EXAMINATION

September 2007

Subject CA1 — Core Applications Concepts

Paper 1

EXAMINERS' REPORT

Introduction

The attached subject report has been written by the Principal Examiner with the aim of helping candidates. The questions and comments are based around Core Reading as the interpretation of the syllabus to which the examiners are working. They have however given credit for any alternative approach or interpretation which they consider to be reasonable.

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Comments

As the title of the course suggests, this subject examines applications of the core techniques and considers broad actuarial concepts in practical situations. 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 notes that follow are not to be interpreted as model solutions. Although they contain the majority of the points that the examiners were looking for, they also contain more than even the best prepared candidate could be expected to write in the time allowed in the examination room.

Comments on individual questions are given in the solutions that follow.

1 (i) An investor should select investments that are appropriate to the nature, term and currency of the liabilities allowing for the investor's appetite for risk.

Subject to the above the investments should be selected so as to maximise the overall return on the assets, where overall return includes both income and capital gain.

(ii) The following controls might be implemented:

- Restrictions on the types of assets that an investor can invest in. For example no self investment.
- Restrictions on the amount of any particular type of asset (or the method used to value assets) that can be taken into account for the purpose of demonstrating solvency.
- A requirement to match assets and liabilities by currency.
- Restrictions on the maximum exposure to a single counterparty.
- Custodianship of assets.
- A requirement to hold a certain proportion (minimum or maximum) of total assets in a particular class — for example government stock.
- A requirement to hold a mismatching reserve.
- A limit on the extent to which mismatching is allowed at all.
- Where a mismatching reserve is required, the regulations are usually framed so that the more an investor decides to invest in riskier assets with a higher expected return, the higher is any resulting reserve. This increases the value of the liabilities and reduces the available free assets/surplus.

Part (i) is standard bookwork that is normally asked once a year. The question and answer are always the same! Part (ii) was answered well with most candidates getting most of the items in the list. The command verb "outline" suggests that more than a list is required, hence there were some additional marks for some amplification, for example the additional comments on the mismatching reserve and some of the examples noted above.

2 (i) Important macro economic factors e.g. interest rates, growth, inflation etc will affect most companies in similar ways, as will the general political climate, which will influence uncertainty and market risks.

Most companies' costs will be affected be similar factors e.g. tax rates, labour markets, access to and cost of finance and fuel.

Many investors choose to invest in an equity market in general terms rather than choosing specific stocks or sectors. Individual investors in particular may invest in collective investment schemes with a broad mandate across the whole market.

The local market may look attractive (or unattractive) compared to say bond markets or overseas equity markets.

Investors may have liabilities that are suitable for equity investment.

There may be a general feeling that the costs of active management are not compensated for by sufficient extra returns. This would suggest investment in tracking instruments or a broad portfolio across all sectors and stocks.

Regulations or tax breaks may encourage investment in domestic equities.

(ii) Conditions in overseas economies might affect the following types of company:

Companies with extensive overseas trade or business links.

Multinational companies with operations in many countries.

Companies that have outsourced manufacturing or other services to developing countries. For example motor manufacturers or banks.

Collective investment vehicles or trading funds whose objectives are to invest in specific overseas markets or assets.

Companies that exploit natural resources eg mining, agricultural or oil companies.

Companies that are listed on a market for tax or political reasons but whose operations are mainly overseas.

In part (i), answers tended to be too limited in scope, concentrating on the macro-economic factors. The question was asking why there is systemic risk in this situation, not what systemic risk is. Comments about domestic companies having similar resource costs were often made at a sector-specific level which missed the point oft the question. Few candidates got to grips with the issues leading to a block demand for equities, irrespective of individual company or sector performance. Many answers suffered from lack of clarity and structure, which led to much repetition and hence wasted time.

Part (ii) was answered better, although the examples given were not always sufficiently diverse. Credit was given for any sensible example, although credit was not given for saying "companies that are major exporters" and "companies that are major importers" as separate items.

3 (i) The capital required to finance the office's business activities is the new business strain expected to arise for each contract multiplied by the expected volume of business, less repayments of capital from business in force.

In determining the new business strain for a contract, allowance needs to be made for setting up reserves including the solvency margins being created and any other capital requirements. Hence the assumptions used to determine statutory solvency margins need to be taken into account.

