

# Subject CA1 — Core Applications Concepts

## Paper Two

### EXAMINERS' REPORT

September 2008

#### 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.

R D Muckart  
Chairman of the Board of Examiners

December 2008

#### General 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 main weakness that candidates show is an inability to read the question carefully, and having done so, to answer the question that the examiners asked. Too many candidates write randomly around the subject matter of the question, and gain few marks.*

*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 for individual questions are given within the solutions that follow.

- 1** (i) The two main methods are market value and discounted cash flows (or another off-market-value method such as smoothed market value).

Market value is the current prevailing price in an efficient and active market. In some cases market values may be unavailable and so will need to be estimated possibly from recent trades. There could be ambiguity over the market value to choose.

To discount cash flows, an estimation of the future proceeds from an asset (income or capital) needs to be made. These proceeds are then discounted at an appropriate rate to give a current value. The choice of discount rate should reflect the risk of the assets being valued and the rate should be consistent with other elements of the valuation basis such as growth in levels of income.

For smoothed market value, an average can be taken over a specified period to damp down short-term fluctuations. To give a consistent liability valuation, one might determine the discount rate (and other financial assumptions) from the average of relevant market yields over the specified period. Some care is needed if the smoothing period brings in historic data (such as a material gain/loss event in the case of valuing a company's equity).

*Marks were given for market value and for any sensible alternative.*

- (ii) Employees will want to know how much their account is worth; to understand their financial position and investment allocations; to project the benefits they might receive; and to plan future pension contributions. If they change employment, they will need to know the amount of any transfer value.

The fund value will be needed to assess the performance of the scheme's assets. This performance will cover a comparison against the assets of other schemes and a relative assessment of the various funds employees of the scheme can select. This may also affect the asset management fees, or may prompt review of the investment managers.

The employer will use fund values to estimate whether the current level of contributions will provide an appropriate level of benefits. They may not want to provide benefits that are either relatively too high or too low, or there may be specific target or underpin benefits.

Auditors and Trustees will want to check that the assets are actually owned by the scheme and have been correctly valued. They will be concerned to assess whether there has been any fraud or misrepresentation.

Assets may need to be valued for the purposes of taxation.

Regulatory authorities may need to use values to ensure that all legislation is being complied with (e.g. maximum benefit levels), or Scheme Rules may require a valuation.

*Part (i) was well answered although many candidates defined the market value method as using the "market value" of assets without describing/defining it any further. In part (ii), some candidates seemed to think the DC arrangement was DB and discussed valuations, comparing assets and liabilities etc. and experience compared to assumptions.*

- 2** (i) Costs will be incurred in
- contract design and pricing
  - market research and marketing/advertising
  - commission to brokers
  - setting up new clients records on administration system
  - ongoing administration of maintaining records and paying benefits
  - ceasing or altering payments on death (e.g. reduced payment to a surviving spouse)
  - investment management costs
  - overhead costs (offices/IT/etc.)
  - cost of capital and profit margin
  - underwriting costs (financial underwriting or medical underwriting for impaired life annuities)
  - valuation/accounting

- (ii) The more complex the contract and the more options/guarantees, the greater the costs, as a generalisation.

Options and guarantees will increase the capital needed and hence the cost of capital throughout the contract period. Options involve choice for policyholders that need to be communicated at the relevant time and recorded after individuals have made their decisions, all adding to costs.

Different types of contract may have different market commission rates.

Investment management costs will be higher for contract types that (implicitly or explicitly) will be invested more actively, such as with-profit/unit-linked annuities.

There may be a lower profit margin requirement and lower underwriting costs for contracts that have lower risk for the provider such as income drawdown as opposed to annuity contracts.

*Part (i) was generally well answered. The command verb "Outline" implies that something more than a list is required – but not much more, give the marks available. In part (ii) there was some confusion between costs and profits. Many candidates talked about the impact of options and guarantees in the context of pricing for them rather than the costs of administering them.*

- 3 (i) The overall risk is the “sum” of the active, strategic and structural risks.

**Strategic Risk**

An appropriate asset mix for the fund will need to be established – the strategic benchmark. The strategic (or policy) risk of the fund is the risk of poor performance of the strategic benchmark relative to the value of the liabilities.

**Active Risk**

The strategy can be implemented by the selection of one or more managers, and a decision on the appropriate level of risk that these managers should take relative to the strategic benchmark. This is known as the active (or manager or implementation) risk.

