EXAMINATION

April 2007

Subject CA1 — Core Applications Concepts

Paper 2

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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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 The market is dominated by the clearing banks who use the instruments to lend excess liquidity funds and to borrow when they need short term funds.

The loans and deposits are very short-term investments, often overnight, and the instruments are generally very marketable and very secure.

Interbank rates are usually taken as the benchmark for short term interest rates.

Central banks, as lender of last resort, stand ready to provide liquidity to the banking system. Central banks also use their own operations to establish the level of short term interest rates.

The money market is not a physical market.

This was a basic bookwork question and well-prepared candidates therefore gained high marks. Some students listed all the different types of money market instrument — this was not a good use of time, as it does not directly answer the question.

2 The approach to valuing the bond depends on the bond yield, conversion option price, current share price and the term outstanding.

The quoted market price of the convertible would also be considered if it were available.

A number of other approaches are possible:

Discounting the future income stream

Consider the convertible bond as having two components:

A fixed income stream until the date of conversion.
A stream of dividends starting at the date of conversion.

The date of conversion is then taken as the date for which this present value will be maximised. This is the first date at which the dividend income on conversion exceeds the fixed income from the bond.

It is necessary to make the following assumptions when using the method:

The rate of dividend growth on the underlying equity stock.
The investor's required rate of return.

Comparison with the share price

A convertible can be valued by considering it as equivalent to the underlying share plus an extra amount of income for the period until conversion.

Thus the value of the convertible is taken as the market price of the underlying share plus the discounted value of the income received in excess of ordinary dividends in the period before conversion.

Comparison with loan stock or preference share price

This is a corporate bond with an option; therefore the value should be a minimum of the current value of an equivalent loan stock or preference share issued by the company ignoring the option to convert.

Option valuation method

Option theory can be used to value the bond including the embedded option to convert. Using option pricing theory a convertible can be valued as a loan stock plus the value of the option to purchase the underlying shares.

In contrast to question 1, this was an application question. Many candidates simply regurgitated bookwork descriptions of market value, smoothed market value, book value, adjusted book value, fair value etc, without considering whether they were appropriate to this particular security. Very few candidates realised that conversion will take place once the dividend income exceeds coupons. The candidates who did well were those that recognised the importance of the option and its inherent uncertainty, and considered how best to deal with that feature.

3 (i) If inflation is underestimated then the liabilities will be understated in the accounts and the apparent solvency will be overstated.

Excessive profit will be disclosed, which will lead to a higher tax charge and possibly excessive dividend payments, which in turn may lead to future solvency problems.

Investment freedom will initially appear to increase and the company may apply assets to other projects.

Inappropriate reinsurance arrangements may be set in place.

If too low a rate of inflation is used for pricing new business, then the premium rates charged would be too low. If the position is reassessed at a later date, adverse market reaction may make it difficult to attract good business in future and there may be problems with the regulators.

(ii) Provided that the reserves are calculated on a prudent basis, the company may have sufficient free reserves to adopt an aggressive investment strategy.

However, the first priority of the company and the shareholders is to meet their liabilities towards the policyholders, and so the investment of the free reserves should not be considered as a separate action from the overall investment policy.

The shareholders, the owners of the free reserves, are rewarded by the overall profits of the company and so their investment should be rewarded on the basis of the company as a whole, not just the investment vehicle.

If the shareholders wish to invest in high growth equities they can do so directly, rather than through the shares of this company.

Other options for the free reserves should be considered and assessed against this proposal.

Candidates who considered the range of practical effects of underestimating inflation in a logical manner scored highly: thinking about reserving, profits, tax, reinsurance, pricing etc. The candidates who didn't move past the theoretical — assumptions, types of inflation, claims models — didn't score as well. Many candidates described under-reserving as being a direct threat to solvency and described at length the consequences of insolvency. They did not realise that this is only the case if the company decides to do something else with the assets that would otherwise be supporting the (higher) reserves, such as distributing them to shareholders or undertaking a high risk investment strategy.

4 (i) When determining the premium to charge for a risk, the prime information source will be the details given on the proposal form. It is therefore important that it produces relevant and reliable information for the system. Subject to this, there are marketing advantages in having in having as short a form as possible.

Questions need to be well designed and unambiguous, so that the proposer will give the full, correct information and the underwriting department can process the application readily, adding any coding that is necessary.

In particular the form will need to identify risks where further information will need to be sought.

The form must comply with relevant regulation — for example, in relation to age discrimination.

Regardless of regulation, the market acceptability of the form should also be considered — for example, questions regarding genetically transmitted diseases may not be deemed ethically acceptable in the market.

This information (together with any subsequent changes) will need to be held for a number of purposes, including cross-checking against the claims information at the time of any claim. This should enable the automatic checking of the validity of the claim and the updating of the policy information.

