EXAMINERS' REPORT

November 2012 examinations

Subject F103 — *General Insurance*
Fellowship Principles

INTRODUCTION

The attached report has been prepared by the subject's Principle Examiner. General comments are provided on the performance of candidates on each question. The solutions provided are an indication of the points sought by the examiners, and should not be taken as model solutions.

QUESTION 1

i. EML is the estimated (or expected) maximum loss.
It is the largest loss, which could reasonably be expected to arise from a single event.

ii. Max. EML = Max. Retention + Max. Reinsurance cover
$= R + N.R$
$= (1 + N)\ R$

iii. a. The minimum recovery occurs when the maximum amount is retained, i.e. when R of the EML of E is retained ($R < E$).

Hence, the minimum recovery is:
$$= \frac{E - R}{E} \cdot C$$

b. The maximum recovery occurs when the maximum number of lines of cover is used.

Hence the maximum recovery is:
$$= \frac{N}{N+1} \cdot C$$

iv. The reinsurer will be concerned that:

- The insurer is unable to accurately estimate the risk it is insuring.
- This could lead to under-priced policies (and hence the reinsurer is not getting an adequate premium to cover the risk it accepts).

v. An XL recovery is made when the retained portion of the claim exceeds the excess point, i.e. R. This occurs as follows:

a. When $R/E \cdot C > R$, i.e. $C > E$

b. When $C/(N + 1) > R$, i.e. $C > (N + 1)$ R
(i.e. larger than the largest EML which can be written on the treaty.)

Regarding the candidate's remarks:

- The candidate is incorrect.
- The threshold for an excess of loss recovery is quite high however, so recoveries may only occur with unusually large claims.
- Such claims can occur though (incl. claims which exceed the EML), so the cover may be appropriate.

The better candidates handled this question reasonably well, but most struggled. Some candidates lost easy marks by simply stating expressions, rather than deriving them as required.

QUESTION 2

i. The standard for full credibility" determines how much data one needs before one will assign 100% credibility to the data.

It is also referred to as the "full credibility criterion".

In terms of the credibility premium formula for a specified risk,

$$Z\bar{X} + (1 - Z)\mu$$

If the standard for full credibility is satisfied, then Z=1.

The factors that need to be considered when selecting "the standard for full credibility" include:

- An assumption regarding the distribution for the claim frequency (or claim severity) e.g. have a Poisson process for the claim frequency.
- The probability P that the observed number/amount of claims X is within a proportion +k or –k of the true mean μ.
  The value of (1-P) gives the probability of being outside the acceptable range on either tail.
- In practical applications appropriate values of P and k have to be selected.
- For situations that come up repeatedly, the choice of P and k may have been made several decades ago, but nevertheless the choice was made at some point in time.
- While there is clearly judgement involved in the choice of P and k, the standards for full credibility for a given application are generally chosen within a similar range.
- Various values for P and K could be used frequently (i.e. set values) and these have hardened into market practice .

ii. If the standard for full credibility is not satisfied, this means that one will assign less than 100% credibility to the past data for a specific risk.

Therefore, when determining the pure risk premium for a particular risk, more information is required to calculate the risk. One would therefore need to use some collateral data i.e. data for a risk similar to, but not necessarily identical to, the particular risk under consideration. Therefore, another factor to consider is which collateral data to use e.g. industry data, reinsurance data, company specific data relating to a similar risk or a combination from various sources.

In terms of the credibility premium formula for a specified risk,

$$Z\bar{X} + (1 - Z)\mu$$

where $\bar{X}$ is an estimate of the expected aggregate claim (or number of claims) in the period, based solely on the data from the risk itself and μ is an estimate of the expected aggregate claims/number of claims in the next period based on collateral data. If the standard for full credibility is not satisfied, then $0 \leq Z < 1$.

Therefore, another factor would be how to calculate the credibility factor Z (or compliment of credibility 1 – Z), i.e. use a classical credibility model or a Bayesian credibility model such as the Bühlmann-Straub Model.

Finally, the question of how much data to use would also be important i.e. only use data from the last 3 years or last 5 years.

iii. Let us assume that:

- We have n years of past data from the motor insurance portfolio giving aggregate claims of amount *S*.
- The mean number of claims each year is λ.

