

# **INSTITUTE AND FACULTY OF ACTUARIES**

## **EXAMINERS' REPORT**

September 2018

### **Subject CA1 – Actuarial Risk Management**

#### **Paper One**

##### **Introduction**

The Examiners' Report is written by the Principal Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

The report is written based on the legislative and regulatory context pertaining to the date that the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

Mike Hammer  
Chair of the Board of Examiners  
December 2018

**A. General comments on the aims of this subject and how it is marked**

1. The aim of the Actuarial Risk Management subject is that upon successful completion, the candidate should understand strategic concepts in the management of the business activities of financial institutions and programmes, including the processes for management of the various types of risk faced, and be able to analyse the issues and formulate, justify and present plausible and appropriate solutions to business problems.
2. This subject examines applications in practical situation of the core actuarial techniques and concepts. To perform well in this subject requires good general business awareness and the ability to use common sense in the situations posed, as much as learning the content of the core reading. The candidates who perform best learn, understand and apply the principles rather than memorising the core reading.
3. The examiners set questions that look for candidates to apply the principles specific to the situation set out in the questions, having read the question carefully. Many candidates gain few marks by writing around the subject matter of the question in a more general fashion. Detailed specialist knowledge is not required and nor is very detailed development of particular points.
4. Good candidates demonstrate that they have used the planning time well to understand the breadth of the question and to structure their answer – this is a big advantage in making points clearly and without repetition. This also enables candidates to use the later parts of questions to generate ideas for answers to the earlier parts.
5. Time management is important so that candidates give answers to all questions that are roughly proportionate to the number of marks available.
6. The comments that follow the questions concentrate on areas where candidates could have improved their performance. Candidates approaching the subject for the first time are advised to use these points to aid their revision.
7. Candidates who give well-reasoned points, not in the marking schedule, are awarded marks for doing so.

**B. General comments on *student performance in this diet of the examination***

- The standard of the answers to Paper 1 was similar to other sessions .Better candidates planned out their answers, particularly for the longer questions and were rewarded because there was less duplication in their answers and ensured they thought widely enough to score well.
- This paper was sat by 7 candidates and therefore comments in each question are based on limited information compared to other papers.
- As per previous sessions answers to the application questions were mixed in that those that were structured scored well, whereas those that weren't had problems getting sufficient depth into their answer
- It was clear that the well thought out answers had planned them better, this is a good use of reading time.
- In this diet the scoring for the exam was done out of 200 and therefore the mark scheme shows a total of 200 marks available for the paper.

**C. Pass Mark**

The Pass Mark for this exam was 60.

## Solutions

### Q1

Systematic risk is risk that affects an entire financial market or system, and not just specific participants. It is not possible to avoid systematic risk through diversification. [2]

In the context of investment markets, the risk of a decline in the market as a whole, with all assets being affected is a systematic risk. So if a general insurance company invests in these assets they will be affected by any general market movements. [2]

In respect of a general insurance company a catastrophe that impacts the whole of the country means that household products could be impacted for a whole country e.g. tsunami. [2]

*Other suitable examples should get credit*

Diversifiable risk arises from an individual component of a financial market or system. [2]

In the context of investment markets, diversifiable risk occurs when the value of an individual security falls. [2]

The general insurance company could have a spread of products to compensate i.e. motor/household insurance [2]

Equally it would not want all of its household insurance in one place to diversify against local risk (flooding from rivers). [2]

*Other suitable examples should get credit*

[Marks available 14, maximum 8]

**[Total marks available 14, maximum 8]**

*Answered well with most candidates scoring full marks*

## Q2

Models will need to satisfy the following requirements:

- The model being used must be valid, rigorous enough for its purpose and adequately documented. [2]
- The model chosen should be capable of reflecting the risk profile of the global retail company – this needs to consider the nature of the global issues, e.g. currency risk. [2]
- The parameters used must allow for all the features of the global retail business being modelled that could significantly affect the profits of the retail company. [2]
- The inputs to the parameter values should be appropriate to the retail company modelled and take into account any special features of the provider and the economic and business environment in which it is operating. [2]
- The workings of the model should be easy to appreciate and communicate. The results should be displayed clearly. The model should exhibit sensible joint behaviour of model variables. [2]
- The outputs from the model should be capable of independent verification for reasonableness and should be communicable to those who will use the results of the model. [2]
- The model, however, must not be overly complex so that either the results become difficult to interpret and communicate or the model becomes too long or expensive to run, unless this is required by the purpose of the model. It is important to avoid the impression that everything can be modelled. [2]
- The model should be capable of development and refinement — nothing complex can be successfully designed and built in a single attempt. [1]
- A range of methods of implementation should be available to facilitate testing, parameterisation and focus of results. [2]

It will be necessary to decide between deterministic and stochastic modelling processes. A deterministic model is more readily explicable to a non-technical audience, since the concept of variables as probability distributions is not easy to understand. It is clearer what economic scenarios have been tested. The model is usually easier to design and quicker to run. The disadvantage is that it requires thought as to the range of economic scenarios that should be tested. [3]

A stochastic model tests a wider range of economic scenarios. The programming is more complex and the run time longer, but the benefit is in the quality of the result. It does depend on the parameters that are used in the model. [2]

Considerable judgement may be required in choosing and using the model and in setting the parameters and interactions between the different features. [2]

The model needs to allow for all the cash flows/profits/costs that may arise. [1]

The time period for calculating the cash flows in the projection needs to be chosen bearing in mind that:

- The more frequently the cash flows are calculated the more reliable the output from the model, although there is a danger of spurious accuracy.
- The less frequently the cash flows are calculated the faster the model can be run and results obtained. [2]

[Marks available 27, maximum 16]

**[Total marks available 27, maximum 16]**

*Most candidates scored well on this question.*

### Q3

- (i) Policyholders using a fitness tracker could be offered a discount on premiums. Possibly further discounts relating to the data (e.g. relating to increased activity). [2]

Alternatively, a fitness tracker could be provided to those taking out the policy. [2]

Both of the above could lead to policyholders modifying their behaviour which could reduce risks. Alternatively, could appeal to relatively healthy lives (a self-selecting group). [3]

This could also give the insurance company additional information which could be used for these policies and future products. [2]

Wearable technology can also give information relating to certain medical conditions. It could improve the management of these conditions and also provide useful information to the insurance company relating to the individual policyholder and the condition in general. [3]

Alternatively the wearable technology could appeal to relatively healthy lives (a self selecting group) [1]

[Marks available 13, maximum 8]

- (ii) The control cycle consists of specifying the problem, developing the solution and monitoring the experience to feedback into the cycle. [1]

#### **Specifying the problem**

The insurance company will need to decide on the type of product it wishes to offer and how it will introduce wearable technology into the product. [2]

It will need to analyse the risks, including mitigations, and the problems from the point of view of each stakeholder. [3]

The aims and objectives of the insurance company for this product will need to be known. [1]

Will also need to know the success measure. [1]

Need to analyse the market to ensure that such a product will be viable. [1]

As well as understand the needs of consumers [1]

And any competition in this market [1]

And understand any competitive advantage that this product could bring. [1]

### **Developing the solution**

The insurance company will need to consider the models which can be used and how they can incorporate any information from wearable technology. [2]

Will then need to select the assumptions to be used in the model. This will include all the assumptions needed for a health insurance product and how some of these may need to be adjusted to allow for the impact of wearable technology. [2]

Interpret the results of the model. [1]

Consider the most appropriate form of benefit and how this would make use of wearable technology. [2]

Will also need to consider any alternative solutions. [1]

Can then come up with a suitable product to meet the needs of potential policyholders and also meet the profit criteria of the insurance company. [2]

