operator accepts payment of the takaful installments or takaful contributions (premiums) from investors or providers of capital or funds (takaful participants). The contract specifies how the profits (or surplus) from the operations of the takaful is to be shared in accordance with the principle of *al-mudharabah* – between the participants (as providers of capital) and the takaful operator. The sharing of such profit may be in a ratio of 50:50, 60:40, 70:30 and so forth, as mutually agreed between the contracting parties.

In order to eliminate the element of uncertainty in the takaful contract, the concept of *tabarru* ("to donate, contribute, or give away") is incorporated. Relating to this concept, a participant agrees to relinquish (as *tabarru*) a certain proportion of his takaful installments (or contributions) that he agrees or undertakes to pay, should any of his fellow participants suffer a defined loss. This agreement enables him to fulfill his obligation of mutual help and joint guarantee.

In essence, *tabarru* enables participants to perform their deeds in assisting fellow participants who might suffer a loss or damage due to a catastrophe or disaster. The sharing of profit (or surplus) that may emerge from the operations of a takaful is made only after the obligation of assisting the fellow participants has been fulfilled. It is

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imperative, therefore, for a takaful operator to maintain adequate assets of the defined funds under its care, whilst striving prudently to ensure the funds are sufficiently protected against over-exposure. Therefore, the provision of insurance coverage in conformity with Shariah is based on the Islamic principles of *al-takaful* and *al-mudharabah*.

*Al-mudharabah* is the commercial profit-sharing contract between the provider or providers of funds for a business venture and the entrepreneur who actually conducts the business. The operation of a takaful may thus be envisaged as the profit-sharing business venture between the takaful operator and the individual members of a group of participants who desire to reciprocally guarantee each other against a certain loss or damage that may be inflicted upon any one of them.

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## APPENDIX 2: File Note of Key Takaful Legislative Requirements in Capland

- Takaful business must be carried out within a trust fund
- Premiums payments must be paid into the trust fund
- Claim payments must be paid out of the trust fund
- Mudharabah must be paid out of the trust fund
- Reinsurance premiums and recoveries are from the trust fund, not the insurer.
- The insurer may take a fixed (as a percentage of premium) expense allowance from the trust fund. That expense allowance must be disclosed in the takaful contract and marketing material, and must not contain a profit margin. Insurers cannot take more than their disclosed expense allowance, and that expense allowance must be authorised by the insurance regulator.
- The insurer must define the rules for mudharabah payments in its takaful contracts, and disclose them in its marketing materials. The amount of mudharabah cannot be arbitrary i.e. it must be an objective calculation, and that calculation must be disclosed before the contract is sold.
- The insurer may also take mudharabah payments for itself, but these amounts cannot exceed payments made to takaful clients.
- Mudharabah amounts may be different for different types of contracts e.g. motor versus property
- For expense efficiency purposes, mudharabah payments that are less than $10 may be paid to authorised charities rather than back to the policyholder. The terms of this charity payment (including cut-off amounts and which charities receive which payments) must be completely defined in the contract.
- Mudharabah may not be a negative amount i.e. if the fund runs at a loss, then the fund cannot ask policyholders for more money.
- If the trust fund is in deficient (assets less than liabilities), then the insurer must lend money to the trust fund to cover the deficit, without charging interest or any other type of compensation. That loan may be repaid over subsequent years out of future fund surpluses.
- Trust fund investments may not be in businesses relating to alcohol, arms and munitions, piggeries, tobacco, or any other "unethical" business practice. Corporate bonds are not allowed, but government bonds are allowed.
- The trust fund may not borrow money, except from the insurer, and the insurer may not charge interest.
- The trust fund is allowed to hold a reasonable surplus for risk management and cash flow / liquidity purposes. Excessive surplus is not allowed, and must be returned immediately via mudharabah. Neither the legislation, nor the regulator have defined what "small and reasonable" or "excessive" means.
- In effect, the insurance company is not really an insurance risk taking insurer, but rather is an administrator of the takaful fund, and provides a zero cost overdraft facility for the takaful trust fund.
- Takaful funds are not for profit, and therefore are not taxed.
- Takaful fund earnings and surpluses do not belong to the insurer, and therefore do not comprise part of the insurer's accounts. For accounting purposes, the insurer is an administrator and guarantor, and so its Takaful income and profitability relate to the fees and mudharabah payments it takes from the takaful fund, versus its expenses.