Given: k = 0.05, E[*X*] = 150 and StdDev[X] = 35.
Therefore: $E[X^2] = 35^2 + 150^2 = 23725$.

The mean and variance of the aggregate claims in one year are $E[X]\lambda$ and $E[X^2]\lambda$.

The true premium for the coming year is $E[X]\lambda$ and the estimate, based solely on the past data is *S/n*. Regarding S as a random variable, using the normal approximation we have:

$$S \sim N(E[X]\lambda n, E[X^2]\lambda n) \sim N(150\lambda n, 23725\lambda n)$$

Therefore if the data is fully credible:

$$P\left(\left|\frac{S}{n} - E[X]\lambda\right| \leq kE[X]\lambda\right) \geq p \quad = P\left(\left|\frac{S}{n} - 150\lambda\right| \leq 7.5\lambda\right) \geq 0.95$$

This can be re-written as:

$$P\left(\left|\frac{\frac{S}{n} - E[X]\lambda n}{\sqrt{E[X^2]\lambda n}}\right| \leq kE[X]\sqrt{\frac{\lambda n}{E[X^2]}}\right) \geq p$$

$$= P\left(\left|\frac{\frac{S}{n} - 150\lambda n}{\sqrt{23725\lambda n}}\right| \leq 7.5\sqrt{\frac{\lambda n}{23725}}\right) \geq 0.95$$

Now,

$$\frac{\frac{S}{n} - E[X]\lambda n}{\sqrt{E[X^2]\lambda n}} = \frac{\frac{S}{n} - 150\lambda n}{\sqrt{23725\lambda n}} \sim N(0,1)$$

Therefore,

$$kE[X]\sqrt{\frac{\lambda n}{E[X^2]}} \equiv 7.5\sqrt{\frac{\lambda n}{23725}} \geq z_{p/2} = 1.95996$$

This implies that:

$$\lambda n \geq \left(\frac{z_{\frac{p}{2}}\sqrt{E[X^2]}}{kE[X]}\right)^2 = \frac{\left(z_{\frac{p}{2}}\right)^2 E[X^2]}{k^2(E[X])^2} = 1620.242$$

Therefore, for the data to be fully credible, we require the number of claims to be at least 1621.

In part (i) most candidates did not outline the factors that needed to be considered when selecting the standard for credibility or did not give enough detail.

Part (ii) was fairly poorly answered. Very few candidates mentioned the fact that you now don't have 100% credibility and therefore need to consider some form of collateral data and use the credibility premium formula.

In part (iii) most candidates failed to "Derive" the expressions but rather gave the formulae and the answers, thereby losing marks. A number of candidates only worked out the number of claims required in terms of the frequency and did not adjust for the pure premium.

QUESTION 3

i. P&I Clubs are mutual associations of ship owners that were originally formed to cover certain types of marine risks (mainly liability).

Advantages of P&I Clubs:

- P&I Clubs can fill gaps in insurance cover that may not be available from the traditional insurance market (e.g. public liability cover).
- They may offer cover at a more acceptable price (e.g. during the hardening phase of the insurance cycle).

- All else being equal, a mutual arrangement would be preferred, as there would be no profit loading payable to an insurance company/Lloyds syndicate.
- P&I Clubs can buy cover directly from the reinsurance market rather than being restricted to going through direct insurers.
- P&I Clubs may be set up offshore in particular countries in order to take advantage of tax and other legislative or regulatory environments.
- In addition to providing insurance, P&I Clubs also provide ship owners with technical assistance in the marine market and advice on issues relating to the shipping industry.