### **Monitoring the experience**

This stage deals with monitoring the experience and its feedback into the problem specification and solution development stages of the cycle. [1]

The models used must be dynamic and reflect current experience. [1]

The company will need to review the sales of the new product and the profits achieved. [2]

Will need to identify any causes of departure from the targeted outcome expected from the model. [1]

They will also want to review the information they have received from the wearable technology and consider whether this was as expected as well as if there is more or different information that would be more suitable. Will also need to know if the policyholders attracted to the new product were the types they expected. [3]

The results of the monitoring process will be part of the feedback process. [1]

This may indicate that the initial problem was not correctly specified or that a vital feature had not been taken into account. [1]

It is more likely that the solution will need to be refined rather than it was not appropriate. May need to be brought up to date e.g. wearable technology may

be more or less popular than assumed, there may have new features that are useful. Or it may need to reflect actual experience; it had none initially and would have been making assumptions. [5]

The cycle must be considered in the context of the relevant economic and commercial environment. [1]

The requirements of professionalism must be recognised throughout. [1]

The design of the new product needs to comply with relevant legislation [1]  
[Marks available 40, maximum 20]

**[Total marks available 53, maximum 28]**

*Candidates struggled with generating sufficient points to score well.*

## Q4

- (i) When considering benefits that might be provided to employees, an organisation should identify the drivers of profitability and other corporate objectives. [2]
- Employees can then be made aware of their contribution to the profitability and other corporate objectives of the organisation. [1]
- Each employee can then be rewarded according to their performance in managing the drivers of profitability and/or other corporate objectives that they can control. [1]
- The contract design chosen should be such that it is tailored to the needs of the workforce or subgroups of the workforce. For example, the needs of a young workforce engaged in manual work may differ from those of the executive board of the same employer. [2]
- The remuneration package will need a balance between fixed and variable remuneration. The variable part is most able to align to corporate objectives. [2]
- The main corporate objective will be profit i.e. monetary but may also be non-monetary e.g. corporate social responsibility/customer satisfaction. [2]
- The non-monetary will need converting to financial worth, and combined with profit objective. [1]
- The design of the package should maximise the combined profit metric. [1]
- The value of the remuneration package must be enough to attract and retain staff. [1]
- The company could employ some flexible benefits. They could canvass staff for what they might value. [2]
- There will also be competitive considerations. [1]
- [Marks available 16, maximum 12]
- (ii) Main objective of the investment managers will be to maximise the eventual long term return. [1]
- The main difficulty will be how to reward long term performance and not just short term performance. [2]
- The variable component can have elements of short term cash bonuses and longer term deferred bonus but employees will generally favour immediate bonuses and place lesser value on deferred bonus – probably much less than true underlying value. [5]

So this case will be difficult to incentivise. [1]

Could base deferred element on units of the investment bond to be receivable in the longer term. This may also be useful as a retention tool. In practise, may need to offer some more bonus at intermediate stages e.g. every 5 years. [4]

Bonus should be based on outperformance compared to the market, rather than in absolute return terms, adjusted for cashflow. [2]

The benchmark will need to be appropriate to the mandate given to the investment managers. [1]

[Marks available 16, maximum 10]

**[Total marks available 32, maximum 22]**

*This question was answered poorly by all candidates.*

## Q5

- (i) An insurance company can manage major flooding risk within its insurance portfolio in a number of ways:

### Exposure

Purchase or develop a flood risk model to identify the precise geographic risk analysis and impact based flood forecasting. [2]

When underwriting precisely identify geographic location of properties, for example the flooding risk or properties within 400m can be very different. [2]

### Measure the flood risk of each property and:

- refuse cover for high risk [1]
- increase excess for higher flooding risk to share risk with insured and incentivise insured reduce potential losses [2]
- charge appropriate premiums for the risk [1]
- reduce/avoid anti-selection i.e. less sophisticated underwriters exposed to anti-selection because premiums will be lower [2]
- limit accumulation of risk by location to reduce size of potential losses [2]
- offer discounts for higher flood risk properties with flood prevention e.g. flood resistant structure, no electrics below 1m on ground floor etc. [2]

