

**Subject ST1 — Health and Care.  
Specialist Technical.**

**September 2009 Examinations**

**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.

R D Muckart  
Chairman of the Board of Examiners

December 2009

**Comments for individual questions are given with the solutions that follow.**

### *General comments*

*Candidates who approached the questions, especially the more substantial elements of each question, in a methodical and detailed manner were far more likely to satisfy the examiners and receive a pass in the subject. Candidates will lose marks if they do not address the question asked. There was often a lack of sufficient detail in the answers. The mark allocation for each question part gives an indication of the relative length of answer or number of points to be made to gain full marks. In general each valid point in the answer would normally attract 0.5 marks with the more basic elements e.g. details in a pricing basis such as age and sex, attracting 0.25 marks.*

*Some papers were not clearly marked at the top of each page as to which part of the question was being answered.*

*Marks may be lost where answers are difficult to read.*

### *Comments on individual questions*

#### ***Question 1***

*This is a fairly typical question for this subject and so students who had invested time in practising past papers were able to score highly.*

#### ***Question 2***

*Many candidates made a good effort at this question by applying common sense to the subject matter contained in the course.*

#### ***Question 3***

*Candidates with a good grasp of the core reading were able to apply it here and demonstrate their knowledge to the examiners.*

*In part (iii), candidates who gave more specific answers scored relatively highly.*

#### ***Question 4***

*(i) This part was generally well answered*

*(ii) Candidates often failed to list sufficient items to gain all the marks available. In order to score fully, candidates needed to address the unit and non-unit funds separately.*

#### ***Question 5***

*(i) In general, candidates made a good attempt at this part, although they did not always set out the assumptions they were making. The commission payment was often incorrectly determined.*

*(ii) Candidates generally failed to give many considerations in answering this part. Candidates should remember to attempt all parts of the question - even if they are not satisfied with their answer to earlier parts.*

#### ***Question 6***

*(i) This part was generally well answered*

*(ii) The better scoring answers considered a wide range of advantages and disadvantages. Candidates should bear in mind that different approaches can be calibrated to the same level of prudence, and so comments relating to the relative prudence of the different methods would not score here.*

***Question 7***

*(i) This part was generally well answered*

*(ii) The candidates who scored most highly would have considered pre and post claim periods separately.*

*(iii) Many candidates commented on rules relating to mismatching - as stated in the question, this would not score any marks*

*(iv) In general, candidates did not put down sufficient points to score highly on this part.*

- 1
  - (i) Possible special events include:
    - Marriage
    - Divorce
    - Entering into a civil partnership
    - Ending a civil partnership
    - Death of a spouse or other family member
    - Becoming a parent /birth of a child
    - Legal adoption of a child
    - Salary increase as a result of promotion or change of job
    - Business expansion for people running own business
    - Buying a new residential property
    - Mortgage/loan increase
  - (ii)
    - Impose maximum allowed increase either expressed as fixed monetary amount or as a percentage of the original sum assured
    - Underwrite the original contract on the basis that option taken up for maximum amount
    - Limit times when option can be exercised. e.g. on specific date/dates, maximum age
    - Maximise take-up rate to get better risk by making sure that the option is well publicised
    - Make sure that premium rates are attractive to those in good health otherwise they may go elsewhere if they require additional cover
    - Impose time limit after the special events
    - Only offer the option to lives that are in good health at outset (ie non-rated cases)
    - Reinsurance
- 2
  - (i) Advantages:
    - May be easier to order drugs via the internet than to have to collect them in person from a pharmacy (or similar)
    - Cheaper prices
    - May bypass import taxes and controls
    - The State refund will still be received, so the individual will take all of the “profit” from the cheaper price (unless the regulator decides to intervene so that it shares in the savings, thereby reducing or removing any cost benefit)
    - Increased competition in the drug market may push down prices to the population’s advantage including for those unable to access the internet
    - Could provide access to a wide range of drugs even without having visited a doctor