Disadvantages of P&I Clubs:

- While the insured's liability to an insurance company/Lloyd's syndicate is limited to the premium charged, the liability to a pool such as P&I Clubs will be related to the insured's share of the total claims and other costs that arise.
- This can lead to financial difficulty for the ship-owner in the event of large losses suffered by other members of the P&I Club.
- The losses might occur at a time the ship-owner if facing other financial difficulties e.g. due to a recession and decrease in shipping demand.
- If one or more of the participants in the P&I Club default on their obligations, the losses for the remaining participants will be larger.

ii. Attritional claims:

- Example: Can include minor property damage claims to hull, cargo, or third party property damage.
- Attritional claims are generally modelled in aggregate.
- A mildly-skewed distribution such as the lognormal may be appropriate, although this should be tested against experience.
- If the standard deviation is a sufficiently small fraction of the mean, a normal distribution may be an adequate approximation.

Large claims:

- Example: loss or damage of entire vessels and cargo.
- Ideally, large claims should be modelled separately from attritional claims so that one can model reinsurance recoveries directly. (The dividing line between large and attritional claims is often the firm's typical retention for policies in the class.)
- Generally model large claims on a frequency-severity basis.
- The Poisson distribution is often used for frequency, but is only appropriate where the claims are independent, since if there is any correlation between claims, this distribution will underestimate the tail risk.
- For severity, sampling from revalued past claim sizes is sometimes used, but this omits the risk of a claim greater than experienced in the past, so it is preferable to fit a distribution.

- A heavily-skewed distribution such as the Pareto would normally be appropriate for severity, and it should be derived from or tested against historic data revalued to current claims costs.
- If it is believed that there is a risk of large losses arising that is greater than those experienced in the past, it is necessary to make an assumption about the likely severity and frequency of these, and ensure that the fitted frequency and severity distributions allow for these adequately.
- This assumption may be subjective due to the lack of detail in the historic data.
- However, information may be available from underwriters, reinsurers, brokers etc.
- Similarly, if the historic data includes unusually heavy experience, then it should either be adjusted to reflect likely future experience, or the fitted distributions should reflect this.

Catastrophe claims

- Example: oil pollution spills causing major environmental damage.
- Catastrophe-type claims should be modelled separately from attritional and large claims.
- We cannot model catastrophe events from the firm's experience because of their rarity.
- A proprietary or bespoke model can apply a set of simulated events to the firm's exposure to derive a distribution of possible costs.
- Alternatively, a subjective allowance could be made, without using a sophisticated model.
- E.g., the insurer could estimate the likelihood of a catastrophic event of a particular size, and then build up a catastrophe reserve over time.

Part (i) was reasonably well answered, although a large number of candidates did not know their bookwork sufficiently well and produced vague answers as a result.

Part (ii) was answered well only by a small number of candidates. A common error was not answering the question asked e.g. a number of candidates went into some detail defining "underwriting risk" and a number gave details on how the capital requirements will be calculated, which is not what the question had asked. Some candidates only mentioned using triangulation methods to estimate future claims, however this ignores future risks and does not produce a distribution of outcomes.

QUESTION 4

i. This insurance indemnifies the insured against legal liability to compensate an employee or his or her estate for bodily injury, disease or death suffered, owing to negligence of the employer, in the course of employment.

Loss of or damage to employees' property is usually also covered.
Legal costs would also be covered.
Other costs such as care costs could also be included.

ii. A discovery period is a time limit, usually defined in the policy wording or through legislative precedent, placed on the period within which claims must be reported.

It generally applies to classes of business where several years may elapse between the occurrence of the event or the awareness of the condition that may give rise to a claim and the reporting of the claim.

iii. Claims frequency will depend o the type of business carried out by the employer.

While many claims may be relatively small, there is a potential for very large individual claims.

Accumulations of risk may arise since conditions and events at the employer's workplace could affect many employees at the same location.

Significant court cases could also trigger an accumulation of risk where the insurer insures several employers in the same industry.

Reporting delays relating to injury claims are generally short-tailed.
Some illness-related claims, e.g. long term exposure to harmful substances, may take years to develop and reporting could take years.

Many small claims should be able to be dealt with fairly routinely without much delay.

