EXAMINERS' REPORT

June 2011 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. The estimated (or expected) maximum loss (EML) is the largest loss, which could reasonably be expected, to arise, from a single event.

ii. Reinsurer's reaction:

   - The reinsurer would not be pleased as this may indicate that the insurer is not able to estimate its risks correctly and thus the insurance premiums may be too low. Even though the premium is shared proportionally with the reinsurers, if the premium is too low they will receive too little premium.
   - They have no choice but to pay the claims now.
   - If this continues they may be unwilling to renew the reinsurance treaties.

iii. Reasons:

   - To allow the insurer to better manage and balance its risk profile.
   - Certain risks may be too large or volatile for the insurer.
   (N.B. "To get rid of "bad" risks is not an acceptable answer as the insurer should not be writing "bad" risks in the first place.)

iv. Co. A: $0.25 \times (120 + 300 + 400 + 320) = \$ 285$ m

   Co. B bases payments on the 75% remaining after the QS, viz.:

Claim	Balance of Claim after QS	XL Recovery from Co. B
1	$ 90	0 (since 90 < 100)
2	$ 225	$0.8 \times (225 - 100) = \$ 100$ m
3	$ 300	0.8×150 (max) $= \$ 120$ m
4	$ 240	$0.8 \times (240 - 100) = \$ 112$ m
Total		$ 332 m

v. Surplus recoveries from Co. C

Claim	Risk Cat.	EML	Proportion reinsured	Surplus Recovery from Co. C
1	I	$ 150	0 (as 150 < RL)	0
2	I	$ 300	100/300 = 1/3	$1/3 \times 300 = \$ 100$ m
3	II	$ 600	9/10 (i.e. use all 9 lines)	$9/10 \times 400 = \$ 360$ m
4	II	$ 400	350/400 = 7/8 (see note below)	$7/8 \times 320 = \$ 280$ m

Note: We cannot use all 9 lines as this would imply retaining only $40m EML, which is lower than permitted

vi. Factors:

- The free reserves available to the company, and the extent to which they can handle very large losses.
- The very large potential losses mean that it could be worthwhile seeking reciprocal proportional reinsurance.
- Management and shareholders' attitude to risk.
- The importance to the company of stable profits. This can be improved by taking more excess of loss reinsurance.
- Consider the extent of possible accumulations of risk.
- Statutory solvency: how will the reinsurance protection impact any statutory solvency position? Does the company need financing assistance, e.g. financing commission?
- Company strategy: is the company expecting to expand its business? How much of a strain will this place on the free reserves?
- How relevant is one year's experience when comparing potential effectiveness of programmes (probably very little).
- To what extent is technical assistance important to the company, and how will different reinsurance programmes affect this?
- Market reputation: how will investors, analysts, brokers and customers react to any significant change in reinsurance programme?
- Security status: reinsurers with better security may charge more for the cover.
- Value for money of reinsurance available in the market.

The bookwork parts were answered reasonably well by most candidates. Candidates demonstrated a wide range of abilities when it came to the calculations in parts (iv) and (v). Several candidates lost marks by failing to show workings, or omitting currency or units from their answers.

QUESTION 2

i. Premiums take credit for expected investment returns on investments held to meet the liabilities in respect of the business. If these returns are lower than expected then premiums will be insufficient.

There is uncertainty regarding the returns of these assets (income and capital gains) due to factors such as:

- Investment market conditions could deteriorate
- The proportion of investible assets is less than expected (e.g. due to a higher proportion held as agents balances)
- Claims are paid faster than expected resulting in assets being held for a shorter period

- Company may be forced to realise assets at an unfavourable time (although less likely than would otherwise have been the case due to rapid growth)
- Limited diversification of investments (likely to still be small company despite rapid growth)
- Investment expenses higher than expected
- Poor investment management, e.g. underperformance relative to benchmarks
- Unexpected taxes on returns
- Risk of default
- Changes to investment legislation
- Risk that investment return does not match claims and expense inflation
- Currency risk if assets and liabilities are in different currencies and currency moves against the insurer

ii. The company would aim to maximise returns subject to meeting liabilities as they fall due.

Rapid growth is likely to lead to pressure on statutory solvency and free reserves relative to written premium.