**Structural Risk**

There may also be some structural risk associated with any mismatch between the aggregate of the portfolio benchmarks and the total fund benchmark.

- (ii) Prospective tracking error is an estimate of the standard deviation of returns (relative to the benchmark) that the portfolio might experience in the future if its current structure were to remain unaltered.

This measure is derived by quantitative modelling techniques and depends on assumptions including: the likely future volatility of individual stocks or markets relative to the benchmark and correlations between different stocks and / or markets.

It provides an estimate of the investment risk within a portfolio at the time it is calculated.

The retrospective or backwards-looking tracking error is defined as the annualised standard deviation of the difference between portfolio return and benchmark return, based on observed relative performance.

It provides a measure of the investment risk based on realised returns of both the actual portfolio and the benchmark.

Tracking errors make no distinction between upside risk and downside risk.

- (iii) The prospective measure assumes an unchanged portfolio and benchmark. It relies on assumptions that are unlikely to be achieved in practice.

The retrospective measure is based on the actual portfolio and on the performance of that portfolio against the benchmark but it reflects experience over a particular period that may not be repeated.

*Candidates clearly realised that part (i) was bookwork, but only about half identified what the examiners were seeking. In part (ii) many candidates assumed that the question asked “Define”. The instruction was “Describe” and candidates who stopped at a definition*

*gained few marks. Part (ii) clearly needed candidates to say something more that “prospective” looks forward and “retrospective” looks backward, but less successful candidates couldn't think what else to say.*

- 4** If the investor doesn't own shares in the market, he could borrow shares and sell them. When the price has fallen, he can buy back the shares, ready to return to the lender. This is **short selling**, and comes with the risk that the investor may become a forced buyer when he has to give the shares back, if prices have actually risen, and to possible regulatory restrictions.

Similar transactions could be undertaken using **derivatives**. For example, if an investor held shares he could buy put options or sell futures on the market: the capital gain on the derivative could offset a capital loss on the portfolio. Alternatively, if the investor didn't own shares, he could write call options, which, if the market falls, wouldn't be exercised so the income received would generate a straight profit.

He could invest in **defensive shares** with have high dividend yields. It is possible that the income from such stocks will offset any capital losses from the share price falling during the bear market, although one might expect such stocks to see a higher than average price fall.

Investors could generate profits by skilful **stock (or sector) selection** because all stocks won't move uniformly in a bear market. Some well managed companies or those in certain sectors (e.g. energy companies when oil prices are high) could still perform well.

The investor may make profits from **good timing**. Share prices will not fall uniformly throughout a bear market: there will be periods when prices will rise, offset by longer periods of falling prices. Skilful investors could buy on short-term recoveries and sell again when prices start to fall again.

The investor could **sell shares** in his portfolio and buy them back at a lower price when (if) prices fall, but only if the investor already holds shares in this market. *This does not really fit the requirements of the question.*

In all cases, returns will be net of dealing/management expenses and taxes

*Marks were given for other sensible arguments and examples, but only the five best discussed examples were counted.*

*This question was probably answered the worst on the paper on average. However there was a wide range of quality of responses, with some candidates producing very good logical answers. Other responses were disorganised and repetitive. Some candidates suggested investing in non-equity assets, which is clearly not what the question is seeking.*

- 5** (i) (a) The underwriting cycle is the process whereby relatively high and thus profitable premium rates that often result in an increase in the supply of insurance lead to increased competition and the lower and less profitable premium rates usually associated with this.

These in turn may be followed by a decrease in supply as companies leave the less profitable market which leads to reduced competition and a return to higher premium rates.

- (b) The risk premium is the amount of premium required to cover claims expected for a risk.

Risk premium = average claim amount  $\times$  average claim frequency

- (ii) When calculating the risk premium the main issue will be lack of data to determine the expected claim amount and claim frequency when the exposure period is not complete for the current policies.

In this case very little will be known about the more recent insurance years, since the policy term is 12 years.

As it is necessary to estimate claims for policies being written now, experience on not-recent insurance years will be less relevant.

Data quality may be unreliable, especially for less recent periods.