Settlement for claims of significant size could involve litigation and may extend into protracted legal disputes.

iv. Adjustments may need to be made to the expected claims amounts to take account of:

- Changes in contract terms and conditions (possibly resulting from changes in legislation).
- The risk characteristics of each policyholder will need to be allowed for, and these may differ from those of the grouped data analysed.
- An allowance for random fluctuations in the future.
- Claims inflation since the period of investigation.
- The past data may not have been of sufficient volume to produce a statistically credible result.
- The period of investigation may be considered not to have been typical, i.e. it may have been either unusually good or bad.
- Changes in the external environment / policyholder behaviour may be expected to change claim patterns in the future

- e.g. if an economic downturn is anticipated there could be an increase in expected claims).
- Latent claims that may now be anticipated but which were not evident in the past data.
- Recent court decisions on the validity of certain claims.

Other premium adjustments may be required for:

- The risk premium will need to be loaded for expenses (fixed & variable, including commission).
- E.g. initial underwriting, ongoing expenses, claims costs.
- Investment return (as this is long-tailed business).
- Required profit margin.
- The position in the insurance cycle.
- The net expected cost of reinsurance.
- Competitors' rates.
- Decisions by management, e.g. to sell business at a more competitive rate than theoretically justified.
- Required growth of business volumes by number of policies and premium and hence standing in the market in respect of market share
- Renewal discounts offered.

Parts (i) and (ii) were reasonably well answered by most candidates. Part (iii) should have been fairly straightforward, but was answered poorly by many candidates. In particular, many candidates missed the fact that in addition to large, long-tailed claims this type of business could also give rise to many smaller, more frequent claims that would be relatively short-tailed. Few candidates pointed out that significant court cases could trigger accumulations.

Part (iv) was more challenging, and was well answered only by the better candidates. Those who did well were able to identify that the premium generated from such an investigation might not yet represent the theoretical best estimate for the coming period, that the office premium would include further loadings, and that commercial considerations such as competitors' rates would impact on the premium the company decides to charge.

QUESTION 5

i. Perils covered:

- Fire
- Lightening
- Flood
- Hail
- Storm

- Snow
- Drought
- Earthquake
- Landslide
- Malicious damage
- Damage due to aircraft crashing / falling debris
- Disease

Exclusions:

- Nuclear
- Pollution
- War
- Illegal activities by the policyholder

ii. Risks & Management:

- Potential for very large claims.
  - E.g. The loss of entire plantations, and related consequential loss claims.

  Manage by:
  - Review adequacy of capital to provide cover.
  - Set overall limits and/or limits for specific claim types.

- Concentrations of risk.
  - E.g. Several plantations could be damaged in the same storm.

  Manage by:
  - Only reinsure some of the plantations.
  - Seek outwards reinsurance / co-insurance.
  - Adequate diversification.

iii. The risk premium will be the expected cost of cover – reflecting the expected payouts after allowing for the various policy terms.

Select an appropriate claims severity model – this will be "from the ground up", e.g. LogNormal.

Select an appropriate claims frequency model, e.g. Poisson.

Claims severity and frequency models will be based on recent claims data. If in-house data is not available/ sparse, use industry data as far as possible.

Severity and frequency models must allow for expected claims experience – do not simply use historic claims experience, but allow for changes in claim trends, inflation, etc.

Severity and frequency models must take account of potentially large claims, as well as those with a long tail (e.g. liability cover for damage adjacent to plantation).

Set up a stochastic model to run the simulations for both the number of claims and size of claims.

The model should incorporate:

- retention limit of the direct writer;
- all deductibles; and
- claim limits – per claim and aggregate

Other elements of the projection, e.g. investment return, can be either stochastic or deterministic.

The model should ideally allow for appropriate interactions between projected items, e.g. it could allow for a greater likelihood of fire claims during recessions.

Set up and run model (say) 10,000 times. Rank outcomes to provide a distribution of each of the simulated costs of cover.

The risk premium will be set as the 50th percentile.

The model should be flexible to allow for testing of different excess points, deductibles and limits. This can then be easily changed to test changes in the contract terms.

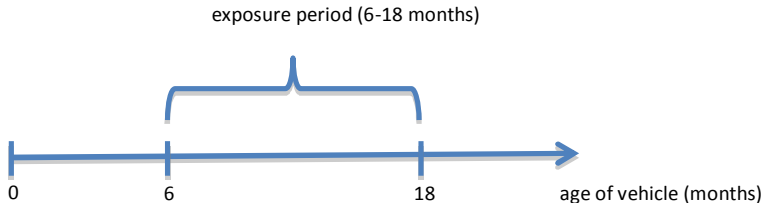
Part (i) was generally well answered. For exclusions, simply including arson was not sufficient. This had to be clarified, e.g. arson caused by policyholder.