Disadvantages:

    - May buy inappropriate drugs
    - Need to know the precise drug that needs to be purchased and the correct time of the day to take and prescription amount
    - No control on the drug being genuine and of good quality
    - The poorer/older section of the population may not be able to access the internet and therefore are not able to benefit from the lower prices etc (although also are not vulnerable to the disadvantages)

Strong price competition could have an adverse effect on the current drug distributors; this could result in constriction of the non-internet market and thus a reduction in available choice

Longer delivery times

Drugs may get lost in the post and it is hard to engage with the supplier if there are any problems or non-delivery

2 (ii) *Prescription requirement*

In order to manage the total scheme costs, the regulator could require a prescription to be obtained before any refund is paid.

This could introduce extra administration and cost for the State, depending on how the current system is controlled.

Internet providers could instead be required to obtain sight of a prescription before drugs can be provided but this is unlikely to be successful in practice.

*Amount of refund*

The regulator could give a reduced refund if the drug is purchased on the internet, reflecting the lower price and require sight of a receipt

*General*

If quality control is likely to be a significant issue then the regulator could take a more extreme action, such as not giving any refunds for drugs purchased on the internet or the regulator could attempt to block these websites or ask the government to declare ordering or importation of drugs over the internet illegal.

Alternatively, the regulator could approve or licence sites.

These options could be practically and/or politically difficult to achieve.

The regulator could ask the government to increase tariffs/taxes on imported drugs, to reduce their relative attraction.

Alternatively the refund system could be redesigned so that the refund is given directly to the customer by the pharmacist used to obtain the drugs, and the pharmacist then claims this back from the State on production of the prescription.

2 (iii) The advantages and disadvantages will be mainly the same as for the internet However:

More of the population will be able to participate in potential savings.

Drug costs may be cheaper via this route than from a pharmacy because of bulk buying, the purchasing power of the supermarkets or the use as loss leaders as likely to be a small proportion of actual business.

However, the drugs may be more expensive than on the internet.

If the supermarket drug price is a deep discount on the existing price, then the regulator may wish to drop the subsidy altogether.

Provides easy access and quicker delivery than via the internet.

Doesn't provide a full range but if successful, the range may be increased.

There is possible access to a pharmacist within the supermarket which alleviates quality concerns.

There is also greater accountability of the supermarket group if the drugs are not of the required quality.

- 3**      **(i)**      Reasons for calculating reserves  
To determine the liabilities to be shown in the insurer's published accounts  
If separate accounts have to be prepared for the purpose of supervision of solvency, to determine the liabilities to be shown in those accounts  
To determine the liabilities to be shown in internal management accounts of the insurer  
To estimate the cost of claims incurred in recent periods and hence provide a base for estimating the future premiums required to attain a given level of profitability  
To value the insurer for purchase or sale  
To set investment strategy  
Because the reinsurer may require them
- 3**      **(ii)**      Are pricing assumptions appropriate?  
The level of prudence of the pricing basis; in some countries, a prudent basis is used, in others, a realistic basis is used, and the risks allowed for via the risk discount rate  
The purpose of the reserves: if the reserves are to be used for internal management; a realistic basis may be required, for supervisory reserves, a prudent basis is required  
How up to date is the pricing basis? If the product was priced a long time ago, the assumptions may have changed considerably  
May not still be selling all products so pricing assumptions may not be available for all products for which reserves have to be set  
Which assumption is being considered: this may be a valid approach for demographic assumptions but a risk discount rate is not appropriate for the calculation of a reserve  
Not all the pricing assumptions will be required for reserving, for example, initial expenses are required as an assumption; these are not required for reserving on a prospective basis  
There may be specific regulatory requirements about how to set both types of basis  
Competitive pressures on the pricing basis would not be appropriate to reflect in the reserving basis  
The materiality of the assumption is relevant
- 3**      **(iii)(a)**      Appendicitis is a one-off event and with no complications reported the reserve is nil. However if the claim for the previous year has not yet been fully paid, then an outstanding claims reserve would be required.
- (b)**      The insurer must not be seen to stop payment in order not to incur a reputational risk. The £10,000 should be pro-rated up to represent a full year's worth of drugs (if they were not purchased from right at the start of the last scheme year). The present value of the annual amount, including a drug

inflation cost, any associated non-drug costs and any margin, should be held as the reserve.

