EXAMINATION

April 2005

Subject CA1 — Core Applications Concepts

Paper 1 (Assets)

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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Chairman of the Board of Examiners

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The division of the syllabus and core reading for CA1into two parts for the 2005 and 2006 examinations in order to cope with the transition arrangements between the old and new examination strategies leads to an unbalanced split in the examination papers. The paper 1 syllabus and reading is shorter and more straightforward than that for paper 2. As expected the standard of candidates' solutions was considerably better in this paper than in paper 2.

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.

1 (i) **An endowment assurance** has the following cashflows:

A regular series of known premiums (amount certain) which cease on death;
A lump sum paid on death guaranteed to repay the loan;
A lump sum on survival to maturity.

The maturity amount may be certain if the policy is without profits and non-linked, otherwise it could be less than or more than the loan amount outstanding, so there may be a potential shortfall to be funded

It may be possible for the loan to be repaid early, but only if the policy has sufficient surrender value.

An "interest-only" loan has the following cashflows:

Initial capital sum received;
A regular series of interest payments to service the loan - the interest rate need not be fixed so the interest payments may vary.

The timing of the final cash flow is uncertain.

A repayment mortgage has the following cashflows:

Initial capital sum received;
A series of amounts each of which includes part repayment of the loan in addition to the interest payments.

The interest rate need not be fixed so the amounts may vary.

The repayment elements of each regular payment are planned to guarantee to repay the mortgage amount by the end of the term without the need for a final large cash flow.

It may be possible for the loan to be repaid early if the borrower makes greater payments than required to service the arrangement.

There is no provision to fund repayment of the loan on death, so there will be a shortfall to be funded on death.

(ii) (a) The disadvantage of the repayment option is that there will be shortfall on death or critical illness.

(b) A term assurance (level or decreasing) would overcome the disadvantage.

The cash flows are a series of known premiums payable and a guaranteed lump sum payable on death, which will at least repay the outstanding loan amount.

Part (i) was generally well answered but many candidates missed the point that the sum assured at the maturity of the endowment policy may not be sufficient to repay the loan. In part (ii), candidates who realised that the main disadvantage was a shortfall on death or critical illness scored very well.

2 (i) The scheme would generally be looking for a higher return. Overseas investments can increase the expected return through investing in higher risk opportunities or taking advantage of inefficiencies in the global market such as changes in currency rates.

Overseas investments can also reduce risk through increasing the level of diversification by investing in different industries and companies, and investing in countries with a low degree of correlation to the domestic market.

There are other possible reasons to use overseas investments:

- There may not be enough suitable assets available in domestic economy;
- The tax situation may favour overseas investment;
- There is a risk of been out of line with other schemes.

(ii) Changes in exchange rates;
currency complications;
irrecoverable taxes;
different accounting practices;
less information available than in the home market;
language problems;
time zone differences;
poorer market regulation — may increase risks;
risk of adverse political developments;
liquidity — may be very low;
restrictions on ownership of certain shares;

complex administration, for example a multi-currency accounting system; and the need for specific expertise

all add to overall costs

This was well answered by most candidates.

3 The investment strategy needs to be consistent with the charity's objectives; any statutory, legal or voluntary restrictions on how the fund may invest; and the amount of risk that the charity is prepared to take.

The primary aim of the investment strategy is to meet the liabilities of the charity as they fall due.

The strategy will need to reflect:

- the nature of the existing liabilities — fixed in monetary terms, real or varying in some other way;
- the currency or geographic location of the existing liabilities;
- the term of the existing liabilities;
- the level of uncertainty of the existing liabilities both in amount and timing.

Other issues need to be considered.

Liquidity —cash coming in due to appeals disasters etc
and cash needed for short term net outgoings.

Tax — both the tax treatment of different investments and the tax position of the charity need to be considered.

The size of the assets, both in relation to the liabilities and in absolute terms.

The expected long term return from various asset classes.

Future accrual of liabilities.

The existing portfolio.

Whether to invest in ethical investments or to invest in a way consistent with the charity's aims.

Costs of investing - charities may have limited money to spend - and of switching investments if a large change is advised.

Well prepared candidates, in particular those who thought more widely about the particular circumstances of the charity, scored well on this question but weaker candidates missed out many relevant points.

4 An appropriate model would have the following features:

Representativeness — The model should mimic the most important characteristics of real-world financial assets.

Economic interpretation — The behaviour of assets within the model should be consistent with generally accepted economic principles.