- (iii) An actual premium charged would be based on the theoretical risk premium but would additionally allow for:
- any differences between the basis used to determine the expected cost and the basis used to set future provisions for the liabilities
  - expenses of setting up the policy, maintaining records throughout the twelve-year period, and costs incurred in payment of claims (if these are not included in the risk premium)
  - commission
  - contribution to profit allowing for the risk inherent in the long term of the policy, and noting that the contribution to profit may be negative, depending on competition in the general market and the provider's position in the market
  - contingency loadings
  - allowance for the risk of rare events or a catastrophe due to any geographical concentration
  - investment income on the balance of the premium remaining, due to the long term of the policies
  - The impact of inflation on claims and expenses
  - the cost of the capital supporting the product

- the impact of taxation
  - reinsurance costs
  - profit sharing, or other allowance for particular policyholder experience.
- (iv) The actual premium to be quoted in this case would be assessed taking account of:
- The size of the existing policy with the construction company
  - The rates that have previously been charged to this company
  - How the rates compare to those previously quoted by competitors...
  - ...and those currently quoted by competitors
  - Whether the business should be priced as a loss leader with a view to maintaining customer relationship
  - Whether analysis of past experience for this construction company indicates in any way that the risk is non-standard...
  - ...allowing for appropriately limited credibility of this analysis, given the policies are still in force
  - Whether there are any expectations of variations or trends in the risk specifically applying to this company...
  - ...which would not be allowed for by existing rating factors...
  - ... such as unusual construction methods used, a propensity to build on flood plains or “brown field” sites
  - The market position of the construction company...
  - ...and the financial status of the construction company.

*Part (i) was well answered by most candidates. A few candidates gave an investment risk premium definition (e.g. equity risk premium). It is clear from the context of the question that this isn't what was being sought. In part (ii) candidates who related the general points to the specific situation given scored well; other responses were too bland.*

*The question for part (iii) clearly states “other than the risk premium”, but this did not put off several candidates who wrote pages on how to calculate a risk premium, and gained no marks. It is clear from the number of marks available, and the use of “Outline”, that more than a list is needed. Part (iv) was one of the better answered sections. Many candidates showed a good commercial appreciation and gave good suggestions especially on the impact on other policyholders.*

- 6 (i) A government can
- Provide benefits itself A1
  - Require/encourage other parties to provide benefits B1
  - Educate people about the need to save and their options C1
  - Regulate those who provide retirement benefits D1
  - Providing investment products DD1
- [Subtotal 4 + 1 bonus]

- (ii) Individual employees who were not saving (or saving less than 5%) will be forced to increase their savings, as will the self-employed saving less than 10%

Individuals who were saving more than 5%/10% may simply reduce their other savings so as to maintain their aggregate saving at what they can afford. They may think that the state-approved funds will provide an adequate pension and so reduce their aggregate savings, or they may carry on with their existing saving and so increase their aggregate saving.

Employers' contributions will be an additional source of saving, except that employers may attempt to reduce any existing retirement provision they sponsor, in order to offset the new required contributions (subject to legal / industrial relations constraints). If employees do not replace any such reductions then savings overall will not rise by the full amount.

Employers may give lower future salary rises (or cut other benefits) in order to control the increase in total employment costs. This would reduce the ability of individuals to afford private saving.

Abolishing the generous means-test might remove a disincentive for some individuals to save, and so lead to an increase in saving.

- (iii) Transitional arrangements will be a major issue, especially if the higher rate means tested benefits are switched off for everyone at a point in time. This will have a significant effect on those currently receiving benefits.

It is likely to be some time before most individuals have accrued a meaningful DC fund, so individuals who retire in the near future may still need means-tested benefits.

5%+5% may not provide an adequate benefit in the long term, especially for those with less than average earnings, or who wish to make provision for their dependants, and is even less likely to be adequate for individuals who do not work a full career, perhaps because of unemployment, or ceasing work to bring up children.

This depends on how long the government expects people to work. Later retirement may be more realistic as life expectancy increases, but individuals can expect to receive relatively less if they retire earlier.

The funds are DC so outcome is variable because of the uncertainty over investment returns if funds are invested in return-seeking assets and annuity conversion rates are based on different assets.

Annuity conversion rates will depend on longevity expectations.

Some individuals will draw their funds at low points in investment markets and so get less than they expected.

Some individuals may start with an adequate benefit at retirement but this may not continue throughout retirement, if pension increases do not keep pace with inflation.

Adequacy is more likely if individuals have other sources of retirement income in addition to the State system.

The system is likely to be reviewed by future governments before many individuals reach retirement.

(iv) Other needs:

- Medical care and living expenses on ill-health (both before retirement and during retirement).
- To support dependants in the event of death.
- Housing and other major capital outlays.
- Education/training for children/self.