In determining the reserves required allowance should be made for any options or guarantees.

The future tax position should also be considered.

Capital requirements for each year are then assessed from the cash flows arising i.e. premiums plus investment returns less claims, expenses, tax and changes in reserves, including solvency margin.

Experience assumptions must be consistent; it is not sufficient to project these independently.

Development costs need to be allowed for. These could include marketing, systems improvements and additional staff and administration costs.

(ii) The following principal experience assumptions may be required:

- Expense assumptions
- Mortality assumptions
- Morbidity assumptions
- Persistency assumptions
- Investment return assumptions
- Inflation assumptions
- Tax assumptions
- Volumes of new business assumptions

In part (i) many candidates saw the word "modelling" and went onto autopilot, reproducing the standard bookwork on the features of a model and the alternative benefits of stochastic and deterministic models. The question was seeking what needed to be modelled, not the modelling process. Part (ii) was answered well by most candidates.

4 (i) A general insurance company requires capital to:

- Meet statutory or regulatory requirements to hold capital.
- Support the uncertainty surrounding the amount of liability outgo.
- Support the uncertainty surrounding the timing of liability outgo eg due to any long-tailed business.
- Support more aggressive pricing (or investment) strategies.
- Smooth any fluctuations in the cost of claims (for example, claims equalisation reserves).
- Smooth returns (dividends) arising for example from high (or low) investment returns to any shareholders.
- Meet new business strain due to the administration and management expenses, commission and any statutory requirements involved.
- Demonstrate financial strength to individuals and investors.
- Meet marketing costs.
- Develop new products.
- Invest in business efficiency projects.
- Enable mergers and acquisitions.

(ii) An international pharmaceutical company requires capital to:

- Finance long term research and design of new drugs.
- Support stock and manufacturing work in progress.
- Provide start up capital for new manufacturing operations.
- Meet marketing costs.
- Provide funds for expansion into new markets and territories.
- Provide a cushion against costs arising from fluctuating trade volumes, due to the risk of drugs being withdrawn, lengthy litigation or the patents expiring, especially as a significant amount of the patent's lifetime may be spent getting the drug approved.
- Cover adverse currency movements or other international events affecting overseas sales/revenues.
- Enable mergers and acquisitions.
- Invest in business efficiency projects.

Part (i) involved the application of standard principles to a situation that most actuaries would be familiar with – an insurance company. This part was generally answered well.

Part (ii) was seeking the application of the bookwork to a non-standard situation (for actuaries), and required application of general knowledge and common sense. Many candidates tried to fit the items that apply to a financial services company to a trading company, and made irrelevant points. It was surprising that so few candidates mentioned *financing stock and work in progress, and covering trade debtors. This is the fundamental difference between insurance companies, where there is no policy until a premium has been paid, and trading companies, who have high costs of manufacture before the goods are sold.*

5 (i) The four widely used accounting concepts are:

Going concern: assumes that the company will continue its operations, so looks at the benefit that will be payable when employees leave/retire in the future.

Accruals: recognises costs as they accrue, and so allocates the total benefit appropriately across employees' total period of service.

Consistency in approach from year to year. In particular in respect of the basis used to value accrued and accruing benefits. If the basis does change, for example due to regulation, the impact of the change should be disclosed.

Prudence: makes provision for future benefit costs even if the amounts/values are uncertain. It is necessary to establish how cautious to be in this provision, given the uncertainties about future benefit costs.

(ii) The following might be disclosed:

Details of the benefit promise.

The value of the benefit that has accrued, and the value of the benefit that is accruing each year.

The actuarial assumptions and method adopted for these calculations.

(iii) This may enable the multinational to understand:

- whether the benefit is competitive, allowing for other elements of the remuneration package.
- how it fits into the multinational's remuneration strategy
- the value of the benefit that has accrued, bearing in mind that the executive may choose to leave or be made redundant, and that special benefit provisions may trigger on acquisition.
- the value of the benefit that is accruing each year.

It is therefore necessary to understand how the actuarial method allocates benefit costs over service. This enables the multinational to assess how prudent or realistic are the actuarial assumptions adopted for these calculations.