In particular, the generated results should be arbitrage-free. The model should also exhibit sensible joint behaviour of model variables.

Parsimony — Models should be as simple as possible, while retaining the most important features of the problem. A balance between realism and simplicity needs to be struck. It is important to avoid the impression that everything can be modelled.

Transparency — The workings of the basic model should be easy to appreciate and communicate. The results should be displayed clearly — graphic formats are often used.

Evolution — The model should be capable of development and refinement. Nothing complex can be successfully designed and built in a single attempt.

It should be fit for the purpose and consistent with the changed regulations.

It should be consistent/compatible with existing modelling.

Implementation tools — A range of methods of implementation should be available to facilitate testing, parameterisation and focus of results.

Cost must be considered - buy off the shelf with customisation cost, or develop internally.

This was mainly bookwork but many candidates did not score as well as would normally be expected for this type of question.

5 (i) The scheme will wish to choose assets that are the most appropriate for its liabilities. In particular assets fixed in monetary terms such as corporate debt would be suitable to match liabilities expressed in monetary terms.

Maturing schemes (closed to new entrants) make bonds a suitable investment as liabilities can be matched.

The decision will be influenced by:

- the relative supply of government debt and corporate debt in the territory concerned;
- the range of terms available; and
- the relative supply of bonds and equity, as equity supply affects bond prices.

Corporate debt also provides diversification benefits:

- higher yield for additional credit risk;
- higher yield for reduced liquidity; and
- scope for active management.

Tax considerations need to be taken into account..

Some types of debt may have additional options to consider, for example convertible loan stock.

(ii) Features that influence yield differences:
marketability / liquidity
supply and demand
credit quality (of particular issue)
corporate prospects (of issuing company)
forecast strength of economy
tax and restrictions on investors
different terms

(iii) Features that could be introduced to reduce risks, or the effect of risks, include:
Floating charge over all or some assets of company
Fixed charge over a given asset
Collateral provided
Financial covenants e.g. income cover
Prior ranking debt
Rights in a technical default
Restrictions on further borrowing / equity distribution
Parent company guarantees
Third party guarantees
Shortening the term
Increasing size of issue

Attempts at part (i) were disappointing. Most candidates picked up that corporate debt would be suitable for matching liabilities expressed in monetary terms and that a higher yield was available than on government debt, but most of the other points were missed. Parts (ii) and (iii) were well answered by the better candidates but many relevant points were missed by others. This question tested the wider thinking that is a feature of this subject.

6 (i) Quote driven system — market makers quote both buying and selling prices at which they are prepared to deal, at least up to a certain volume of shares.

Order driven system — buyers and sellers are matched, usually electronically.

Stockbrokers can observe the prices at which deals are being made on the system and can make an offer to buy or sell at a certain price for their own account, or on instruction from their clients.

(ii) Using a quote driven system the investor does not need to disclose the transaction he wants to do.

The investor can decide not to trade without revealing the trade they were considering.

Large trades can take a time to find a party to transact with and negotiate a sale, particularly if the trade is so large that there are a number of parties on the other side.

Confidentiality is required to obtain the best price.

Using a market maker under a quote driven system addresses these issues

Market makers are closer to the market than investors, and understand the underlying liquidity of a stock. Thus they have the experience to smooth through large trades reducing sharp price movements.

Using an order driven system the size and direction of the trade has to be revealed before a price is agreed. This is usually a disadvantage to the first investor to reveal the trade but can be an advantage to other investors who may deal at a good price.

An order driven system may have lower operational costs, as there are no market makers to take a turn.

For large trades revealing both the size and direction of a potential trade can result in the market moving before the trade is agreed and therefore a poorer price obtained.

The solutions to this question were generally weak. Many candidates were confused between the two systems. In part (ii), many candidates failed to read the question and did not pick up on the fact that a large amount of stock was being traded. Very few candidates realised that the main advantage of the quote driven system was confidentiality; this enables the investor to gain a better price.

7 (i) Investment indices can be used:

as a measure of short-term market movements;

to provide a history of market movements and levels;

as a tool for estimating future movements in the market, based on past trends;

as a benchmark against which to assess the investment performance of portfolios;

to value a notional portfolio;

to analyse sub-sectors of the market;

as a basis for index funds which track a particular market;

to provide the basis for the creation of derivative instruments relating to the market or a subsection of the market.

(ii) Government bond indices can be used:

As a standard against which yields on other fixed interest investments can be assessed;

For an approximate valuation of a fixed interest portfolio;

To provide a picture of general yield structures of fixed interest investments;

Yield indices allow comparison to be made with yields on ordinary shares as a measure of the yield gap between bonds and equities.