(v) How to adapt:

- Enable money to be released from the pot before retirement
- ... possibly in restricted circumstance to ensure “proper” use
- ... or to purchase insurance against death/incapacity
- Allow pot to be paid to dependants on death
- Use the pot as security against loans.
- Flexibility over the contributions required or opt-out of the state scheme

(vi) Target fund could be:

- at a level intended to smooth contributions under a pay-as-you-go approach, allowing for fluctuations in cashflows
- or the expected cost of the benefits that will eventually be payable to everyone who has completed the 20-year qualification and is over age 65 (that is, terminal funding when first tranche payable)

- or expected cost of the benefits that will eventually be payable to everyone who has completed the 20-year qualification. (that is, terminal funding when potential entitlement established)
  - or expected cost of the benefits that will eventually be payable to everyone who has completed the 20-year qualification, plus a proportion of the expected cost for those who are part-way through the 20-year period (that is, regular contributions)
  - or expected cost of the benefits that will eventually be payable for all individuals (that is, lump sum in advance)
- (vii) Initially there will be nothing in the fund, hence there will be a deficit against the target fund. The size of deficit will depend on the chosen approach to funding - the approaches above are in increasing order of target fund.

The government might set an objective of reaching the target within say 10 years and pay contributions into the fund accordingly, allowing for the expected increase in the target fund over the period.

The government would then review these contributions periodically. The contributions would need to be met either from existing tax revenues or by raising additional tax.

Note that the government would save money if over-60s were no longer eligible for the more generous means-tested benefit and because over 65s may cease to be eligible for any means-tested benefit if they receive the new pension.

The actual position depends on what (if anything) the government does for people who do not qualify for the new pension and on how it transitions people who are already in receipt of the current benefits.

There will be additional administration/communication costs in the short term.

*Part (i) was answered well. In part (ii) many candidates had clearly not read either the preamble or the question thoroughly and started to write down points regarding whether savings would be adequate, rather than how they would change. When these candidates arrived at part (iii) they had nothing more to say, so there was a lot of repetition. The core points in this part were answered well, although the less successful candidates were too superficial in their responses.*

*Responses to part (iv) were good, and the better candidates also came up with suggestions for part (v) that were both sensible and practical.*

*Several candidates produced good answers to part (vi), although few really took the funding concepts and explained them in this context of this example. Part (vii) dealt with the transition to the new scheme. Not many candidates got beyond the obvious issues of new administration costs, and it seemed that because they couldn't think of anything else, this was laboured excessively. The successful candidates discussed the eligibility issues and change in retirement ages and so scored relatively well. The structure of the question was designed to*

help candidates. Part (vii) follows part (vi) and so the issues covered there can be used to structure the response to the later part.

**7** (i) (a) Sale of home

Once the sale proceeds of the house are used, then the individual accepts the whole cost of future care, perhaps subject to any social security benefit his mother may receive.

In particular he accepts the risks of his mother's longevity, nursing home fee inflation, and the investment risk during the period when the sale proceeds of the house are invested but not yet spent on fees.

There is a risk of forced sale of house when need for care commences, and foregone benefit from possible house price inflation in the period between the sale of the house and his mother's death. He accepts the requirement to finance care costs in the period before the house sale can be realised.

He avoids reducing his personal assets as long as possible, or at all should the property proceeds be enough to finance the total cost of care, or care never be needed.

Tax on his mother's estate may be reduced or avoided.

No risks are transferred.

(b) Single premium policy paying a lump sum

Once the proceeds of the policy are used, the individual's position is exactly as in (a) in terms of the costs of future care and the acceptance of longevity and fee inflation risk.

The individual will have to manage the house while his mother is in the nursing home. His mother's estate (and thus the individual eventually) will have the risks connected with letting residential property: rental voids, damages, etc., against which must be set rental income.

There is also the possible benefit that house price inflation might be greater than the individual might earn on other investments, or the risk that it is much less.

An estate that includes the value of the house may incur an additional tax liability.

He accepts the risk that the policy may never pay out if the need for care never arises, or that the fixed return may be poor value for the investment if a long time elapses before care is needed.

He accepts the risks connected with the loose definition of the insured event. The point at which nursing home care is needed is highly subjective and frequently depends on personal circumstances.

He transfers the investment risk on the premium to the insurance company. He also transfers the risk relating to the length of time between taking out the policy and care being needed. If this is short, the policy will be good value.

He accepts the risk of insurer default.