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## APPENDIX 3: File Note on New Takaful Capital Requirements in Capland

- Capital requirements move from a formula based approach to an internal-model approach
- Calculations are based upon a one-year time horizon projection of accounts, and the calculations are done annually as at 31st December
- The requirements for takaful become similar to convention insurance, except that they will use 10% and 2.5% of written premiums, instead of 20% and 5% written premiums (which are the conventional business benchmarks)
- The minimum capital requirements during 2016 are:
  - 50% probability of available capital dropping below 10% of written premiums
  - 10% probability of available capital dropping below 2.5% of written premiums
- The minimum capital requirements during 2017 are:
  - 35% probability of available capital dropping below 10% of written premiums
  - 5% probability of available capital dropping below 2.5% of written premiums
- The minimum capital requirements during 2018 are:
  - 15% probability of available capital dropping below 10% of written premiums
  - 2% probability of available capital dropping below 2.5% of written premiums
- The minimum capital requirements for 2019 onwards are:
  - 5% probability of capital dropping below 10% of written premiums
  - 0.5% probability of capital dropping below 2.5% of written premiums
- Insurers may adopt more conservative risk appetites than those implied by the statutory minimum capital requirements.
- The solvency of a takaful fund will allow for the ability of the administrator insurer to cover fund deficits via loans.
- An insurer cannot include loans to a related company in its calculation of assets supporting capital requirements.
- Broadsure's board has stated a risk appetite for Broadsure General:
  - 99.5% probability of holding 25% more capital than the minimum capital requirements,
  - expects an average 10% p.a. return on capital over the long term
  - will strategically accept lower returns on capital in the short term if they pay off over a 25 year time horizon
- Broadsure's Board has not previously had a stated risk appetite for Broadsure Takaful, but from 2016 onwards it will use the same risk appetite for Broadsure Takaful as for Broadsure General

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## APPENDIX 4: File Note on Simulation Spreadsheet

## WARNING: Before editing the spreadsheet please save your own copy, leaving the original unedited so that you can revert to it if need be.

### Assumptions You Need to Enter Into the Spreadsheet

- Future gross written premiums for Broadsure General and Takaful
- Formulae for Dividends paid by Broadsure General (note that the shareholders have agreed that Broadsure Takaful will not pay any dividends over the next five years)
- Formulae for mudharabah paid by the takaful fund. This can be different for payments to customers versus payments to the administrative company, but payments to the administrative company must never exceed payments to customers.
- Future capital injections to Broadsure Takaful. Note that capital injections cannot exceed dividend payments from Broadsure General.
- The existing assumptions are not suitable. You must determine your own assumptions and replace the ones provided in the case study.
- You can change the loss ratio and investment return assumptions, for example to see a particular scenario, however **overwriting the loss ratio and investment return formulae will mean the simulations no longer work, so if you want to do scenario testing then create a second copy of the Excel workbook in which to do this!**

### Running Simulations

- Make sure you allow macros to run in Excel before attempting simulations.
- Simulations are run separately for Broadsure General versus Broadsure Takaful. Click the "Run Simulations" button on the "Broadsure General" and "Takaful Fund" sheets to run the simulations.
- You will need to rerun the simulations after any changes in assumptions, because the capital requirements simulations / calculations are a function of the assumptions.
- The simulations rely on formulae that reference the random numbers provided. Make sure that you have not overwritten these formulae before running your scenarios. If in doubt, take a new copy of the spreadsheet from the original provided.

### VBA

- There is enough VBA for you to do the report.
- You may enhance the VBA if you wish, but there is no expectation that you will.

## END OF QUESTION

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# GLOBAL RETIREMENT INCOME SYSTEMS

## QUESTION

Capland is a developed country with a compulsory accumulation superannuation system that covers all employees. Details of the system are set out in Appendix 1.