Part (ii) was answered reasonably well. Credit was given for reasoned answers referencing anti-selection, moral hazard and poor claims management by the direct writer. However, most candidates missed out on at least one of the key risks.

Part (iii) was answered very poorly, although it was not an easy question. A clear and simple "step-by-step" approach – taking account of the scenario sketched in the question – was required. The question specified a simulation approach. No credit was given for references to re-sampling and bootstrapping. These were not appropriate given the type of insurance. Also, there was no credit given for scenario modelling. This is not simulation.

QUESTION 6

i. Timeline:



ii. Explanation:

- The period of risk is mostly after the year in which the premium is written.
- This means that the accounting result for the current year does not accurately reflect the business written in the current year.
- It may be more appropriate to account on a funded accounting basis.
- 2-year accounts may be appropriate because during that period all exposure will be earned.
- A period longer than 2-years would lead to more certainty in accounts, but less usefulness as the accounts will be out of date.

iii. Comments on the reasonableness of assumption 3:

- The older a car gets, the more likely it is that a part will fail.
- But this effect will probably be more significant for older cars.
- Nonetheless, the true risk is likely to be increasing with the age of the car.
- Thus the assumption is not completely accurate (or for saying that the assumption is reasonable since cars are new and the effect is less significant for new cars).
- It would be reasonable to earn acquisition costs over the full life of the policy rather than just the risk period with the remaining premium earned over the risk period.
- Policyholders may take their cars in for a service (where faults may be detected) near the end of the warranty period, leading to many claims just before the warranty expires (even though it is likely that manufacturing defaults will be picked up without requiring a service).

No credit was given for commenting on effects which may cause seasonality in claims by calendar year e.g. weather (as opposed to policy year).

iv. Premiums written at end of Jan 2010, will be earned from 1 August 2010 to 31 July 2011, i.e. 7 of 12 months will be earned in 2011.
Assuming premiums are written evenly over each 12-month period, the premium written in Jan 2010 is R130m/12 = R10.83m.
The portion of this premium earned during 2011 is 7/12, i.e. R6.32m.

Similarly for the rest of the business written during 2010 we obtain:

Month written	Exposure period	No. of months in 2011
Jan 2010	1 Aug 2010 – 31 July 2011	7
Feb 2010	1 Sep 2010 – 31 Aug 2011	8
March 2010	1 Oct 2010 – 30 Sep 2011	9
April 2010	1 Nov 2010 – 31 Oct 2011	10
May 2010	1 Dec 2010 – 30 Nov 2011	11
June 2010	1 Jan 2011 – 31 Dec 2011	12
July 2010	1 Feb 2011 – 31 Jan 2012	11
August 2010	1 March 2011 – 29 Feb 2012	10
Sep 2010	1 Apr 2011 – 31 March 2012	9
Oct 2010	1 May 2011 – 30 Apr 2012	8
Nov 2010	1 June 2011 – 31 May 2012	7
Dec 2010	1 July 2011 – 30 June 2012	6

Thus for policies written in 2010 the total earned premium for 2011 is:

$= 130m/12 \times (7+8+9+10+11+12+11+10+9+8+7+ 6)/12$
$= R97.5m$

Similarly, for the business written in 2011:

Month written	Exposure period	No. of months in 2011
Jan 2011	1 Aug 2011 – 31 July 2012	5
Feb 2011	1 Sep 2011 – 31 Aug 2012	4
March 2011	1 Oct 2011 – 30 Sep 2012	3
April 2011	1 Nov 2011 – 31 Oct 2012	2
May 2011	1 Dec 2011 – 30 Nov 2012	1
June 2011	1 Jan 2012 – 31 Dec 2012	0
July-Dec 2011		0

Thus for policies written in 2011 the total earned premium for 2011 is:

$= 156m/12 \times (5+4+3+2+1)/12$
$= R16.25m$

Thus the total premium for 2011 is:

$= R97.5 + R16.25m = R113.75m$

v. Potential impact:

- The risk/exposure period will now be even later, creating more uncertainty in the estimation of claims.
- Cars will be older during the period that the insurer is exposed to risk, which may result in more claims as parts are more likely to fail when older.