### Reduce impact from flooding:

- Automated warnings to policyholders when severe weather/flood risk to give them more time to take flood precautions [1]
- Contracts with contractors to rapidly react to a flooding event, for example arranging alternative accommodation, clearing flood damaged contents/fittings, start drying out properties [4]
- Reinsurance to limit maximum losses from events [1]
- Source contractors more efficiently so pay less of a premium and reduce time delays in repairing and length of time alternative accommodation provided for [3]

### Insurance company:

- Staff flexible working so that claims lines, loss adjusters etc. available to deal with claims [2]
- Ensure business critical operations are in very low flood risk locations [2]
- Ensure critical business systems (e.g. computer systems) are in low flood risk locations and have flood prevention so insurance company can continue to operate [3]
- Flood training/crisis management simulations so that company can test and identify issues that could cause systems to breakdown and expose company to higher losses [3]
- Ensure that there is a combination of liquid assets including cash and liquidity facility to avoid having to sell less liquid assets at depressed prices [3]

[Marks available 36, maximum 16]

- (i) A change in the environment can alter the frequency, intensity and location of major floods [3]

Frequency

- There will be more flood events during a year increasing losses [1]
- There is increased risk of multiple weather events in a short period having an increased cumulative impact [2]
- For example a series of weather events can cause areas to remain flooded for an extended period [1]

Intensity

- An increase in intensity of weather events will increase the risk that larger areas are subject to flooding [1]
- Increased risk that flood defences are overwhelmed [1]

Location of floods

- Changes in the environment can change weather patterns so that storm paths change, changing the areas subject to major flooding [2]
- Historical data on flooding risk is a less accurate predictor of flooding risk so premiums do not reflect the risk [1]

Effectiveness of reinsurance changes, for example more frequent less intense floods less likely to reach deductible. [2]

Maximum potential loss increases so need more layers of reinsurance coverage. [1]

Increased risk that insurance company needs to purchase additional reinsurance outside normal reinsurance programme. [1]

There may also be an impact on future premiums and the insurance company's capital requirements. [2]

[Marks available 18, maximum 8]

**[Total marks available 54, maximum 24]**

*This question was answered poorly by most candidates.*

## Q6

- (i) Expenses can be split into the following categories:

Direct/indirect  
Fixed/variable  
Function [3]

### **Direct/indirect**

Some expenses can be identified directly as belonging to a particular class of business – motor, buildings as well as other lines for this general insurance company. [2]

These expenses can be allocated the relevant product. For example, salaries and salary related expenses relating to car insurance only will be allocated to that cost centre. [2]

If direct expenses arise from areas dealing with more than one class of business then time sheets can be kept to help split the costs between classes. [2]

Some expenses will be related to providing a support function for the insurance company and will not be directly related to any particular class of business. These indirect expenses are harder to allocate. It will be necessary to find a sensible apportionment of these expenses across the direct business activities. A 'charging out' basis could be used based for some costs. Others costs may require a more arbitrary approach e.g. senior management costs. [4]

### **Fixed/variable**

Fixed expenses include property costs. They may remain relatively fixed in real terms. [2]

Variable costs will vary directly according to the level of business being handled at that time. These may be linked to the number of policies or claims or the amount of premiums or claims. [3]

Also, some costs may be fixed in the short term but variable in the long term e.g. rent with break clauses if the requirements of the business change. [2]

### **By function**

Securing new business [2]

Maintaining existing business (renewal and investment) [2]

Terminating business (including claims) [2]

[Marks available 26, maximum 18]

(ii) One mark for each of two reasonable examples

e.g. a car accident giving rise to a claim

building claim following a fire

[2]

[Marks available 2, maximum 2]

(iii) Future expenses for these cases will be unknown. A loading will need to be made to ensure that sufficient premiums are charged to cover the costs of expenses related to administration and claims handling for business written at those rates.