- (c) Miss C's operation is standard and reasonable. The reserve should be set either at the total package price (if a package price has been quoted by the hospital), or at a level similar to other cases paid recently.

**4 (i) The formula approach:**

is simple to apply  
does not require sophisticated modelling packages  
is easier to check and audit  
is quicker to run.

However, it:

does not allow for the proper timing of events  
does not allow for the accumulation of reserves  
does not allow for the impact of net negative cash flows in any period  
does not allow for separate inspection of premium related flows  
does not allow for the variation in returns/assumptions that vary over time  
does not properly allow for capital needs

**Cash flow techniques**

Cash flow techniques were developed to overcome the problems outlined above

The formula approach may be more suitable for short term business (eg PMI) but the cashflow approach is more suitable for long term business

Practical difficulties in implementing the cashflow approach can be overcome in many territories through the use of commercial software packages

Sensitivity tests can be performed simply by varying the assumptions

Iterations can be incorporated to produce the premium that meets the shareholders' profit criterion

It allows for shareholder return on capital (RDR) - the formula approach does not

Results can be readily combined into a new business model or full model projection for other purposes

Multi-state models are impossible with the formula approach

The cashflow approach would be necessary if stochastic methods are required eg valuation of complex options or guarantees

**4 (ii) Separate projections for unit fund and sterling fund**

**Non-unit Fund**

Premiums

Unit allocations

Initial commission

Renewal commission

Policy fee

Initial expenses

Renewal expenses  
Claim expenses  
Mortality/morbidity deductions  
Mortality/morbidity claims cost  
Tax charges  
Change in non-unit reserve  
Investment income on non-unit reserve  
Change in solvency capital  
Investment income on solvency capital  
Fund management charge

**Unit Fund**

Unit allocations  
Mortality/morbidity deductions  
Unit growth  
Unit expenses directly charged to unit fund  
Fund charges  
Unit funds paid on claim or surrender  
Reinsurance premiums and recoveries would also be allowed for where appropriate

- 5 (i) Assume claims occur evenly through the year  
Assume claims are all closed in the period shown (i.e. no IBNR)  
Full claims (i.e. gross up 2008 to 12 months =  $\pounds 28,000 \times 12/9 = \pounds 37,333$ )  
Adjust risk units for 1.2 and 0.25 ratios correctly (i.e. multiply number of spouses by 1.2 and number of children by 0.25)  
Adjust risk units for budget version in 2009 correctly (i.e. multiply number of risk units for spouses and children derived for 2009 by 0.5 =  $35 \times 1.2 \times 0.5 = 21.0$  for spouses and  $25 \times 0.25 \times 0.5 = 3.125$ )  
Add up total risk units for each year 2006-2009  
Cost per unit before inflation for years 2006-2008  
Cost per unit including inflation to mid 2009  
Average cost per unit including inflation (=  $235.3 + 301.22 + 304.1$ )/3 = 280.206)  
Assumption how the averaging should be done (NB here have taken simple average over years, ignoring volumes of claims in each year)  
Assumption whether to allow for other trends (NB the inflated cost seems to have an increasing trend over time but here we have ignored that)  
Assumptions about interest and discounting  
Total expected risk cost (=  $280.206 \times 84.125 = 23572.33$ )  
Expenses: per member (=  $60 \times 50 = 3000$ )  
Expenses: % risk cost (=  $0.5 \times 23572.33 = 1178.62$ )  
Commission =  $(23752.33 + 3000 + 1178.62)/0.95 - (23752.33 + 3000 + 1178.62) = 1460.58$  (NB needs to be 5% of gross premium not 5% of premium less commission)  
Total premium (=  $23752.33 + 3000 + 1178.62 + 1460.58$ ) = 29211.53