Recent volatility in investment markets highlighted to Capland's Government that accumulation fund members can face significant investment risk. The Government has received many complaints from fund members close to retirement, who were aggrieved at a sudden and significant decrease in their superannuation lump sums. Younger fund members also complained about losing out when they switched to conservative investment options after falls in investment markets.

In response, the Government commissioned the Finance Ministry to undertake modelling to understand the extent of the investment risk that members face. Details of the modelling assumptions and results are provided in Appendix 2.

Following on from this modelling work, the Finance Department proposed an Investment Return Guarantee Scheme for superannuation funds that elect to participate. Under this Scheme, funds would be subject to the following:

- They may apply Crediting Rate rules which guarantee to members that the annual interest rate to be credited to their account will never be less than the Price Inflation rate for the year; but

- In any year where the actual investment earnings rate exceeded Price Inflation by more than 11%, the fund would be required to limit the Crediting Rate to the Price Inflation rate plus 11%; and

- They would be required to keep records of the member's Retirement Account balance, both on the Scheme basis (the member's Scheme account balance under the Crediting Rate rules) and also assuming that all investment earnings are fully distributed to members each year.

  (In other words, when a member retired, each participating fund would have maintained records which would enable it to compare the member's Retirement Account balance under the Scheme's Crediting Rate rules with the actual fund assets attributable to that member's account.)

- When a member retires, they would be paid their Scheme Retirement Account balance as a lump sum. At the same time, a financial reconciliation would take place:

  If the fund held a surplus in respect of the member (because, overall, actual fund earnings had exceeded the earnings which had been credited to the member's account), then this surplus would be remitted to the Government as a form of 'Deferred Investment Return Guarantee premium'.

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On the other hand, if the fund was in deficit in respect of the member at the time of the member's retirement (because, overall, actual fund earnings had been less than the earnings which had been credited to the member's account), then the Government would contribute the amount of the deficit to the fund to allow the member to be paid without causing a strain on fund assets.

The Government has been told by Finance that, over the long run, it would expect to collect significantly more Deferred Investment Return Guarantee premiums than it will pay out in the way of Investment Return Guarantee contributions.

The Government is considering implementing this Scheme from 1 July 2016, with the first annual financial reconciliations applying to fund members who turn 65 in the first year. The second annual financial reconciliations will apply to those fund members who turn 65 in the second year, and so on.

However, Capland's Financial Regulator has reviewed the proposed Scheme and raised concerns that the Scheme design might lead to moral hazard in periods of good investment returns.

The Regulator has also suggested that it would be better to do a financial reconciliation at the end of each year in respect of all fund members (not just those who reach retirement age in that year). In years where the investment performance was higher, funds would pay a levy to the Government (equal to the excess investment return over Price Inflation plus 11%). Of course, in years where the investment return was below Price Inflation, the Government would have to pay superannuation funds the difference (enough to allow them to credit their members' accounts with a Price Inflation return).

The Government has asked you, an actuary, for advice on the proposed Investment Return Guarantee Scheme, in particular:

- the merits of the proposed Scheme for the Government and fund members
- the reasonableness of the Finance Ministry modelling results
- practical considerations for the implementation, administration and governance of the Scheme
- any other issues or risks to be considered

The Government has also requested advice, including simple illustrations, on alternative approaches to managing investment risk for accumulation fund members to maximise their retirement income.

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## APPENDIX 1: Capland's superannuation system

The main features of Capland's superannuation system are as follows:

- Employer contributions are set at 10% of salary
- No tax is payable on contributions, investment earnings or benefit payments
- Fund members are free to choose their superannuation fund
- Many funds are available for members to choose from and most funds offer a menu of investment options including High Growth, Growth and Conservative (see Appendix 2 for details)
- Superannuation benefits cannot be accessed until age 60. There are no restrictions on the payment of benefits after that age. For example, benefits can be taken as an immediate lump sum on retirement, or by regular monthly payments or some other flexible arrangement after retirement.
- Around 90% of members have their superannuation invested in Growth investment options while the rest are divided between High Growth and Conservative
- Fund fees and costs generally average around 1.0% of assets each year.