- On the other hand, the longer duration of the original warranty may be due to the manufacturers' increased confidence in the quality and hence lifetime of the parts, hence lower or similar claims even though the insurer's exposure period is for older vehicles.
- Estimating expenses will also be more difficult owing to the delay.
- By the time the insurer knows its claims experience it may be too late to make adjustments e.g. increase premiums if they are too low.
- The demand for the product may reduce if customers are satisfied that a 2-year warranty is sufficient.
- Claims arising from faults affecting many vehicles are arguably going to occur within a relatively short period after the vehicle sale – the original warranty will now pick up these claims, resulting in fewer claims to the insurer from manufacture faults affecting many cars.
- Policy administration will be made more difficult as different policies could have different durations before cover commences, which will need verifying at the time of a claim.
- There will be development costs incurred in adjusting product, premium, etc.
- The insurer will need to invest premiums for longer, resulting in more investment return, but more investment risk.

In part (ii) many candidates commented that the period of risk exposure was 6 months after the policy inception date and suggested funded accounting as an alternative to accident year accounting, but not many candidates clearly explained that the accruals accounts may not accurately reflect the business written during the financial year

Part (iii) was well answered by most candidates

In part (iv) candidates who followed a pragmatic approach generally scored well. Candidates who made simplifying assumptions (such as premiums written half way through the year) were penalised as they did not use all the information available.

Part (v) required candidates to think creatively. Generally too few points were given.

QUESTION 7

i. Reasons why claims reserves are needed:

- The insurer is liable to pay for all claims arising from a past period of cover.
- There may be delays before the claims are settled due to reporting and/or settlement delays.

NB: must be clear that reserve is for expired business (not UPR)

ii. Run-off triangle:

		Development period			
		0	1	2	3 ...
Origin period	2008	40	30	20	10
	2009	48	36	24	
	2010	56	42		
	2011	64			

- Origin period refers to the period in which claims arose (could be underwriting, reporting or accident time).
- Development year refers to the year in which claims were paid or estimates adjusted (expressed as time since origin period).
- The values in the triangle show the amounts of claims corresponding to a particular origin period and development period. The claims could refer to claims paid or claims incurred (claims paid + case estimates).
- It is generally required that the first origin year is fully run-off or that a tail factor has been estimated.

iii. Data required:

- End goal: For the triangle, we need to know either the cumulative claims paid (or incurred) for each origin period at each development year since the origin year, or we need the incremental claims.
- We will thus need the date of origin of the claim (either underwriting date, accident date or reporting date).
- The date and amount of movements, which may be:
  - claims paid
  - changes in case estimates
  - reinsurance recoveries
  - salvages
  - subrogation
- Details of expenses on claims to include with claims (as reserves should include an allowance for expenses.
- Where possible, it is useful to analyse claims expenses separately.
- Class and peril.
- An inflation adjustment is required to get figures into the same money terms before performing the reserve calculation.

iv. Data errors:

- Incorrect dates: using date of reporting as the accident date
  - Avoid: remind staff inputting data that the reporting and accident dates are not the same, and that reporting date cannot precede the accident date.
  - Check: date of reporting does not precede date of accident.

