Subject CA1 — Core Applications Concepts
Paper One

EXAMINERS' REPORT

April 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.

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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 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 after each of the solutions that follow.

1 (i) (a) When selling the home and moving to a smaller residence there will be initial cash outflow of legal fees, expenses and possibly holding deposits.

The homeowner will then have a lump sum cash inflow of the selling price of the existing property followed by a smaller lump sum cash outflow of the purchase price of the new property, plus cash outflow of any other outstanding expenses.

The timing of the cashflows will be short term but unknown and will depend upon the time taken to find a buyer for the existing property and a property to buy, and that taken to agree the sale of the existing property and the purchase of the new property.

All cashflow amounts related to house prices would be unknown prior to agreement of the sale and the purchase.

On death, the house becomes part of the estate and may be sold.

(b) When taking out this policy the homeowner has a regular cash inflow with known regular timing. The amount may either be level and known, or unknown and linked to an inflation index.

This regular cashflow ceases on death either of the policyholder or the last survivor, at which point the house reverts to the insurance company. The insurance company may then sell it to achieve a cash inflow, which is unknown in both amount and timing, including timing relative to the point of death.

The insurer will have expenses related to selling and maintaining the policy.

(ii) The main disadvantages to the homeowner in taking out this product are:

The homeowner may not want to release the whole of the equity in the home, and may prefer a lump sum rather than an annuity or they may prefer exposure to the property market than to inflation.

Moving to a smaller home may be more suitable and may have lower associated costs. The homeowner may also wish to release cash for other purposes.

The policy may be perceived to be poor value, especially in the event of early death, and because when calculating the annuity rate the company will have to reflect the risks of matching a stream of annuity payments with a reversion on the house, which yields no income. Any house valuation is likely to include a margin for risk and may not reflect the value on a competitive open market.

There may be tax disadvantages to the homeowner in taking out this policy compared to buying/selling their main residence.

The policy may impact any state benefits currently received or due to be received.

The homeowner may wish to move house in future, or may wish to modify the home in some way, for example making the property more accessible or extending it for a live in carer. This may not be possible under the terms of the tenancy.

The homeowner may wish to leave an inheritance (or a whole property) to their children.

There is a risk that after taking out the policy the homeowner's circumstances will change (through marriage or divorce, say) and the type of annuity would no longer be suitable. Admission into long term care may also mean that the annuity is no longer suitable.

If the level annuity option is taken, the homeowner will be exposed to inflation risk.

The policy may be difficult for the policyholder to understand and additional legal advice may be required.

There may be additional risk if these policies are not regulated.

Marks were given for other valid flexibility points as alternatives to the above.

Comments: This was well answered by most candidates but only the well prepared candidates mentioned that the exact cashflows and timings in (i)(a) would be unknown in advance. In part (ii) candidates were asked to discuss disadvantages so there were no marks available for stating the advantages.

2 (i) Current rates of inflation, both of prices and earnings.

Expected future rates of inflation.

The difference between the gross redemption yields on government fixed interest and index-linked securities.

Recent expense experience of the company or, if available the industry as a whole.

It is important that the inflation assumption is consistent with other assumptions.

(ii) The company will need to price for the long term. The starting point for its pricing and valuation unit costs will be next year's estimated figures.

The company needs to check that the unit costs are representative of future experience, ignoring inflation, which will be added as a specific assumption.

Review the calculations to check that one-off expenses are spread over the appropriate term.

Review projected policy volumes. Will need to consider new business, in force business and claims as well as the mix of business If these are declining, it may be necessary to allow for additional unit cost inflation in addition to normal inflationary increases to ensure that overhead costs are covered.

Review new business projections but beware of allowing for economies of scale from large projected increases in new business, in case this doesn't materialise.

After these adjustments, long term best estimate unit costs will result.

(a) **Valuation**

New business unit costs would not be used.

Renewal and claim unit costs would be loaded as a specific allowance in the valuation basis, applied to each policy and each claim. Unit costs might also be used in the calculation of general additional reserves, such as provisions for closure to new business.

It might be decided to merge renewal and claims costs into a single per policy in force figure. However this would generate distortions if the volume of business changed.