This will enable them to adjust the figures onto a different basis if they wish, and understand how they would be incorporated into the multinational's own accounts.

It is necessary to bear in mind the materiality of these figures at this stage of the deal.

Part (i) was straightforward bookwork, which candidates either knew or didn't. Part (ii) was also intended to be a straightforward application, but many candidates did not find it so. Many candidates failed to state the simple and obvious – which is what would appear in company accounts – such as what the benefit promise actually is.

Answers to part (iii) were disappointing. Most candidates commented on the possibility of the executive leaving early but failed to state how the accounts could be used by the multinational to enable it to gain an understanding of the benefit then payable. Although many made a reference to the multinational possibly wanting to calculate the value of the accrued on its own basis, few related this back to the original basis. The staff and other practical issues were generally overlooked.

6 (i) Local authority
Railway and/or station operator
Rail track owner
Government or regulator
Potential passengers
Local residents or businesses
Local tax payers
Any other provider of capital
Competitors eg bus companies
Employers of potential passengers

Credit was also given for any other sensible suggestions.

(ii) The criteria will typically be expressed in terms of the financial results expected e.g. IRR or NPV.

In this case the financial benefits will be the money saved from reduced congestion and accidents, reduced pollution and health improvements. There could also be the prospect of boosting local tax revenues from more local economic activity.

Criteria may also be related to overall risk. In particular the chance that the project is unsuccessful and the expected financial returns don't arise.

However, there will be political or environmental factors that can't be quantified in financial terms. For example achieving synergy or compatibility with other projects such as other transport plans.

Satisfying targets for reduced transport on roads and increasing the use of public transport.

Increasing labour mobility and providing cheaper transport for less well off people e.g. in rural areas.

Boosting the local economy or making the area more attractive to commuters. This may have implications for other services such as schools.

Having the broad support of local residents or other stakeholders.

Using scarce financial, human or other resources in the best way.

(iii) The cost of land for station buildings, car parks, etc. is greater than estimated. An accurate initial valuation of the cost must be used when initially considering the project and the time between this valuation and acquiring the land must be kept to a minimum.

The cost of construction is greater than estimated. All areas of the project should be well planned and researched and thoroughly costed at each stage. Some of this risk can be passed to the contractor.

Service arrangements or the timetable are unsatisfactory. This must be negotiated and agreed upon before commencing with the project. This includes commitments to maintain the service for a minimum period and on levels of fares.

Investment from other parties is not forthcoming or is less than expected. Must ensure finance agreements are in place before beginning the project and that there are satisfactory arrangements in case of any cost overrun.

The project is not completed on time. Each part of the project should be planned in advance to ensure the project is completed on time and action must be taken at the first sign of overrun.

Planning permission is not granted. Find out whether permission has been granted to similar projects locally or in other areas and adjust plans if necessary to increase likelihood of acceptance.

There are construction problems e.g. delays due to weather. Consider all aspects of the construction process and ensure they have all been used successfully in the past. Ensure there are clear procedures to be followed in the event of any problems.

Lease agreement with station operator is not completed before start of project. A satisfactory agreement must be arranged before beginning the project.

Passenger numbers are lower than anticipated. Carry out market research to anticipate demand. Can also compare with any similar stations and make any necessary adjustments.

Credit was given for other sensible and relevant examples. For each example, it was necessary to specify a risk, give a mitigating action and explain the link between them.

In part (i), the possible types of stakeholders were vast, and most candidates scored well despite some repetition.

In part (ii), candidates tended to reproduce too much bookwork. Those who thought about the specific issues to the case at hand scored well. The better candidates realised that the local authority's objectives may only be partly financial, as it needs to serve the local community too, and, in turn, gave good examples of how this could be achieved.

Generally part (iii) was well answered although sometimes the range of risks given was not sufficiently broad bearing in mind the large scope possible and marks available.

7 (i) The extent of the analysis will depend on the volume of business written. The aim is to split the data into homogeneous groups whilst keeping the volume of data within each group credible.

The investigation may be carried out on an amounts basis as well as a lives basis and also net and gross of reinsurance. Only business accepted at standard rates would be included.

The experience is calculated as the claims divided by the exposed to risk. It is important that the claim data and the exposed to risk data correspond. The exposed to risk will normally be the average of the in force policies at the year start and the year-end.