Detailed information on the risks accepted will enable appropriate provisions to be determined for the liabilities taken on.

(ii) Information:

Current age and gender of policyholder
Smoker/non-smoker
Height & weight
Alcohol consumption
Type of cover (hospital type, group or individual)
Extent of cover (excess, limits)
Occupation / income
Medical information — both past history and present conditions
Address, as an indicator of likely regional hospital costs
Relevant family history.

This was a standard piece of bookwork, and was answered well, although some candidates padded their lists in part (ii) with a host of irrelevant items.

5 (i) Advice regarding:

Protection against financial loss arising from employees' death or ill-health, in particular for key individuals.

Insurance protection of tangible and intangible assets.

Risk analysis and mitigation.

Provision of benefits that will attract and retain good quality staff, and managing the operation of the pension and ill-health schemes.

Advising on legislation or tax.

Managing the costs of running the business.

Quantification of the amount of surplus capital in the business.

Investment policy.

Raising additional capital.

Project appraisal and project management.

(ii) The cost of the salary continuance benefit equals the cost of benefit payments plus expenses plus insurance loadings.

Could control benefit costs by restricting eligibility, for example, only to employees with more than two years' service.

Could control benefit costs by altering the benefit terms:

Increasing the waiting period.

Reducing the maximum age.

Ceasing the benefit after a fixed period of payment (say 10 years).

Reducing the initial level of benefit or offsetting any state ill-health benefit payments.

Restricting the pension contributions (e.g. freeze at pre-sickness level).

Reducing/removing/capping the annual rate of increase.

Introducing a more restricted definition of ill-health.

Could control benefit costs by more effectively managing ill-health absence, such as requiring medical reports both during the deferred period and during payment of the benefit, or by introducing a specialist firm to manage ill health absence more effectively and successfully.

Could try to reduce incidences of ill-health through lifestyle management and health and safety policy at work — e.g., on-site smoking policy.

Could control finance costs by changing or reviewing the insurance provider and by reviewing how much of the benefit to insure (say, could self-insure payments up to 12 months).

Could control its own expenses of managing the benefit (although most expenses effectively passed to the insurer).

Could stop the benefit altogether either for all employees or just for new employees.

Although part (i) was only seeking a list, candidates needed to write down more than single words to show they had a grasp of the context of the question and gain full marks. For example, "Capital" wasn't enough, but "how to raise capital", or "working capital requirements" was. In part ii), candidates who used the product details to generate actions scored reasonably. Those who scored well used all the information given in the question and considered the wider options that may be available, considering expenses, insurance, management options, etc.

6 (i) Data that could be used:

Historical population data for country
Historical insured life/pension scheme data for country
Projections of mortality improvement for country
Historical population data for other similar countries
Historical insured life/pensions scheme data for other similar countries
Projections of mortality improvement for other similar countries
Medical papers about future longevity
Research papers by experts
Any data that the insurance company or its reinsurers have

(ii) Past data can be used to project future mortality improvements, however, the conclusions will rely considerably on use of judgement. Due to the uncertainty it may be useful to compare the actuary's judgement with the range of views within the industry.

In a developed country it is likely that extensive population data will be available, though whether there is significant insured life/pension scheme data depends on whether and for how long annuities have been available in the country.

The country is small so the volume of data will mean it has lower credibility, particularly if there are significant numbers of sub-divisions. Data may be over-simplified or not detailed enough.

It is important that the past data used is relevant to the group of individuals about whom assumptions are to be made — for example, general population data may not be relevant for use with insured lives. The insurance company's own past data may relate to different products.

Using data from other countries would alleviate some of the data shortage, however, it will be necessary to either adjust the data or at least recognise differences between the countries both now and historically over time.

The social and economic conditions are likely to have changed to some degree over any period of history. This will affect the factors that the actuary needs to project. The actuary therefore needs to consider the conditions that will apply in the future period to which the projections will relate and how those conditions will lead to a difference from the past data that is being used.

The relevance of past data to future projections must also be balanced against the need for sufficient data for its analysis to be statistically credible. The actuary must manage this conflict between credibility and relevance.

When using past data the actuary therefore needs to consider how to deal with:

- Abnormal fluctuations
- Changes of the experience with time
- Random fluctuations

- Changes in the way in which the data was recorded
- Potential errors in the data
- Changes in the balance of any homogeneous groups underlying the data
- Heterogeneity with the group to which the assumptions are to relate
- Effects of economic changes
- Effects of healthcare and lifestyle changes

Mortality data is affected more by medical advances than by economic circumstances. Past data should be considered with this in mind. This is likely to result in significant emphasis being placed on the most recent data, with consideration of past trends and their underlying reasons being important in determining the extent of future change.