- Incorrect dates: wrong payment dates
  - Avoid: extract payment date directly from financial transaction system.
  - Check: payment dates does not precede reporting date and is before date of data.
- Wrong claim type:
  - Avoid: make staff inputting data select from drop-down list and confirm date.
  - Check: spot checks on description field to check that it matches claim type.
  - Check: claim amount consistent with type e.g. theft of vehicle = sum insured.
- Incorrect claim amount entered
  - Avoid: staff inputting data required to confirm amount.
  - Avoid: don't allow entry of negative amounts or amounts greater than the sum insured, and give a warning message for unreasonable amounts.
  - Avoid: extract amount directly from finance system.
  - Check: spot checks of individual files to ensure correct amounts entered.

v. Reasons and appropriateness:

- Discounting is not significant for short-tailed classes, since cashflows are only discounted for a short time.
  - However, bodily injury claims have the potential to be long-tailed because the claims are only paid when liability is determined.
  - There may be lengthy court cases (settlement delay).
  - There may also be a delay before injured parties realise that their injury is more serious than they thought and so decide to pursue a claim (reporting delay).
  - Discounting gives a more realistic picture of the profits of the company due to the potential for long settlement delays.
  - Not discounting would also make premiums less competitive if reserves filtered through into the calculation of premium rates.
- Claims are (generally) likely to increase with inflation, so not discounting to reduce claims will roughly offset the increase due to inflation.
  - The claims for this class are fixed, so this argument does not apply.
  - Although claims expenses (such as legal) may increase with inflation.
  - Could consider treating claims and expenses separately.
- Not discounting is prudent because liabilities may be understated if discounting is used.
  - This argument is valid to some extent, but there is limited uncertainty due to the fixed nature of claims.
  - The extent of uncertainty also depends on the amount of the fixed benefit.
  - There is uncertainty in timing though, with the potential for claims to happen earlier than anticipated (hence less investment income).
- Regulations may prohibit discounting for statutory purposes.
- The insurer would not want to understate reserves, as this would result in more profits and hence a higher tax payment.

vi. Potential challenges:

Determining the liabilities:

- The actual timing of liabilities is uncertain for two reasons:
  - random variation as to the time of accident (and which accidents cause injuries)
  - variation in the time to settlement (with the potential for some claims to go to court)
- Claim amount is uncertain: bodily injury claims are less frequent than accident claims since many smaller accidents do not result in injury. There is thus more randomness in the total number and hence amount of claims. In addition, the injuries which arise (and hence the individual claim amounts) are uncertain. The expense amount is particularly uncertain (legal expenses).
- Cash available for investment:
  - There may be uncertainty as to the timing of premium income, reducing the money available for investment.
  - Not all assets are available for investment e.g. broker balances. This depends on the method of sale used.

Availability of suitable assets:

- Even once an estimate of timing and amount of liabilities has been decided, suitable assets may not be available to invest in e.g. not long enough term.

Other factors:

- The asset returns may have an allowance for default risk (higher returns).
- How to take account of tax and expenses of investing in assets.
- Volatility of market values on assets making it difficult to decide on the market value (and hence implied return) to use.
- Uncertainty of income from assets e.g. dividends on shares.
- The replicating portfolio may consist of a number of assets making the combined return calculation onerous.
- The available assets may include components that are not applicable to the insurer's liabilities and which cannot easily be stripped out.

vii. It is not likely to be appropriate since:

- by definition a mismatched portfolio is taking on extra risk; and
- it is not sensible to hold lower reserves simply because more investment risk is being taken on.

Part (i) was poorly answered as most candidates did not distinguish between claims reserves (for expired business) and UPR (reserve for unexpired business.

Part (ii) was reasonably answered, although the terms origin year and development year were generally not explained well. A number of candidates wasted time explaining how a runoff triangle could be used for reserving e.g. by showing the chain-ladder method. No marks were awarded for this.

In part (iii) candidates generally listed enough relevant data items to score well. Although many did not display a clear understanding of how movement data is used to construct a runoff triangle (candidates were not penalised harshly for this as it was not specifically asked for)

Part (iv) was not well answered. Many candidates commented on general distorting factors (such as large losses) which are not due to data errors. Many checks and avoidance mechanisms suggested were not practical.

In part (v) some candidates struggled to generate enough points. Only the better candidates discussed whether the general arguments for not discounting applied to the insurer.

In part (vi) many candidates failed to comment on the uncertainty inherent in the liabilities making it difficult to determine the "portfolio" to replicate. Some candidates focussed on the difficulty of actually investing in assets, rather than estimating the return on those assets.

In part (vii) most candidates failed to realise that the insurer was mismatched, resulting in more risk.

END OF EXAMINERS' REPORT