Different matching considerations apply for vehicle damage and bodily injury/liability.

- Vehicle damage claims reported and settled quickly.
- Bodily injury claims longer tail

Cash:

- is liquid
- has stable capital values (useful for maintaining solvency)
- has low risk of default.
- but does not provide inflation protection for either the property damage claims or the bodily injury claims.

Other (real) investments:

- Would expect other asset classes to produce higher returns over the long term e.g. equities
- Would consider using other asset classes for matching the free reserves (especially if company is in a strong solvency position).
- However other assets may not be appropriate if there is a currency mismatch.
- Such investments may be less liquid/stable and have a higher risk of default.

Other considerations:

- Different tax rules for different assets may affect decision.
- May be restricted by legislation or statutory solvency rules.

iii. Data:

- Actual investments held at start of projection.
- Amount of liabilities at start of projection (split by currency if applicable).
- Tax rates
- Reinsurance strategy
- Any restrictions on investment policy, either statutory or management specific.
- Definitions of solvency and return to be used in assessing the benefits of any investment strategy.
- The amounts of any dividends paid
- A rule or target (e.g. for solvency)

Assumptions:

- Expected (claim and expense) payment profile.
- Expected variability associated with payments.
- Nature of liabilities and how strongly correlated to price inflation (damage claims) and wage inflation (bodily injury).
- Expected rates of judicial inflation (for bodily injury liability claims)
- Expected investment returns by type and currency of investment
- Expected variability of investment return by type of investment.
- The amount of business to be written in the future, split by currency and nature.
- Time horizon to be used for the projection of assets and liabilities.
- Expected broker balances and other non-investible assets.

Other Items:

- A stochastic economic model for generating a large number of future economic scenarios.
- An asset model for projecting future asset levels;
- A liability model for projecting future liability levels.

iv. **24$^{\text{ths}}$ method:**

It assumes that annual policies are written evenly over each month and risk is spread evenly over the year.

The UPR at the end of a 12 month accounting period for a policy written in month m is:
$(2m - 1)/24 \times$ Monthly Premium

365$^{\text{ths}}$ method

It assumes that the risk is spread evenly over the 365 days of a year of cover.

The UPR at the end of a 365 day accounting period is:
$(365 - \text{Number of days since inception of the policy})/365 \times$ Premium

For a rapidly growing insurer, the 24^{ths} method might overestimate earned premium (and underestimate unearned premium) compared to the 365^{ths} method.

Hence the latter would be preferable.

Well answered by the better candidates.

In part (i) a number of candidates made the general comment "mismatching risk caused by mismatching by term, nature or currency" without elaborating on exactly how this creates risk and uncertainty to the insurer. An even greater number of candidates were not clear in their answers that risk of loss arises when experience is different from expectations. So a change in say broker balances or tax rates or investment expenses are not a risk if the insurer had priced allowing for these expected changes.

In part (ii) some candidates wrote that cash is "secure" without defining this – is this referring to risk of default or stable market values? A number of candidates thought that cash provides high risk of default, which is in general incorrect.

It was surprising to see a number of candidates not appearing to understand that third party liability claims are not all long tailed, but also include short-tailed property damage claims.

Part (iii) was answered well by only the better candidates. A number of candidates went into lots of detail on how to project the claims, ignoring the assets. A number of candidates chose to write about how to do the projections rather than answering the question asked.

Part (iv) was generally well answered, although many candidates did not state the assumptions behind each of the methods (in terms of when policies are written and in terms of how risk is spread over the policy year). Credit was given for valid alternative methods.

QUESTION 3

Accident Year:

- Claims are grouped by the time period (e.g. calendar year) during which they occurred, irrespective of when they were paid or when cover commenced.
- Advantages:
  - ➢ All claims in a cohort belong to the same period of exposure.
  - ➢ The claims will all therefore be subject to the same risk environment, even if they have been written under different rating and policy conditions.
- IBNR claims will be included (eventually) in the original accident year cohort in which they occurred, as will recoveries and re-opened claims.
- Projection of the future development of claims (reported or paid) in this form should therefore allow automatically for all IBNR claims (& recoveries and re-openings) belonging to the cohort.
- Consistent with losses occurring basis.