Investment costs would be allowed for by a deduction from the valuation interest rate. For unit linked policies it would also be necessary to make a specific allowance in the cash flows.

All the unit costs used would be increased by a margin for prudence. The extent of this would depend on the regulatory regime and solvency capital requirements in the country concerned.

If there is a high explicit solvency capital calculation required, then prudential margins in each element of the basis may be little more than rounding in the cautious direction.

If the explicit solvency capital calculation leads to a low result, then it will be necessary to hold a much larger prudential margin in the basis elements.

(b) **Product pricing**

New business unit costs would be included.

Other unit costs would be applied to the model in the same manner as above, without any margins, but with the following differences.

The company would expect its premium rates to apply for a period. This might be only a few months for a competitive commodity product such as term assurance or annuities, but might be several years for savings products.

For the expense loadings to be robust, all the monetary amounts need to be inflated to the mid-point of the period the premium rates are assumed to apply. It is unlikely to be necessary to inflate the investment expense unit cost.

It will be necessary to allow a margin for uncertainty and risk in the pricing basis. This might be achieved by loading each item with a specific margin, as in the valuation basis. The size of this margin may be driven by competitive or other factors.

More commonly the company will determine a risk discount rate at which all the cash flows will be discounted when profitability is determined. If this approach is followed, the best estimate unit costs should be used in the pricing model without further adjustment.

Comments: Part (i) was reasonably well answered by many candidates but only the better prepared candidates picked up all the marks. Given that the command verb was "list", and that there were only two marks available the key was to be high-level and straightforward. Part (ii) was poorly done. Most candidates didn't appear to have read the question, in particular the preamble, which stated that unit costs had been calculated and allocated. The examiners were seeking comments on how the unit costs might me used in the two scenarios. Many candidates considered some valid general points but did not bring out the differences between (a) and (b) and consequently did not score well.

3 (i) There are 2 broad reasons: lower costs or higher returns.

The committee may take the view that the costs associated with active management are too high compared to the extra returns that could be generated.

Their approach means that there will be no trading expenses, fees or commissions, but conversely it will not be possible to take into account investment opportunities that arise mid-year.

There will be no need for the research provided by brokers or consultants that an active strategy would need. Similarly, advice on suitable strategies or modelling exercises wouldn't be needed. There will also be an opportunity cost saving as less time will be needed to run the portfolio so giving committee members more time to do their normal jobs.

However, expenses will be incurred at the annual re-arranging of the portfolio and in monitoring returns. These expenses are likely to be relatively small.

Given the make up of the committee, there could be an element of elitism and a "we know best" attitude.

The approach is easy to communicate and understand.

(ii) The rationale could be based on the view that markets are cyclical and that, for a given sector, relatively good periods are followed by relatively bad periods and vice-versa.

The view could be that due to fear and greed markets over react both in good and bad times. This could mean that shares and sectors are over bought or over sold. This could lead to some prices being too high or too low relative to fundamentals.

This could mean that sectors that have recently performed relatively badly are now relatively cheap. The worst sectors are avoided as their performance could reflect serious long- term problems not just market inefficiency.

The view could be that good stocks in relatively bad sectors represent the best value. However, the best stocks are avoided, as they could be relatively expensive within the sector. The relatively good recent performance may not be repeated as it could be due to factors that have been more than fully discounted e.g. takeover speculation.

The fund will be comprised 16 of stocks in 4 sectors. This is designed to give some diversification but not so much as to dilute the impact of focusing on a narrow, hopefully, cheap area of the market.

This approach is an example of technical analysis as opposed to fundamental analysis.

(iii) New money either from dividends or other injections (e.g. from a higher-level reallocation) will arise. The committee will need to decide whether or not to reinvest this income, and if so, in which shares.

Some of the companies in the portfolio may be subject to a takeover bid or merger. The committee will need to decide whether or not to accept the terms offered. If they do or if the bid is ultimately successful, new money may arise as above.

Some companies may have a rights issue. The committee will need to decide whether or not to subscribe. If they do, they have to decide where the money will come from. The implication in the question is that they will not subscribe.