Because the morality data is significantly affected by medical advancements, it will be necessary to consider the views of doctors and other healthcare professionals to understand the range of views about future medical advancements when determining the range of potential future changes.

The candidates who performed best on this question were those who used well the core reading information and lists on data issues, especially the section on using past data. Many answers to part (ii) were unspecific and repetitive. To score reasonably, it was necessary to ensure that the answer to part (ii) covered all of the sources identified in part (i). The better candidates noted that longevity improvements are the key to annuitant mortality, and used this feature as base to hang a logical discussion on.

7 (i) (a) There are two main reasons: either to raise money for the club; or to raise money for the family.

The club may want to use the money to develop the stadium and its facilities, or to use spare land for related purposes, such as a hotel or conference centre.

It may wish to buy new players, expand into new areas linked to sport, e.g. clothing, or expand into other sports and set up new teams.

It may have large debts or other liabilities (e.g. tax) that it wants to clear.

The family members may be getting older and have lost interest, with no clear succession. They may wish to cash in part of their investment. If more investment is needed outside investors may have more resources.

External shareholders may bring in better management and financial discipline, which could benefit the family longer term. This could a first step to gaining a quotation.

(b) The main reason would be because he expects to get a good return. The investor may consider that the club or the sector (sport) has good medium or long term prospects.

The sector may be becoming fashionable or other club specific developments may be about to happen, such as sponsorship deals. This could give rise to possible short-term speculative gains.

The investor may have other operations, such as media subsidiaries that could lead to gains from synergies.

This investment will have particularly different features to other traded shares, and therefore the investor could benefit from diversification.

The reason was required to gain credit — "diversification" on its own was not sufficient as an answer.

Sport could be the investor's area of expertise or it may be his narrow investment objective.

Depending on the site, it could be viewed as a property investment with large development potential.

The investor may see it as an ego boost or as a glamorous "hobby" — so not really a commercial investment.

(c) The balance sheet will set out the assets and liabilities of the club. The investor would want to check that nothing unexpected was present and that what they expect to see is covered.

A major point will be to check that the values given in the balance sheet are realistic and to consider the accounting regime under which they are prepared.

The club may have significant land and property assets or it may rent the ground from others. The ownership needs to be clarified and the realistic value of any property assets assessed. The value as a sports complex may be less than that of a redeveloped site. Are there any covenants that could restrict the uses of the site.

The club may show sponsorship, merchandising or TV rights deals as assets. Are the values realisable and how are they depreciated.

If the club shows players as assets, on what basis and can the values be realised. The values can be volatile.

Given the ownership, the investor will need to look carefully at any loans: who they are they from (the family?); what they are secured against; what the repayment terms are - can they be called in immediately?

Consider any current liabilities carefully. Look for items that could cause problems such as unpaid tax, wages or other contractual obligations to players.

(ii) The two types are defined contribution and defined benefits.

Under a defined contribution scheme, contributions are allocated to an account set up for each individual member. The benefits that each member is entitled to are those that can be purchased by the accumulated contributions. There is no cross-subsidy between members, as the cost of the benefits in any circumstance is met by the individual member's fund.

Under a defined benefits scheme, the scheme rules set out the members' benefit entitlements. The benefits are paid irrespective of the investment returns.

In a DC scheme the member primarily bears the investment risk whereas in a DB scheme the employer primarily bears the investment risk.

(iii) Given the likely number of employees, resources may be scarce. Hence administration and complexity issues are relevant.

The legislative framework surrounding defined benefits schemes can be onerous. The employer may have to pay a lot for the requisite expertise.

The mechanisms in running a defined contribution scheme can be complex. However there may be providers who can handle all the administration for a fee.

A lot may depend on the practice within the country or industry. The employer will probably not wish to be too far out of line with similar companies. This will also encompass employee expectations.

Possible groups to consider are: players, coaches/managers, executives and other "normal" employees.

Players are likely to be on relatively short contracts. They are unlikely to stay for a long time. They may have a retirement age that is lower than normal, or be subject to a special legislative framework. Their earnings are likely to be high but volatile with lots of bonuses etc. The club may want to treat each player on an individual basis.

For these reasons the flexibility offered by defined contribution arrangements may be preferable.

Coaches and managers may be similar to players but may be older, and in general will stay for a longer time.

Executives may be offered relatively generous pension benefits, as they are usually a tax efficient way of gaining remuneration. Each executive may have negotiated individual terms or may want flexibility from their pension arrangements.

Again, defined contributions probably offer the best means of tailoring and differentiating between executives. Alternatively, executives could be members of a company wide defined benefits scheme but also receive top up benefits from an extra arrangement.

The arrangements for the other employees may depend on the makeup of the workforc, the turnover rates, and whether the employer wants to provide the guarantees implicit in defined benefits schemes.