Capland's population profile is steady and expected to remain so over the very long term. About 150,000 people are expected to reach age 65 every year. About two thirds of these will be in the workforce when they reach age 65. In Capland, workforce participation rates are very steady – people generally tend to start work between ages 20 to 25 and work through until they are 60 to 65 or else they do not work at all. On average, those in the workforce earn about $40,000. Life expectancy at age 65 is around 20 years.
Capland's GDP is around $500 bn and annual tax receipts and expenditures are around $100 bn.
In conjunction with compulsory accumulation superannuation, Capland provides a universal age pension of 10% of average earnings from age 65, funded from general tax revenue.

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## APPENDIX 2: Proposal Development

The Finance Ministry (Finance) developed a stochastic asset model for the investment profiles set out in Table 1.

**Table 1 – Investment Profiles**

| Investment Profiles | High Growth | Growth | Conservative |
|---|---|---|---|
| Equity | 100% | 75% | 20% |
| Bonds | 0% | 20% | 50% |
| Cash | 0% | 5% | 30% |

The assumptions for the asset model are set out in Table 2.

**Table 2 - Stochastic model assumptions**

| | Long term mean (annual) | Volatility (annual) |
|---|---|---|
| Price inflation | 2.5% | 1.3% |
| Wage inflation | 3.5% | 1.8% |
| Short term interest rates | 4.0% | 1.7% |
| Long term interest rates | 5.0% | 1.7% |
| Equity returns | 8.5% | 13.3% |
| Investment fees (% funds under management) | 1.0% | n/a |

Table 3 below shows, for each of the main investment options, the simulated distribution of retirement balances, expressed as a multiple of final salary, for a member who has a 40 year period of contributory membership. The results are from 1,000 simulations, with each simulation depicting an independent 40 year period of contributory membership.

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**Table 3 – Multiple of final salary**

| Multiple of final salary | High Growth | Growth | Conservative |
|---|---|---|---|
| 5th percentile | 4.6 | 4.3 | 3.4 |
| 25th percentile | 6.9 | 6.0 | 3.9 |
| 50th percentile | 9.2 | 7.4 | 4.2 |
| 75th percentile | 12.6 | 9.3 | 4.5 |
| 95th percentile | 20.0 | 13.2 | 5.1 |

Both Finance and the Government were surprised at the range of outcomes that resulted from the modelling, particularly for the Growth and High Growth options. The model was then checked by a modelling expert and both the model structure and the selected model parameters were confirmed as reasonable although subject to the usual inherent uncertainties.

Next, Finance set about investigating whether there was any scope to mitigate the extent of investment risk facing members. To this end, Finance carried out some additional modelling which involved the use of investment fluctuation reserves.

In particular, they modelled a system whereby the underlying investments were in line with a High Growth asset portfolio and whereby the investment return that was credited to a member's account (before any deduction for administration or investment fees) in any year was, firstly, limited to a (somewhat arbitrary) maximum rate and, secondly, was never below the rate of inflation for that year. As well as modelling the retirement balance, they also modelled the implied investment fluctuation reserve at retirement. The implied investment fluctuation reserve at retirement, in effect, represents the accumulated difference between the actual (simulated) fund earnings rate and the Scheme Crediting Rate.

The table below sets out some of the results of this modelling. It shows, for an annual (before administration and investment fees) Crediting Rate cap equal to the rate of inflation plus 11%, the simulated distribution of retirement balances, expressed as a multiple of final salary, for a member who has a 40 year period of contributory membership. It also shows the simulated distribution of investment fluctuation reserves at retirement, again expressed as a multiple of final salary.

**Table 4 – Multiple of final salary – applying Scheme Crediting Rate**

| | **Gross-of-fees Crediting Rate cap of Price Inflation plus 11%** | |
|---|---|---|
| | Retirement balance (multiple of final salary) | Investment fluctuation reserve at retirement (multiple of final salary) |
| 5th percentile | 5.8 | -1.9 |
| 25th percentile | 7.0 | -0.4 |
| 50th percentile | 7.9 | 1.3 |
| 75th percentile | 9.1 | 3.7 |
| 95th percentile | 11.2 | 9.3 |

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Relative to the earlier results for Growth portfolios, simulated final balances were higher at the lower end of the distribution in this second tranche of modelling. As well, the range of outcomes for members was substantially reduced – both desirable results from the Government's perspective.