The directors of some of the companies may propose a share buy back plan. If the committee decides to sell (again unlikely) new money will arise.

Some companies may get into difficulties. This could lead to proposals to reconstruct the balance sheet. The committee could be asked to approve these plans.

Ultimately, some companies may wind-up. If anything is payable on the wind-up, new money will arise. In this case a decision will be needed as to whether new companies should be invested in so as to keep the number at 16.

There will be routine (or extra ordinary) shareholder meetings. The committee will need to decide whether or not to attend and on how (if) to vote on each resolution.

There may be more substantive resolutions for example concerning issues of new capital. A decision will be needed, as new capital will affect the circumstances of the shareholding.

There may be circumstances where money is needed e.g. for projects in other areas of the university or to pay tax or to be transferred to other funds. A decision may be needed if some shares have to be sold. Alternatively, unallocated new money could be used.

(iv) A benchmark index will be needed to compare the performance of the fund against the general domestic equity market. The benchmark will need to take into account any constraints or restrictions imposed on the portfolio the committee can choose.

The index will need to be appropriate for the purpose of assessing performance e.g. weighted by market capitalisation. It is likely that an index covering the whole domestic equity market will be needed e.g. an S&P 500 type rather than Dow Jones30 type.

If possible, the profit or loss against the market overall should be split between that due to the choice of sectors and that due to the choice of stocks within each sector. To do this, an appropriate index for each sector of the equity market will be needed. The question implies that these indices exist.

In order to assess performance, allowance needs to be made for both income and capital gains from the benchmark portfolio. The indices used should therefore give total returns directly or be easily adapted to provide them (e.g. with xd adjustments).

The choice of indices may depend on targets (if any) set for the fund. For example if the target is set relative to other funds, the indices used should reflect the assets that these other funds can invest in.

Comments: This question was a good discriminator enabling the better candidates - those that read the question carefully – to be identified. Parts (i) and (ii) were reasonably well answered with most candidates grasping the main points. The candidates who understood the point of part (iii) scored well, but others focused on general market related points rather than stock specific factors for which there were few marks. In part (iv) some candidates were too specific in the requirements of the index in terms of matching the fund. If the index composition perfectly matched the actual fund, the index would be pointless. The better candidates realised that an index covering the whole domestic market was needed along with appropriate indices for each sector but only the better prepared candidates picked up the other points.

4 (i) An individual's assets consist of current wealth and future income. Liabilities consist of future spending, including any debt repayments. Both the term and nature of future spending will need to be considered as well as the expected level.

The sophistication of the planning process used by individuals will vary greatly, but most will take some account of the pattern of their expected future income and major likely expenditure, such as a house purchase, in making their plans.

Individuals may also have personal reasons for investing or not investing in certain types of asset. For example they might want to invest in residential property to provide a home to live in, or might have particular religious or ethical views that override normal investment considerations.

Most of an individual's liabilities will be real in nature, although the relevant index measure may not be the RPI. Occupational income can be considered as a real income stream, but pensioners may be on a fixed income.

Because liabilities will generally be real, assets for long term investment should usually be real although monetary assets may be chosen for short term investments, diversification or because they appear good value.

Most investors will have liabilities and hence assets in their domestic currency, although there may be special reasons for holding other currencies.

Individuals may be constrained in their choice of investments by the size of their liabilities relative to their assets. They will often not be in a position to accept very much risk. Attitude to risk is partly a personal matter as well as being dependent on an investor's financial position.

Risk can be reduced by diversifying assets both between and within asset classes.

A major constraint is uncertainty. Individuals may lose much of their income for a variety of reasons, such as redundancy or ill health. Similarly unexpected expenditure requirements can easily occur. Therefore it will be desirable to keep some assets in a reasonably liquid form.

Insurance can also be used to mitigate the effect of some types of uncertainty.

In addition to the considerations of matching liabilities and allowing for uncertainty, individuals will wish to maximise their expected return. This means selecting assets that are good value after allowing for the expenses of dealing in the asset and the individual's tax situation.