[3]

The expenses may relate to the amount of a claim or may be the same amount for each policy or a mixture of both. [3]

The loading could be allowed for as a fixed amount per contract or a percentage of the premium. In this way it is linked to per policy expenses. Could use a combination of these methods. [3]

[Marks available 9, maximum 6]

**[Total marks available 34, maximum 26]**

*Parts (i) and (ii) were answered well, with part (iii) answered poorly.*

## Q7

- (i) For a risk to be insurable:
- the policyholder must have an interest in the risk being insured, to distinguish between insurance and a wager [2]
  - a risk must be of a financial and reasonably quantifiable nature [2]
  - the amount payable by the insurance policy in the event of a claim must bear some relationship to the financial loss incurred. [2]

In most countries individuals are deemed to have an unlimited insurable interest in their own lives and that of any spouse.

[1]

[Marks available 7, maximum 6]

- (ii) The friends will all pay premiums and share the risks involved. [1]

There are likely to be many similarities. The items and amounts covered may be similar and the friends may live near each other. This will mean that they all have a similar level of risk. [2]

This arrangement should reduce moral hazard as the friends will not exaggerate any claims. Also, they may be more likely to take preventative measures to reduce the risk of a claim. Similarly, they may encourage each other to take preventative measures. [5]

Any claim that needs to be paid should be able to be made relatively quickly. They may be able to replace the items covered for a competitive amount. [2]

There will be no insurance company expenses to be covered and no proposal forms to fill out which may appeal to the group. [2]

Also, there will be no contribution needed to insurance company profits. [1]

[Marks available 13, maximum 8]

- (iii) There is a risk that the premiums paid into the pool are not correct. [2]

The premiums will be calculated using many assumptions and some of these assumptions may not be appropriate. A model may have been used to calculate the premiums and this may have had errors. [3]

This set of friends is unlikely to have the data needed to calculate the premiums correctly. [1]

The above can be mitigated by holding more capital in the pool to act as a contingency. [2]

And also by further research into the assumptions although this may be difficult for a small group. [2]

And further work on any model used. [1]

There is also a risk that the claims are greater than the pool held. [2]

This could be mitigated by holding a much larger pool although this will be impractical beyond a certain amount. [2]

They could insure the amount above a certain level (either per individual claim or in total) with a traditional insurance company. [2]

There is also the risk that the friends could fall out or move away and so may want to withdraw. [1]

May need to draw up a formal contract to give details relating to cover and excess assets in the pool in these circumstances. [1]

There is a risk that this type of insurance could be subject to regulation in future. [1]

Could carry out research into the likelihood of this. [1]

[Marks available 21, maximum 12]

(iv) A similar arrangement could be used for these risks but they have additional features which will need to be taken into account.

(a) There will be issues relating to the third party cover for motor insurance. [1]

The liability is potentially very large and could not be covered by a small group. [1]

Some additional insurance will be needed for this arrangement, perhaps for claims above a certain amount. [2]

The arrangement could still work for claims (of all types) up to a certain agreed amount. [1]

There may also be legal issues as motor insurance is likely to be compulsory. [2]

(b) Term assurance covering a mortgage is likely to be for a relatively large sum assured. [1]

It will pay out the full sum assured if death occurs and nothing if not. [1]

It is unlikely that a small set of friends could cover this liability but it may be more practical for a large group. [2]

Some additional life insurance for sum assureds above a certain level could be used.  
This could be above a cumulative amount for a larger group. [2]

Cover will be needed over a very long time period and so this may not be practical. [1]

(c) Travel insurance is likely to be relatively complex for a set of friends to cover. It can cover many perils. [2]

It may be practical for such an arrangement to cover loss of belongings and travel delays. [1]