Credit was also given for other reasonable and well argued conclusions for these groups.

(iv) Policies tend to be sold on a one-year risk premium basis.

Reserves under the policies are low.

Markets are competitive, with policyholders frequently changing insurers.

It is easy to compare rates, putting pressure on margins.

The value of a claim can be high relative to the premium charged.

Insured lives are often accepted with minimal underwriting.

Many policies are sold with exclusions or excesses, e.g. no payment if the claim arises from an excluded risk, no payment of the first £x of any claim.

Frequently market can be for a bundled product covering all these arrangements.

(v) This is likely to be a small group and so the profile may be non-typical. The club is based in a provincial city and so local health or mortality factors could have an influence.

Again, consider the same possible groups: players, coaches / managers, executives and other "normal" employees.

Players are likely to be male, young and physically fit. One would expect them to have lower than average mortality rates. However sport can put a lot of strain on the body and so they may be more at risk from stress/cardiac complaints.

For similar reasons one might expect a lower rate of sickness. Depending on the nature of the sport, the risk of injury due to accidents may be higher than average.

The usual lifestyle issues associated with young men will be present to a greater degree, e.g. fast cars and fast living.

Accident experience may be reduced if players are prohibited from undertaking dangerous pursuits. Expert medical care could mean injuries or sickness doesn't last as long as for other group.

Coaches and managers will be older than the players and are likely to be fitter than the general population, though the role of manager may induce greater stress.

Executives and senior management will be hard to categorise. If ex-players are present, this could distort the experience. Experience for this group could be very variable depending on the lifestyle of the individual concerned. High living could imply higher mortality and sickness risk. But equally, affluence and education could imply the individuals take better care of themselves.

The remainder of the workforce are likely to be clerical, administrative, and manual ground staff. As such, their profile is likely to be the most similar to the general insured population in terms of age, sex and lifestyle.

However, this will depend on the nature of the employees covered by group schemes. For example, in an industrial economy these employees may have lower than average mortality and morbidity, but in a more service-based economy their experience could be assumed to be standard.

(vi) Information required:

- The length of the contract and what earnings potential exists after the end of the contract.
- The guaranteed level of income plus what the player expects from bonuses each year.
- Other sources of income, e.g. sponsorship or advertising deals.
- Where tax will be paid and at what rates
- Whether income can be paid overseas to minimise tax liability.

Sufficient information would be required to know the client prior to giving any advice - for example details of their family, their preferences and their habits.

After determining the level of income, the conclusion will be high income for a relatively short period of time.

Net income will need to be determined after looking at expected outgo. For example, the player may take a lax view on spending so leaving little for longer term investments.

Consider where the player will live — will the club provide or cover the costs or will the player buy or rent property from his own funds. Buying could be a sound investment in any event.

Consider the target date for retirement. For example, he may wish to have enough saved so that he no longer has to work from, say, age 35. In this case, the aim will be to accumulate funds to provide the player with the resources to fund his chosen lifestyle.

Although a high return from real assets may be the most obvious route, a more cautious view may be better if the player is going to rely on the fund for future income over a long period. For example, assets with secure income.

Allowance for existing assets may be relevant — but there may not be many existing assets if the player is relatively young. Existing liabilities and debts should also be considered.

The funds involved could be large and so diversity via direct assets could be possible. If not, indirect vehicles could be considered.

Overseas assets may be wise if the player is likely to return home or go to other countries at the end of the contract.

If the player foresees long term high earnings potential or wants to take a risky approach, then more speculative, higher return type assets or investments could be looked at, such as business ventures exploiting his name.

Most candidates realised that despite being worth 37 marks, this was actually a set of shorter questions linked by a common theme, and most of the parts were answerable independently. Those parts of the question that are not bookwork required a logical approach that is related to the particular context of the question. In turn this required both general knowledge and common sense. Candidates who showed both these features usually did well.

In part (i) (a) relatively few candidates identified that there could be two distinct drivers: the desire of the ***family*** *either to exit or to raise cash for personal reasons, and the need for the* ***club*** *to obtain more investment capital. In (c) many candidates described features that would not appear on a balance sheet such as revenue items.*

Part (ii) was bookwork and generally well answered although the descriptions were often too brief relative to the three marks available.

The candidates who performed best in parts (iii) and (v) were those who differentiated clearly between the needs and circumstances of the different groups of employees. Some students simply wrote at a high level about the pros and cons of the two different types of pension scheme and did not apply their answer to the specific situation described, and therefore would not have done well on this question part.

*Many candidates appeared to have mis-read part (iv) and described the **specific** features of each **product**, rather than the general features of the market, and consequently scored poorly.*

Part (vi) was generally answered well.

END OF EXAMINERS' REPORT