Differences in taxation can mean that an investment, which is good value to one person, can be unsuitable for another. Some investments are particularly efficient for taxpayers.

The individual will wish to be aware of the impact of their investment on any state benefits.

Individuals usually face practical constraints. These can include:

- not enough assets for direct investment in some asset classes.
- high relative expenses when investing small amounts.
- lack of information and/or expertise.

Many individual investors, particularly the retired, rely on the income from their investments to live on. In this situation it is necessary to find a strategy which will provide a high enough current income while allowing for sufficient growth of capital and income to maintain the level of income in real terms.

A different situation is faced by investors who are investing for the long term, and don't require a current income from their investments, possibly because they are still working. They will be freer to concentrate on maximising total return.

Individuals investing for the long term may not be concerned about short term variations in the market value of their investments. However, in practice, most people dislike volatility, particularly if their liabilities are uncertain or are short term. A suitable strategy is often to switch to less volatile assets as the time at which the investments need to be realised draws near.

(ii) An investing institution will also need to consider the following factors:

- Statutory, legal or voluntary (e.g. meeting the expectations of policyholders) restrictions on how the fund may invest.
- Statutory valuation and solvency requirements.
- The strategy followed by other funds. They will not want to risk underperforming compared with their competitors.
- What the market wants.

(iii) Most people would use an inheritance to cover the gap between assets and liabilities. The use of the inheritance will depend on the size of the assets and liabilities.

<u>23 year-old</u>
Assets: future income, any savings
Liabilities: accrued debt, living expenses

Suggestions for use of inheritance:

- pay off debt
- deposit on home
- non-investment spending/ satisfying emotional needs
- long term investment
- including pension provision

50 year-old
Assets: pension scheme, savings, home, future income
Liabilities: mortgage, living expenses, any debt, education costs

Suggestions for use of inheritance:
- money towards education costs
- pay off all or part of mortgage, particularly if not covered at maturity
- possibly small non-investment spending / satisfying emotional needs
- balance to long term investment probably linked to retirement (depending on existing provision)

75 year-old
Assets: pension, savings, home
Liabilities: living expenses, possible future care costs

Suggestions for use of inheritance:
- invest to provide increased income
- consider moving to a retirement home or adapting current home
- provide for long term care costs/funeral expenses
- non-investment spending/ satisfying emotional needs
- gifts to other members of the family or used to increase their inheritance

Other well reasoned valid points also gained marks.

Comments: Most candidates scored well on parts (i) and (iii) with many candidates achieving high marks. Part (ii) was not so well answered – some candidates struggled to find the key points.

5 There are two strands to address – technical issues and professional issues.

Technical issues

A reduction in fixed interest yields will mean a reduction in annuity rates. As single premium contracts the investment return that can be earned on the premium is a major factor.

The profitability of the business is the product of the profit per policy and the number of policies written.

If more business is written, then there are more policies over which to spread overheads and other fixed costs. The costs per policy will reduce, and it is therefore entirely appropriate to reflect the lower unit costs in the premium rates.

At the extreme, if other product lines can support all the overhead costs, then one product can be priced on marginal costs only. It could be that the shareholders agree to support some of the overhead costs in order to grow the business, but this is likely to be only for a limited period, and the issue will only be deferred.

However pricing a product using lower than marginal costs will result in increasing losses if business volumes grow.

Marginal costing one product line might enhance sales of more profitable products as well as the marginally costed one.

The Pricing Actuary needs to be aware of detailed sales and expense forecasts for the whole of the company's business, following the decision not to reduce rates. If there are none, the company needs to be asked to provide them. This will enable him to review the profitability of the annuity rates in the light of the fall in interest yields and projected growth in volumes.

He also needs to review the profitability of other lines of business written. It may be that the Pricing Actuary actually heads the actuarial pricing team (as he is an employee) in which case he will have ready access to the information. If not it needs to be requested formally from the company.

It may be appropriate to review other aspects of the pricing bases for any of the contracts, such as the mortality assumption.

If the premium rates are insufficient to support the new projected volumes of business, then further discussions with the company are necessary – see later.