Related to the modelling, Finance provided an indication of the distributions of annual Crediting Rates (after assumed fees of 1.0%) that might be expected under each arrangement.

The table below sets out these indicative distributions.

**Table 5 – Annual Crediting Rates**

| Annual Crediting Rates | High Growth | Growth | Conservative | Scheme |
|---|---|---|---|---|
| 5th percentile | -18% | -13% | -2% | 2.5% |
| 25th percentile | -4% | -3% | 2% | 3.5% |
| 50th percentile | 7% | 7% | 4% | 7% |
| 75th percentile | 15% | 12% | 9% | 11% |
| 95th percentile | 31% | 22% | 12% | 13% |

Finance advised that, based on their modelling, there is about a 1 in 3 chance that average fund returns (for High Growth funds) will be less than the rate of inflation in any given year. You are referred to the High Growth column in Table 3. However, there is only about a 1 in 9 chance that returns will be less than the rate of inflation in any two successive years.

Finance concluded that under the proposed Scheme there will be about a 1 in 3 chance that the Scheme will have to pay money out to funds in any year and a 2 in 3 chance that the Scheme will result in a net positive contribution to the Government (refer to Table 2 above where the implied investment fluctuation reserve is around zero at somewhere around the 30th percentile).

If the Scheme results in a loss in the first year, the chance of a loss in each of the first two years is quite small (around 1 in 9). Finance is of the view that the risk of successive losses will further diminish quite quickly in each successive year. Accordingly, Finance is satisfied that the risk is manageable.

## END OF QUESTION

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# INVESTMENTS

## QUESTION

Capland is a developed first world country with a comprehensive financial market. Mega Research ("MR") is one of Capland's larger medical research institutes. It is not associated with any of Capland's universities. As a result of the government's spending cuts its annual research grants have been significantly reduced. Its research capacity has, therefore, been reducing.

Some years ago it was a leader in the discovery of a treatment which enabled a particular type of cancer to be cured. One of the first to receive this treatment was Sylvia, a seriously wealthy widow. In thanks for MR's discovery, which saved her life, she has just given MR $C250 million to support its continuing medical research. The relevant terms of this grant are set out in the attachment.

You are the senior partner of Capland Actuarial Investment Advisors ( "CAIA") and are a board member of MR. Your appointment to the board arose through your long standing friendship with the chair of MR's board and your standing in the community as CAIA's senior partner.

MR has not previously received grants which require serious investment strategy to be developed. As a result they have asked you to provide advice as to the investment strategy which should be adopted for Sylvia's grant.

In her invitation to provide this advice the CEO of MR has made the following points

- While you are conducting this assignment you will be acting independently of your position as a director of MR. This will be achieved by your not taking part in any board discussions in respect to your advice. You will, of course, be able to present that advice, respond to questions and, in the board's discussions with you about that advice, be able to defend it if necessary.
- While the terms of the grant are, in several places, not prescriptive, your advice is expected to take very serious regard to Sylvia's expressed views.
- As part of your advice, commentary should be provided as to a decision-making process to be followed in deciding the number of projects to be funded at any one time while complying with Sylvia's views.

### TASK

Prepare your advice.

### ATTACHMENTS

**A:** The relevant terms of the grant
**B**: Data in respect to MR's cost parameters for research projects
**Spreadsheet:** Capland_Investment_Data_Jun15_incl_Sector.xlxs

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**Attachment A:** Relevant Terms of Sylvia's Research Grant

The purpose of this grant is to fund MR so that it can complete at least 2 major research projects in each decade for of 50 years independent of any government or other research funding and ignoring any share of drug companies' revenue. The prime objective is to fund the maximum number of major research projects. There is no objective of having the funds last longer than 50 years.

As a committed environmentalist I have no desire to see investment in any coal, gas, nuclear or similar resource industries. The exposure to the energy sector should be focussed on renewables.