The analysis would be performed to cover the experience for each year since commencement, but as significant volumes have only been sold for the last three years, it may be necessary to group the experience for some calendar years together.

A decision must be made either to analyse all claims or only accepted claims.

The most important levels at which to carry out the investigation are:

- Sex
- Age (grouped as required)
- Smoker Status
- Duration since outset (grouped for longer durations)
- (Experience will be lighter at early durations due to underwriting)
- Sales Channel (this is an indicator of target market)
- Type of illness
- Medical/non-medical cases
- Occupation
- Sum assured
- Premium size
- Premium payment method
- Claim decline rate

As there may be a delay between the date of a claim and when it is admitted, care needs to be taken to include the claim within the calendar year and duration to which it relates. Allowance should also be made for any incurred but not yet reported claims in the more recent years.

(ii) Assumptions are required for both the current level of critical illness experience and the expected future changes in this over the duration of the contract.

In interpreting the experience, care needs to be taken to allow for any features that may have impacted on the experience over the period of the investigation that may make it an unreliable guide for future experience.

The more recent years' experience would be used to help make an assumption about the current level of critical illness experience. This might be expressed as a percentage of reinsurer's rates, of a standard table if one exists, or of the pricing basis if different.

The trend in experience for recent years would be used to help make an assumption about the expected future trend in critical illness experience. If the volume of data were sufficient this trend would be considered separately for each type of illness to understand better the causes of the experience.

(iii) Underwriting standards may have changed over the period of the investigation.

The experience for durations greater than three is based on small volumes of data so may not be credible. Similarly the trend in experience is only based on significant volumes of data for the last three years. This is unlikely to be sufficient to give an indication of likely future trends.

Changes in the sales process or the target market over the period of the investigation may affect experience.

The average premium size may have changed over the period of the investigation. This will affect the results if the analysis is not split by premium size.

The company may have reduced its premiums or there could have been reductions in market premium rates over the period of investigation. This may have led to selective lapses and worse experience. Alternatively, changes in the volume or mix of business may have arisen because of a change in relative premium rates.

Changes in the definition of a critical illness or the critical illness covered over the period of the investigation will distort results, as will changes in claims admittance standards. Consumerist pressure may lead to more pressure in future to admit claims that do not meet the strict definition. Social or economic trends (greater affluence, less reliance on state provision or fashion) may make past trends less relevant to future experience.

Future medical advances may lead to earlier detections of critical illnesses or more routine operations in future such that past trends are not indicative of the future. Particular medical advances that are not expected to continue in future may have caused past trends in experience.

Part (i) was intended to be a straightforward process question: "set out what you do". Candidates who approached it from this viewpoint scored well. Some candidates wasted time by going beyond the scope of the question, for example talking about why external data may be necessary.

In part (ii) many candidates seem to misunderstand the question, for example discussing how to perform a discounted cash flow with sensitivity testing. The question was merely focussing on the claims assumptions needed for the purpose in hand, and so basic issues, such as future claims assumptions being based on the most recent data, were missed. Some candidates wasted time talking about other items of experience e.g. investment, expenses. The question said "use the results of ***this analysis****", and only offered three marks for doing so.*

(iii) Most candidates made a number of relevant points. Few mentioned that the actual data on which to base the rates is not amenable to providing either good credibility or a good indicator of trends. Some mentioned "because of future medical advances" as if no allowance had already been made for this. The important point is why future medical advances may be different to those projected from past experience.

8 (i) The actuary would need to have sufficient background about the client to put the task into context, and to know for whom in the client firm the work is being performed.

Are there any conflicts within the client firm — is the actuary advising for one side of an argument.

What complaints procedures will be in place.

What is the specific task.

(ii) Client agreements set out in writing the terms of reference or the scope for a particular task and outline the output to be delivered to the client, the timescale in which the output will be required, and the actuary's charging basis. They may also cover the relevant regulatory environment governing the work.

The terms of reference will be agreed with the client.

The agreement is likely to cover issues surrounding client confidentiality.

The agreement will cover legal issues such as ownership of the work product, and what happens if the relationship is cancelled or the project terminates before completion.