It may be that the premium rates are adequate, but only if the projected increases in business or the projected changes in the mix of business occur. The Pricing Actuary needs to establish with the company appropriate reporting and review mechanisms, and agree trigger points for action on premium rates, should the expected business volumes not materialise.

With these safeguards in place, it will be appropriate to give the necessary certificate.

Professional issues

The Pricing Actuary has all the professional duties of an actuary. As an employee he has two duties. He has the normal responsibilities of any professional employee to act in the best interests of the company's business, and to follow reasonable instructions given. He also has the statutory duty to act on behalf of the regulator and to report if necessary. These duties can conflict, and the Pricing Actuary needs to make the employer aware of the potential for conflict.

Most aspects of product pricing involve an assessment of likely future experience. This involves professional judgement. It is possible that different actuaries will have different views on most items. Hence the Pricing Actuary should make the company aware that there is a range of premium rates that he would consider acceptable, not a single correct answer.

If the Pricing Actuary has had regular discussions with management they should be aware of the deteriorating profitability of annuity rates, and be aware of the limits of the Pricing Actuary's acceptable range.

The Pricing Actuary must ensure the company is aware of the difference between marginal costing, and writing business on terms that doesn't cover even marginal expenses.

The fact that premium rates are not going to change does not absolve the Pricing Actuary of his statutory duties. This must be stressed to the company. A positive decision not to change rates when a change is justified should be treated in exactly the same way as a change. The proposal to evade statutory requirements by such a technicality is unacceptable.

If the Pricing Actuary feels he cannot give the certificate he should work with the company to clarify the changes necessary to bring the position back into the acceptable range. There is a clear duty to the employer to try and achieve an acceptable position before reporting to the regulator.

However if such a position cannot be reached a report to the regulator should be made. In doing so the Pricing Actuary must keep the company fully informed of his actions. If possible he should advise the company of the possible regulatory actions as a result of any report.

Comments: The type of question that is not divided into parts and has a lengthy paragraph setting the scene is normally the most difficult on the paper. The better candidates recognised this (we have made the point in past reports) and spent their reading time planning how to answer the question. The question gave a clue that separate consideration of technical and professional issues would be needed.

Annuity rates are commonly expressed as the amount of annuity that can be purchased for a fixed lump sum. Hence if annuity rates reduce, the customer gets a poorer return. Candidates who treated an annuity rate as the cost of buying a fixed annuity were not penalised if their argument was clear. Very few candidates understood that it is whether marginal costs are covered or not that is the trigger for exposure to losses from large volumes of new business.

On the professional issues, most candidates realised there was a potential conflict of interest but few considered how it could be dealt with. Few candidates pointed out that not reducing rates when a reduction is justified is actually the same as improving them.

6 (i) The commitment can be considered both in relation to different groups of employees (male, female, young, old, short service, long service etc.) and in relation to different benefits (normal retirement, early or ill health retirement, death in service, withdrawal etc.).

The strictest interpretation would be that all benefits for all members would be at least as good. The most practical way to do this would be to provide a scheme, which replicates the government scheme.

The less strict interpretations could be:

- All members are better off in most cases. This would mean that some benefits aren't, in general, as good as those under the government scheme.

- Most members are better off in all cases. This would mean that certain groups of individuals are, in general, worse off under the new arrangements.

- The benefits pre and post transfer should be actuarially neutral. The justification for this is that circumstances where some members are worse off are compensated by circumstances in which the same or other members are better off. Hence the overall commitment is met.

In order to assess the suitability of the new arrangements, the relative levels of benefits under various scenarios could be considered. This could be a complex exercise and the results could be difficult to interpret.

Alternatively, the expected value of future benefits (allowing for the probability of each benefit arising) could be calculated for a representative sample of employees. These values could be compared to the value of future benefits under the government scheme. Problem groups and the reasons why problems arise could then be identified.

Pension benefits for the transferred employees could either be based on the government scheme or on any existing scheme used for existing employees of the new employer – assuming that the two schemes differ in material ways.

(ii) The major problems the new employer could face are:

The government scheme could be very generous hence any attempt to provide corresponding benefits could be unaffordable.