In addition, I have no desire to see investment in the three B's (Bombs, Booze, Brothels). As far as is possible, investment should be focussed on companies which make a material contribution to Capland society's wellbeing.

Apart from these desires the investment decisions are not constrained by these grant terms.

**Attachment B:** MR's Cost Parameters for Research Projects

MR has well developed and evidence based parameters for costing research projects. These are divided into 'major' and 'minor' projects. Major projects are those which target significant diseases and health issues. These projects commence with potential ideas and conclude with sufficient results from trials to make it possible to hand those results to drug companies for future development and commercialisation. MR then takes a share of the drug companies' revenue, usually in the order of 5%.

Major project costing varies according to the years since commencement of the particular project. It is assumed that a major project extends over six years. The costs p.a. are as follows. Figures are in year 1 $C (millions), i.e. no inflation.

| Year | Research Staff | Support Staff | Trials | TOTAL |
|---|---|---|---|---|
| 1 | 2.2 | 0.4 | 0 | 2.6 |
| 2 | 2.9 | 0.9 | 0 | 3.8 |
| 3 | 3.1 | 1.2 | 0 | 4.3 |
| 4 | 2.4 | 1.0 | 1.5 | 4.9 |
| 5 | 2.1 | 1.2 | 1.8 | 5.1 |
| 6 | 2.2 | 0.9 | 1.3 | 4.4 |

The past data on inflation suggest that research staff have cost inflation in the range 1% - 2% p.a. above average weekly earnings; support staff cost inflation equals average weekly earnings; and trials have cost inflation in the order of CPI + 3% to 5% p.a.

**END OF QUESTION**

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# LIFE INSURANCE

## QUESTION

Capland is a developed first world country with a comprehensive financial market and prudential regulations. The regulations in respect to life insurance capital are in Attachment E.

The largest segment of investment funds comes from the retirement savings and retirement income sectors. The regulatory rules previously required that no fund manager could provide life insurance to its customers. Life insurance companies were not allowed to sell any investment business. Any life insurance purchases had to be made independently i.e. from a totally unrelated life insurance company. In January 2014 the Capland government amended those rules. The new rules came into effect one year after that amendment, i.e. 1 January 2015.

Part of the impetus for these changes in regulations came from a customer attitude survey sponsored by the fund management industry. See Attachment B.

Those new rules now provide that risk life insurance can be sold to fund manager customers by subsidiary or associated life insurance companies. However, independent life insurance companies are still not allowed to sell any retirement savings, retirement income or investment products.

Great Capland Fund Manager ("GCFM") is one of the largest fund managers in Capland. It is a wholly owned subsidiary of Worldwide Fund Managers ("WFM") who operate in most large developed economies. WFM have a policy of neither owning nor having an association with life insurance companies. With the consolidation of financial services providers in a number of countries where WFM operates this policy is coming under pressure. WFM's reasons for this policy are set out in Attachment A - Separation of Fund Management and Insurance.

While GCFM has been urging WFM to relax this policy for Capland there has, so far, been no change. As a result GCFM has fallen behind its competitors as most have either made life insurer acquisitions or are in the final stages of such a process. While the time since the new rules came into effect is less than a year, GCFM has seen early signs of a reduction in sales and an increase in withdrawals.

You are the Senior Partner of Capland Financial Services Consultants ("CFSC"). CFSC is a large consulting firm with clients across the whole spectrum of financial services organisations. You have previously had a number of consulting assignments from GCFM in respect to fund management issues.

The CEO of GCFM has contacted you to provide advice which would assist in changing WFM's policy in respect to life insurance acquisitions. She has asked you to prepare advice which counters the issues raised in WFM's policy document (Attachment A). Her instructions also refer to GCFM's discussions with Best Capland Life ("BCL"). BCL is a large risk life insurer and is one of the last major life companies which has not been acquired by a fund manager. She has asked you to use BCL as an example of a potential acquisition. She is concerned that without such an acquisition GCFM will be at a serious disadvantage which will be difficult to overcome.