(c) Regular premium deferred annuity

The individual accepts the full cost of care, but has the annuity payments to offset this. Thus the position is as in (b), except that the longevity risk is partly transferred to the insurance company.

All the property-related points in (b) apply.

If care is not needed, or needed late in life, the policy will not pay out, or the value of the return may be poor.

With regular premiums, he avoids much of the investment risk of using part of his personal capital. Premiums could be financed from income.

The tight definition of the insured event avoids risks of dispute. The annuity will commence even if his mother is not cared for in a nursing home – but the definition may be too tight, leaving care costs uninsured.

As well as part of the longevity risk once the annuity has commenced, he transfers the risk relating to the length of time until the payments commence to the insurance company – because if this is short, only a few monthly premiums will have been paid.

(d) Single premium full indemnity.

The individual transfers all the risks relating to the costs of future care, longevity and fee inflation to the insurance company.

All the property-related points in (b) apply.

If care is not needed, the policy will not pay out.

The points about the loose definition of the insured event in (b) apply.

The points about the investment risk on the single premium in (b) apply.

(e) Single premium tail indemnity

Effectively this arrangement is the same as (d), except that the individual accepts all the risks of care for the first two years, and then transfers all subsequent risks.

All the property-related points in (b) apply.

If care is not needed, the policy will not pay out. The individual will also not need to make any payments himself.

The points about the loose definition of the insured event in (b) apply.

The points about the investment risk on the single premium in (b) apply, although the premium will be very much less than in (d).

- (ii) The policy in (b) pays a lump sum at the point of claim.

Thus the main concern will be the probability that nursing home care starts to be needed at each age. These are a set of transfer probabilities with a similar structure to sickness claim inception rates.

There is likely to be a select period because the contract is less likely to be purchased if the life is in good health.

There may not be much experience on which to base the rates. Thus margins for data error need to be included.

The definition of the insured event is loose. The company might feel obliged to pay claims in circumstances that it was not originally anticipating. The rates might include a specific margin for this, or it might be included in a general prudential margin.

The policy in (c) pays an annuity once the claim is admitted.

The issues in (b) are all relevant with the exception of the margin for the loose definition of the insured event.

The value of the benefit at the point of claim is an annuity that will depend on future life expectancy in the home.

It is likely that mortality rates will have a long select period – in other words they will depend on both age and duration since entering the home.

It may be that the duration in the home is more important than age at the advanced ages that are usually involved. Thus age could be grouped into broad bands except at very advanced ages, and the primary decrement might be duration.

The benefit in policy (d) is a full indemnity.

Thus in addition to the issues for policy (c) the cost of nursing home care, and the inflation of the cost both before and after payment commences needs to be taken into account.

The uncertainty of this suggests that appropriate margins need to be included. The margin for the loose definition of the insured event is also necessary.

In policy (e), there is no payment for the first two years once a claim is admitted. As the risk insured will be very much reduced compared with (d), the risk premium will similarly reduce.

But the insurer accepts the risk of a high severity claim (a very long period of nursing home fees), so the volatility is high and the margins will need to be re-assessed.

This might result in the margins being a much greater proportion of the risk premium, which might give rise to marketing problems.

*Part (i) was lengthy and there were lots of marks available. It is clear that some repetition is necessary, but the examiners were looking for the differences between each scenario. On the whole this part was well answered, particularly by those who had structured their answers before they started writing. Very few candidates dealt with the definition of the insured event, which is a fundamental risk mitigation tool – a tight definition saves argument, reputation, and costs. The requirement was thoroughness and depth – lots of marks need lots of points. Some candidates seemed to get bored and ran out of steam by (d) and (e) and so missed easy marks.*

*Part (ii) was poorly answered. The question says “insurance risk”. It then goes on to help those who did not read this clearly by saying “ignore investment and expense risks”. Despite the examiners trying to help, this did not stop a large number of candidates answering a full premium rating question complete with looking at competitors, loss leaders, underwriting cycles, asset matching, new business strains, etc., all of which gained no marks.*

*There were other areas of weakness in reading the question. Some read “(b) to (e)” as “(b) and (e)”, while others read insurance risk as meaning death benefits not care benefits and so missed the points.*

*The angle was risk and its implications. Most successful candidates got the basic issues (and looked at it from the right perspective – the insurer) but very few developed it. The aim is to build on each section – to discuss the extra issues needing consideration each time. The concept of risk and uncertainty needing margins was generally missed.*

## **END OF EXAMINERS' REPORT**