The government scheme contains guarantees such as the inflation link for pensions in payment. The new employer may consider that the risks associated with these guarantees (e.g. volatile contribution rates or large deficits) are too great.

Having different schemes for different groups of employees would increase administration and other costs. If there is no existing scheme, a scheme will need to be set up.

The existing data will need to be transferred.

If the new arrangements differ significantly from the government scheme, it may be difficult to convince transferring employees that they are no worse off. It will be easy to find examples where an employee could be worse off.

If the new arrangements are similar to the government scheme, existing employees may feel aggrieved if transferring employees appear to be receiving more generous pension benefits.

To meet the commitment, lots of special rules, caveats or guarantees could be needed. These will be messy and difficult to implement.

(iii) It may be possible to improve other elements of the remuneration package to compensate for worse pension terms. Pension benefits under the government scheme may have been relatively generous because other elements of remuneration weren't.

Such increases in other remuneration may not be a significant cost if existing employees enjoy better terms than the government employees (i.e. overall the cost of the transferring employees is similar to that of existing employees). This may be unlikely as the major way private companies can reduce costs is to have lower staff costs than the government.

It may be possible to offer:

- a pay rise or a one-off payment to buy out future service rights
- bonuses if employees hit certain targets
- increased holiday entitlement
- reduced working hours and/or more generous overtime pay
- improved additional benefits e.g. share-option, other savings schemes, childcare vouchers or discounts on certain goods
- improved ancillary benefits e.g. sickness or maternity/paternity pay

Generous benefits in the government scheme could have required relatively high employee contributions. Employee contributions to the new scheme could be lower.

It may be possible to get transferring employees to accept slightly worse pension terms if the alternatives were redundancies, cuts in pay or job insecurity.

(iv) The first decision will be what benefits are to be provided. The broad alternatives are either standard leaving service benefits or benefits based on the value of the accrued benefits (allowing for future salary and pension increases) held in the government scheme for each member.

Given the context, it likely that a value of accrued benefits basis will be appropriate. This may be a legal obligation. Benefits could be retained in the government scheme, transferred to the new scheme or transferred to a third party.

Again the context may imply a transfer out of the government scheme. Alternatively, employees may be given a choice.

Any benefits retained in the government scheme are likely to be expressed in terms of deferred pensions payable on the same terms as other deferred pensions under the scheme.

If benefits are to be transferred, a basis to calculate the value of these benefits (and the benefits to be purchased by the transfer values) will need to be agreed between the actuaries advising the relevant parties. This could entail protracted negotiation. The government scheme won't want to pay too much relative to its funding assumptions. The receiving scheme will want to receive enough to ensure that deficits don't arise on its funding basis.

These transfer values will be used to purchase benefits in the receiving scheme. These benefits could be expressed in terms of deferred pensions payable under the same terms as other deferred pensions in the scheme. More likely, they will be used to buy added years of service in the new scheme. In this way, benefits for past and future service will be paid on the same terms. Alternatively, a broad-brush approach could be used where transferring members are granted X years service in the new scheme for each year of service in the government scheme.

Third parties could be insurance companies or other providers of personal pensions. They could offer benefits in the form of guaranteed deferred pensions (with or without profit) – though the inflation link is unlikely to be retained. Alternatively they could project the pension that could be purchased at retirement if the transfer value was invested in a unit-linked fund.

If a large number of employees were to transfer, the provider could offer preferential terms e.g. lower expense loadings or less strict underwriting.

Comments: Question 6 was generally not answered well. In part (i) many candidates interpreted the question as a discussion of the various methods of funding, or how the future benefits could be valued by means of a discounted cash flow. Although the question clearly referred to future service benefits, many candidates discussed past service benefits. Part (ii) was answered better, although some candidates gave all the risks of defined benefit schemes in general without focusing on the specific risks created by the incoming members. In part (iii) few candidates mentioned how non-pension scheme benefits could be used to offset the loss of future pension rights. Many candidates simply listed various ways future pension benefits could be reduced. In part (iv) most candidates made the basic points, but few gave these enough substance to gain all the marks available.

END OF EXAMINERS' REPORT