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**Task**

Prepare your report

**Attachments**

Attachment A  WFM - Separation of Fund Management and Insurance
Attachment B  Customer Attitude Survey
Attachment C  GCFM Recent Sales and Withdrawal Data  GCFM Data.xlsx
Attachment D  BCL Financial and Business Data
Attachment E  Capland Capital Rules for Life Insurance Companies

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**Attachment A: WFM - Separation of Fund Management and Insurance**

This note summarises the reasons why WFM has a policy of not owning life insurance companies.

1. Funds management and insurance are businesses which require very different skills to achieve success. Funds management is an investment decision business whereas insurance is a risk decision business.
2. In WFM's experience there is little pressure from customers to be able to purchase their funds management and insurance from associated companies.
3. Life insurance is a capital intensive business and the profit margins generally available do not allow a sufficient return on capital to be obtained.
4. Apart from expense overruns there is little possibility of losses from funds management whereas insurance is always susceptible to losses from excessive claims.
5. Starting an insurance company from scratch is a slow and expensive project. Alternatively, acquiring a life insurance company would expose WFM to potential unknown problems in the business being acquired.
6. Having an association with a life insurance company e.g. a distribution arrangement, exposes WFM's brand to the behaviour of the associated company. No amount of contractual controls can adequately control this risk.

**Attachment B: Customer Attitude Survey**

In the second half of 2013 a representative sample of retirement savings customers were asked several questions about their life insurance needs and wishes associated with their retirement savings. The summary of the results was

Repondents 2,150

Do you currently have life insurance associated with your retirement savings – Yes: 71%; No: 21%: Don't Know: 8%

Would you like to obtain your life insurance directly from your fund manager rather than an independent life insurance company – Yes: 62%; No: 15%; Undecided: 23%

Why would you like to obtain your life insurance direct from your fund manager – Easier: 58%; Cheaper: 30%; Don't Know: 12%

Why would you not like to obtain your life insurance direct from your fund manager – More expensive: 27%; Conflict of Interest: 31%; Other: 42%

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**Attachment C: GCFM Recent Sales and Withdrawal Data**

**GCFM Data**

| Year | Month | Customer Deposit Rate % of FuM | Market Share of Deposits % | Withdrawal Rate % of FuM |
|---|---|---|---|---|
| 2013 | Jan | 10.5 | 12.4 | 9.2 |
| | Feb | 10.4 | 12.3 | 8.7 |
| | Mar | 10.6 | 11.9 | 8.9 |
| | Apr | 10.8 | 11.8 | 9.3 |
| | May | 10.6 | 12.1 | 10.2 |
| | Jun | 10.5 | 12.6 | 10.3 |
| | Jul | 10.8 | 13.1 | 9.8 |
| | Aug | 11.3 | 14.2 | 9.7 |
| | Sep | 11.2 | 13.8 | 9.6 |
| | Oct | 11.1 | 14.2 | 9.8 |
| | Nov | 11.2 | 14.3 | 9.5 |
| | Dec | 11.9 | 14.3 | 9.4 |
| 2014 | Jan | 11.6 | 14.1 | 9.1 |
| | Feb | 11.5 | 13.8 | 8.9 |
| | Mar | 11.5 | 14.1 | 9.3 |
| | Apr | 11.7 | 14.3 | 9.4 |
| | May | 11.8 | 14.4 | 9.7 |
| | Jun | 11.9 | 14.4 | 9.1 |
| | Jul | 12.1 | 14.5 | 8.8 |
| | Aug | 11.9 | 14.3 | 9.1 |
| | Sep | 11.8 | 14.2 | 9.2 |
| | Oct | 12.2 | 14.6 | 9.1 |
| | Nov | 12.3 | 14.6 | 8.6 |
| | Dec | 12.5 | 14.7 | 8.5 |
| 2015 | Jan | 12.4 | 14.8 | 8.7 |
| | Feb | 12.2 | 14.5 | 9.2 |
| | Mar | 11.6 | 14.5 | 9.1 |
| | Apr | 11.4 | 14.1 | 9.4 |
| | May | 10.8 | 13.8 | 9.9 |
| | Jun | 10.6 | 13.9 | 10.3 |
| | Jul | 10.6 | 13.5 | 10.7 |
| | Aug | 10.4 | 13.2 | 11.1 |
| | Sep | 10.2 | 12.8 | 11.2 |