Covering medical expenses and any repatriation costs will be much more expensive and likely to be impractical. Insurance for such claims above a certain amount could be considered. [2]

There may also be language, cultural and currency issues. [2]

[Marks available 21, maximum 12]

**[Total marks available 62, maximum 38]**

*Parts (i) and (ii) answered reasonably well, with (iii) and (iv) less so*

**Q8**

- (i) The university may be looking to appeal to new students: students interested in swimming/diving and students studying sports. For home students and international students. [3]

It may wish to be known as a specialist centre which may give it prestige nationally and internationally. [2]

It may be hoping that it can make money from these facilities. From charging for their use and from other university facilities which could also be used e.g. student accommodation (out of term time). [3]

There may be incentives available which make this an attractive proposition. [1]

[Marks available 9, maximum 6]

- (ii) I'll need to start by making a high-level preliminary risk analysis to confirm that the project does not obviously have such a high risk profile that it is not worth analysing further. [1]

Can then hold a brainstorming session of project experts and senior internal and external people who are used to thinking strategically about the long term. [2]

The aim will be to:

- identify project risks, both likely and unlikely, and upside and downside [2]
- discuss these risks and their interdependency [2]
- attempt to place a broad initial evaluation on each risk, both for frequency of occurrence and probable consequences if it does occur [2]
- generate initial mitigation options and [1]
- discuss them briefly [1]

Carry out a desktop analysis to supplement the results from the brainstorming session, by identifying further risks and mitigation options researching similar projects undertaken by the sponsor or others in the past (including overseas experiences), and obtaining the considered opinions of experts who are familiar with the details of the project and the outline plans for financing it. [5]

Carefully set out all the identified risks in a risk register, with cross references to other risks where there is interdependency. [2]

[Marks available 18, maximum 12]

(iii) Risks: Finance may not be available – at the initial stage or later in the project. [2]

Mitigation: ensure that finance is arranged before starting the project and that arrangements are in place for further finance at later stages. [2]

Risks: Costs of the project are greater than expected. This will apply to the cost of the goods and the cost of construction. These are both likely to be very specialist. [3]

Mitigation: The project should be well planned and costed in advance. Could fix some of the costs of goods at an early stage. Could pass some of the risks relating to the cost of construction to any contractors. [3]

Risk: Project takes longer than expected. [1]

Mitigation: The project should be thoroughly planned in advance including key milestones. Appropriate action should be taken at the first sign of any overrun. [2]

Risks: There is opposition to the project. There may be environmental risks. Planning permission may not be granted. [3]

Mitigation: Investigate whether any opposition exists. Research any potential environmental risks. Find out whether planning permission has been granted to any similar (although less ambitious) projects in the past. Adjust plans if possible to take any relevant issues into account. [4]

Risk: There may be construction problems. [1]

Mitigation: Consider all aspects of the construction process particularly focusing on building the swimming and diving pools. Investigate to ensure that there have been no problems in the past and if there have been how these were resolved. [2]

Risk: Insolvency of any contractors. [1]

Mitigation: Check the history and financials of all contractors. [1]

Risks: The priorities and/or financial position of any sponsors (e.g. sports body) change meaning that they can no longer support the project. [2]

Mitigation: Research the background of all sponsors. Have a number of sponsors so not overly reliant on a single sponsor. [2]

Risk: A similar development is built relatively nearby introducing unexpected competition. [1]

Mitigation: Research any plans for similar developments. [1]

Risk: Running costs of the facility are higher than expected. [1]

Mitigation: Investigate the running costs of similar pools - may need to look at those other countries. Identify the most important factors and keep these under control. [2]

Risk: The sports facility does not attract the numbers expected. [1]

Mitigation: Carry out market research to anticipate demand. Be prepared to adjust plans to increase attraction. [2]

[Marks available 37, maximum 20]

**[Total marks available 64, maximum 38]**

*Parts (i) and (ii) answered well, with (iii) less so.*

**END OF EXAMINERS' REPORT**