- 5 (ii) If Co Q matches the Co R quote, is there sufficient margin for profit, contingency and cost of capital and sufficient contribution to expense overheads?  
The importance and strength of relationship with XYZ plc  
Does XYZ plc have other policies with Co Q?  
Quality of the business and therefore whether want to keep it  
Can Co Q offer other attractive services to retain XYZ plc, i.e. compete on other than price?  
Quotes may not be directly comparable because benefits may not be the same (eg different excesses/exclusions)  
Might Co R reduce its quote further and start a price war
- 6 (i) Non-financial risks for critical illness  
Morbidity risk – risk that more people incur a critical illness within the term of the policy than expected (including effects of early diagnosis/screening/pandemics)  
Mortality risk – risk that more people die within the term of the policy than expected  
Lapse risk – risk that more people than expected lapse their policy in the early years when the accumulated value of the cashflows (i.e. the asset share) is negative or very small  
Expense risk – risk that expenses are higher than expected (other than due to general inflation)  
Operational risk – risk that mistakes are made by staff which cause the products to lose money or be badly managed  
Third party default risk – eg the risk that a reinsurer fails to make good on the reinsurance recoveries due  
Regulation/legislation risk – risk that regulations or legislation changes, or have been misinterpreted, eg so that we have to pay out on more illnesses than we expect  
Tax risk – risk that the tax position changes and so the policies make less money than expected  
Fraud risk – including the risk of policyholder non-disclosure and the risk of fraudulent claims.  
Option take up risk – mis-estimating the proportion taking up any option offered, linked to anti-selection  
New business volume risk - could go either way  
New business mix risk - if cross subsidy in pricing  
Reputational risk - eg from declining claims
- 6 (ii) Relative merits of each  
A:  
+ simple to apply and quick to implement  
+ easy to understand and explain  
- does not differentiate between high risk and low risk products; would therefore cross subsidise and underprice high risks and overprice low risks which would result in selling relatively more of the (underpriced) higher risk

and less of the (overpriced) lower risk products if other companies price with more sophistication

- the allowance for risk will be heavily skewed by the timing of the cashflows eg shorter term policies will be much less affected than long term policies
- is only relevant for profit criteria using a risk discount rate
- how do you calculate the correct adjustment to use

B:

- + is more accurate than A in that it can allow for the different levels of risk in each product
- + therefore more useful for making strategic business decisions
- + should be easy to implement
- + can allow for all risks, not just those with a relevant assumption to model
- is less accurate than C in that the same level of risk is allowed for in every model point
- need to determine the correct allowance to make for each product
- difficult to explain – will need to be able to justify the different rates used for the different products in a way that non-actuaries will be able to understand and accept.

C:

- + easy to understand and explain
- + accurate – can allow for the risk in each assumption
- + accurate – will incorporate the allowance for risk into each model point
- + can be allowed for in either a cashflow model or a formula approach
- + is useful for a wider range of profit criteria, i.e. can also be used in comparison of IRR and payback period
- + can vary the margins easily by product
- cannot allow for risks not included in the pricing model – e.g. some operational risk, customer service risk
- time consuming if intending to complete a full statistical analysis to assess the correct margin to include in every assumption
- might be difficult when setting margins to allow appropriately for correlations in order to avoid 'double counting'
- may give the impression of more accuracy than is merited

In each case need to consider any regulatory requirements on pricing bases that would favour or prohibit any of these options