Comparison of yields on fixed interest and index-linked government bonds indicates the market's view of future inflation.

Comparison of short term yield and long term yield indicates the market's expectation of future interest rates.

(iii) FTSE 100 consists of the UK's 100 largest quoted companies by market capitalisation, accounts for about 80% of the total UK equity market capitalisation, and is the main indicator of short term movement in the UK equity market.

FTSE All-Share contains over 350 shares covering around 98% of the market, including small-cap stocks. It is more representative of the whole market.

Neither reflects reinvestment of dividends.

(iv) If the manager wants to manage fewer holdings within the fund then the FTSE 100 containing only 100 companies but representing over 80% of the market may be suitable.

It will in general have similar performance to the whole of the UK Equity market, but at times the performance of the small cap stocks excluded from this index is very different from the large cap stocks.

FTSE 100 is the most widely-known UK equity market indicator, and is the easiest point of reference for investors.

The All-Share index gives a more diversified portfolio, but because of the number of stocks, replicating its performance will be more expensive in terms of investment research and transaction costs.

If the FTSE 100 is used, there will be additional costs associated with trading whenever there is a reclassification of the index, which occurs frequently.

Some fund managers offer index trackers of FTSE 100 and others FTSE All-Share so the manager needs to decide which funds they want to compete with.

There will be practical and cost problems if the fund is small initially; to track the FTSE 100 a derivative strategy could be used, but tracking the FTSE All-Share would involve investing in representative stocks.

Part (i) was well answered by nearly all candidates. Parts (ii) and (iii) were fairly well answered but few picked up all the relevant points. Only the better prepared candidates scored well on part (iv), which is where the application of the previous parts was tested.

8 (i) The discount rate is the current cost of raising incremental capital in order to fund the project. This is the rate of return which needs to be earned on the capital if the existing shareholders are to be no better or worse off.

This should be the company's cost of raising capital, taking this as a weighted average where the weights are based on the optimum capital structure for the company as between equity and debt.

The cost of equity capital is the current expected total real return on index-linked bonds plus a suitable equity risk premium.

The cost of debt capital is the current expected total real return on index-linked bonds plus a suitable bond risk premium, having regard to the company's credit rating, and then multiplied by $(1 - t)$ where t is the rate of tax.

As this is the company's first international venture, the discount rate used should be higher than that used for projects in the home territory.

Ideally the starting point should be the discount rate used by companies which habitually engage in such projects, adjusted upwards to account for the fact that it is this company's first such project. In practice it will be difficult to get this information, and the home project discount rate should be used with an adjustment to account for the riskiness of the venture. Care must be taken to avoid spurious accuracy.

Although the discount rate needs to be adjusted upwards to take account of the extra risk of this project, care should be taken not to make it too high, as the relative weights placed on short term and longer term will be distorted.

(ii) Scenario A: NPV = $-565v^{0.5} + 180v^{1.5} + 210v^{2.5} + 240v^{3.5} + 240v^{4.5}$

= \$127,000

Scenario B: NPV = \$29,000

Scenario C: NPV = –\$266,000

Expected net present value of project:

$0.3 \times 127{,}000 + 0.6 \times 29{,}000 + 0.1 \times -266{,}000 = \$29{,}000$

(iii) On average, this project is expected to make a profit.

On 90% of occasions, this project would show a profit but on 10% there would be a significant loss. The loss could be as high as \$266,000 or even more, if a scenario worse than C evolves.

The decision makers should also look at considerations outside the financial analysis, for example:

any bias or approximations in the estimates;

doubts about the feasibility of entering a relatively unknown market; and

any last minute developments.

They should also consider mitigation - insurance against worst outcome - and sensitivity to assumptions.

The decision makers should evaluate this project against other available opportunities and determine whether this fits with other activities of the company before deciding to proceed.

Part (i) is well covered in the core reading but was not well answered. Many candidates realised that weighted average cost of capital was required but only the better solutions gave details. Very few candidates discussed the problems arising from using too high a discount rate.

Part (ii) was well answered by nearly all candidates although a surprising number did not provide the correct units in their solutions, and therefore lost marks. Mathematicians may think that the correct units are a side issue; clients tend to think differently if they are given an answer 1000 times too small, or in sterling when dollars are meant!

In part (iii), many candidates failed to comment on their results from part (ii). Most candidates discussed considering other available opportunities and how the project fitted with other activities but many of the other points were missed.