There may be restrictions on the use of the actuary's work by the client — particularly the extent to which it can be place in the public domain.

(iii) Each feature could have valid reasons or it could give rise for concern. For example, the reasons to keep admin or investment services in house may be due to convenience or control rather than ulterior motives. However, given that there are many suspicious looking items, there may be reason to worry (one or two items may be more understandable).

To take a view, the actuary needs to know what is strictly allowed and what is within the spirit of any legislation.

The state of the company may be a guide. If it is struggling there may be motivation for sailing close to the wind. A detailed analysis may be needed since the company may be trying to hide things.

Reasons for the actions could be to transfer surplus from the scheme to the employer, to reduce tax liability, to improve the reported profitability or enhance the balance sheet or to pay shareholders in the way that they prefer. None of these reasons is necessarily suspect.

Alternatively, the company may be trying to paint a false picture of its financial position and/or reward owners (boost the share price) and managers in inappropriate ways.

(iv) The investment expenses may be a result of profit-related fees from good performance. The low reported investment returns would suggest not. It is necessary to consider how much the investment manager charges other schemes.

The actuary should review what administration services are provided and by whom. There may be a formal contract setting out details of the arrangement and how charges are calculated. Charges for other services (e.g. legal) may be included

It would help to have information on the unquoted companies e.g. profitability, assets, dividends paid and other shareholders.

It is necessary to form a view as to whether the values shown for the unquoted shares are realistic and compare these with the prices paid for them. Need to determine from whom the shares were bought.

The loans could be viewed as self-investment and so be unwise in principle. The actuary needs to investigate whether they are on commercial terms.

The actuary needs to investigate whether the values shown for the loans represent realistic values of the likely proceeds. This includes analysis of the security charged (if any) and whether the loans will have value if the employer gets into difficulties.

The actuary needs to form a view on the reason for the low investment returns. In particular were investment guidelines inappropriate or were they broken. Either the unquoted shares or the loans could be a factor explaining the low investments returns. Poor relative performance may have been due to poor allocations between types of investment, or poor individual stock selection.

Employer contributions could be low if there was a large surplus in the scheme. The employees may pay relatively high contributions.

The actuary needs to review the method and assumptions used for funding the scheme. The basis used may not be realistic. The assumptions need to be credible and internally consistent.

(v) As Actuary to the scheme, it is likely that the client responsibility is to the members and Trustees (or other managers of the scheme).

The actuary should discuss any concerns with the client and to the extent that the client can exercise control, seek assurances. This will depend on the explicit or implicit control exerted by the employer who is probably not the client.

The actuary should consult the previous actuarial advisors. They may be obliged to disclose any concerns that caused them to cease being advisors.

The actuary might approach any regulatory authorities (this may be an obligation).

The actuary might seek professional guidance from senior actuaries in his firm, or from the actuarial profession.

The actuary may decline to accept the work.

Parts (i) and (ii) were largely bookwork and answered well by those who knew it, but there was a lot of repetition. It seemed that candidates were unsure which part of the question the point they wanted to make was answering, and so wrote it down twice. This is always unnecessary as the examiners give marks for valid points, even if written in the "wrong" part of the answer.

Candidates would have benefited from reading the whole question first before starting to answer part (iii). Many candidates gave piece-meal answers to each bullet point that they went on to repeat in part (iv). This part was an opportunity to look at the scene collectively from a high vantage point, for example could the employer be trying to hide something; is it significant all these apparently odd things are happening at once. Many candidates were dogmatic about there being definitely cause for concern - failing to consider the other possibility that there are innocent actions or coincidental issues. Most wrote far too much, ignoring that fact that there were only four marks available.

In general in part (iv), too much was said on the problems each bullet point may cause to the scheme (e.g. lack of security or diversification), rather than the actual issues the actuary would need to investigate. The better candidates kept an open mind on whether each bullet point was indeed suspect. Most candidates drew comparison with arm's length market practice where relevant. Many candidates repeated "allowed by legislation" for each bullet *point, although one blanket comment in part (iii) would have been sufficient to gain all the available marks.*

Some candidates scored well in part (v), but too many failed to change the approach from part (iv) and discuss the initial actions the actuary could take against the background of his/her professional responsibilities.

END OF EXAMINERS' REPORT