- 7      (i)      How to implement mismatching regulations  
Have rules on the extent to which mismatching is allowed at all  
May require assets to be held in a matching currency even if no further mismatching rules are in place  
Requirement to hold a mismatching reserve  
Returns will be required to the regulator to evidence that the rules are being complied  
Restrict valuation assumptions to encourage matching

- 7      (ii)      Assets for matching  
Need to match by nature, term, currency

*Pre-claim:*

For the benefits guaranteed in money terms, fixed interest bonds would be the best match. For closest matching these should have no default risk, e.g. government bonds

The cashflows arising from the bonds should be matched by term to the expected liability cashflow profile but there may not be any bonds of a sufficiently long term in which case an alternative would be to seek an immunised approach

For the indemnity based business, the benefits will be both a long time in the future and highly uncertain in amount – so perfect matching will not be possible

One approach might be to invest in assets offering a “real” return, such as equities; however this would be a high risk strategy

For both forms, if the benefit is payable in the domestic currency, the assets should also be denominated in the domestic currency

*Expenses:*

Inflation linked assets to match expenses. These could be government index-linked bonds, but as these particular expenses are likely to be closely linked to salary inflation, and may be many years in the future; equities may be a better match.

*Premia:*

Also need to take account of expected future premium income, e.g. when calculating the discounted mean term.

*Post claim:*

The benefits will be of much shorter duration

Liquidity will be much more of an issue

Best match will be made up of some government bonds, and some cash type investments

For indemnity benefits, may still want some inflation linked assets, however equities are unlikely to be appropriate given the short duration of long term care claims so index-linked bonds may be used instead and we also still have some expenses to match with inflation linked assets

The company should try to diversify its assets provided it can still be matched

- 7      (iii)      Other investment controls:  
Restrictions on the types of assets that can be invested in  
Restrictions on the amount of any particular type of asset that can be taken into account for the purpose of demonstrating solvency  
Restriction on self-investment  
Limit on the amount that can be invested in any class  
Restrictions on the maximum exposure to a single counterparty  
Custodianship of assets

A requirement to hold a certain proportion of total assets in a particular class – for example government stock  
Secondary methods include affecting the choice of assets through their relationship with the basis used to value the liabilities

- 7      (iv)    Develop an investment strategy  
Will need to use a stochastic model projecting liabilities, and assets backing them, including a proportion of the free assets  
Need to determine an appropriate timeframe over which to project  
Deterministic assumptions will be best estimate – realistic and sensitivity or scenario testing could also be carried out  
Build asset model, which should allow for  
    investment income and growth on a range of asset classes  
    timing and amount of investment income  
    reinvestment  
    growth in level of investment income  
    capital growth  
    investment expenses  
The investment income and capital growth can be modelled stochastically.  
This could also be used to produce a stochastic model for the inflation rates to be used throughout  
Use the current asset portfolio as a starting point for the model  
Build liability model, which should allow for:  
    benefit payments – amount and timing of claim  
    benefit escalation  
    probability of death prior to claim  
    expense outgo  
    premium income  
Use model points to represent the current in-force book and use the current statutory basis to ensure solvency is correctly modelled at outset.  
Future projected liabilities should be calculated using the valuation basis appropriate to the economic conditions within that scenario ie the asset and liability models should be dynamically linked.  
Then identify the item of interest, this will be the excess of assets over liabilities which needs to be sufficient to cover the amount of solvency capital required by some comfortable margin. What makes the margin comfortable will depend on items such as regulatory requirements, nature of business, and amount of parental support.  
The stochastic model will produce a statistical distribution of solvency for each modelled investment strategy and hence a probability of potential future insolvency. This will allow us to identify acceptable strategies, ie ones that have a probability of future insolvency below the company's chosen target (eg 99.5%).  
We also need a secondary item of interest to identify the optimal strategy out of the acceptable range. This means we also need to project a measure of shareholder value, for example shareholder income combined with change in embedded value.  
The model will have to be re-run on a number of different investment strategies until the optimal position is found.

**END OF EXAMINERS' REPORT**