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**Attachment D: BCL Financial and Business Data**

***Risk Product***

No policy fee

Yearly renewable term, premiums paid monthly

Premium rates: [Males – NonSmokers]

| Age Next Birthday | Premium per $1,000 sum insured | |
|---|---|---|
| | Death | TPD |
| < 31 | 1.00 | 0.50 |
| 31–35 | 1.10 | 0.60 |
| 36-40 | 1.25 | 1.00 |
| 41-45 | 1.80 | 1.50 |
| 46-50 | 2.80 | 2.80 |
| 51-55 | 5.00 | 6.50 |
| 56-60 | 9.20 | 15.00 |
| 61-65 | 15.00 | N/A |

Commission: 10% of each premium

***Business Data (Year Ending 30 June 2015)***

| | |
|---|---|
| **In Force (BOY)** | |
| Policies | 100,000 |
| Annual Premium (C$m) | 78 |
| Avg Sum Insured | 185,000 |
| **In Force (EOY)** | |
| Policies | 135,000 |
| Annual Premium (C$m) | 103 |
| Avg Sum Insured | 207,000 |
| **New Business** | |
| Policies | 45,000 |
| Annual Premium (C$m) | 44 |
| Avg Sum Insured | 228,000 |

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***Expense Analysis (Year Ending 30 June 2015)***

| Expense Category | $'000 |
|---|---|
| Corporate Overhead | 3,800 |
| New Business Processing | 11,250 |
| Underwriting | 4,900 |
| Renewal Processing | 3,800 |
| Marketing | 7,750 |
| Sales Management | 8,400 |
| Business Unit Management | 2,800 |

***Mortality Assumptions Underlying Current Premium Rates***

| Age | Mortality | TPD |
|---|---|---|
| 27 | 0.00045 | 0.00020 |
| 33 | 0.00050 | 0.00025 |
| 38 | 0.00057 | 0.00041 |
| 43 | 0.00082 | 0.00061 |
| 48 | 0.00127 | 0.00114 |
| 53 | 0.00227 | 0.00266 |
| 58 | 0.00417 | 0.00613 |
| 63 | 0.00680 | 0.00000 |

***BCL's Mortality & TPD Experience***

The experience is shown as Actual/Expected measured by amount. Expected is the pricing assumption underlying the current premium rates.

| Year Ending 30/06 | Mortality A/E % | TPD A/E % |
|---|---|---|
| 2010 | 93 | 101 |
| 2011 | 90 | 97 |
| 2012 | 82 | 92 |
| 2013 | 85 | 98 |
| 2014 | 72 | 87 |
| 2015 | 75 | 84 |

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***BCL Financials Year Ending 30 June 2015***

**Income Statement (C$m)**

| | |
|---|---|
| Premiums | 98.5 |
| Investment Income | 2.6 |
| | |
| Expenses | 42.7 |
| Commission | 9.9 |
| Claims | 31.7 |
| Change in Policy Liabilities | 8.7 |
| | |
| Profit (Before Tax) | 8.1 |
| Tax (30%) | 2.4 |
| **Net Profit** | **5.7** |

**Balance Sheet (C$m)**

| | |
|---|---|
| Investments | 70.4 |
| Other Assets | 4.9 |
| | |
| Outstanding Claims | 7.8 |
| Policy Liabilities | 10.6 |
| Other Liabilities | 4.6 |
| | |
| **Net Assets** | **52.3** |
| | |
| Regulatory Capital | 48.4 |
| "Free" Capital | 3.9 |

**Attachment E: Capland Capital Rules for Life Insurance Companies**

The capital rules require that life insurance companies must maintain capital equal to 150% of the expected claims in the following 12 months calculated on the actuary's most recent valuation basis.

Policy liabilities are calculated on a "best estimate" basis with initial expenses able to be spread over the realistic life time of the policy. Profit must also be spread over the realistic life time of the policy.

## END OF QUESTION

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