Reporting Year:

- Claims are grouped by the time period in which they are reported to the company, irrespective of when they occurred.
- Consistent with claims-made basis.
- Advantages:
    - An apparent advantage is that (by definition) no further claims will be added after the end of the reporting year covering that cohort.
- Disadvantages:
    - The method does not allow for the cost of IBNR and reopened claims.
    - Claims will arise from different exposure periods which may have different volumes of business, cover and claims settlement patterns.
    - Hence any claims patterns derived may not represent the current position.

Underwriting Year:

- Claims are assigned to the calendar year in which the policy was written, irrespective of whether the claim occurred in the first or second calendar year of the policy.
- Consistent with risk attaching basis.
- Advantages:
    - It follows the way in which funded accounts are divided and follows the total outcome of all policies written in each year.
- Disadvantages:
    - It takes up to two calendar years before all claims have occurred and an additional period before all are reported (assuming policies are for 12 months).
    - Each cohort of claims will have occurred over a wider risk period than an accident year cohort, which can blur run-off patterns.
- IBNR claims will be included automatically in projections (eventually)

This was a straightforward bookwork question for which well-prepared candidates should have been able to score full marks. Some candidates went into too much detail about the methods that could be used to calculate IBNR reserves, which was not the main focus of the question. Weaker candidates failed to generate enough ideas to score well.

QUESTION 4

i. EOL reinsurance with $\theta = 0.1$, $\xi = 0.15$, $Y = \min(X,M)$, $Z = \max(0, X - M)$ and $X \sim U(0,250)$

To find the net of reinsurance adjustment coefficient R, need to solve the equation

$$M_Y(R) = 1 + c*R$$

Where

$$C^* = (1 + \theta)E(X) - (1 + \xi)E(Z)$$

and

$$M_Y(R) = \int_0^M e^{Rx} f(x)dx + \int_M^\infty e^{RM} f(x)dx$$

Now,

$$E(X) = \frac{250}{2} = 125$$

and

$$
\begin{aligned}
E(Z) &= \int_M^{250} (x - M)\frac{1}{250}dx \\
&= \left(\frac{x^2}{2} - Mx\right)_M^{250} \frac{1}{250} \\
&= \frac{1}{500}(250 - M)^2
\end{aligned}
$$

and

$$
\begin{aligned}
M_Y(R) = E\left(e^{RY}\right) &= \int_0^M e^{Ry}\frac{1}{250}dy + \int_M^{250} e^{MR}\frac{1}{250}dy \\
&= \frac{1}{250}\left(\frac{e^{MR} - 1}{R}\right) + \frac{e^{MR}}{250}(250 - M) \\
&= \frac{e^{MR}}{250}\left(\frac{1}{R} + 250 - M\right) - \frac{1}{250R}
\end{aligned}
$$

Therefore,

$$
\begin{aligned}
c^* &= (1 + \theta)E(X) - (1 + \xi)E(Z) \\
&= 1.1(125) - 1.15\frac{1}{500}(250 - M)^2
\end{aligned}
$$

Therefore, need to solve for R such that

$$M_Y(R) = 1 + c^* R$$

$$\Rightarrow \frac{e^{MR}}{250}\left(\frac{1}{R} + 250 - M\right) - \frac{1}{250R} = 1 + \left[1.1(125) - 1.15\frac{1}{500}(250 - M)^2\right] R$$

ii. R is a proxy for risk. We want to maximize R, so that Lunbergs inequality (which provides an upper bound for the probability of ruin) is as small as possible, to minimize the probability of Ruin. Therefore, want to find M such that R is maximized.

© Actuarial Society of South Africa

In general the question was answered fairly well, although some candidates omitted parts of the question. Mistakes included:

- *Several candidates did not use the correct equation for c_{net}, suggesting that they did not understand the derivation of the formulae from the compound Poisson model.*
- *Some candidates did not use the correct values which were given in the question for theta and zeta.*
- *Some candidates attempted to calculate E(Y) directly rather than just E(X) and E(Z). In addition, they did not realize that Y = min(X,Z) showing a lack of understanding of Excess of Loss reinsurance.*
- *In part (ii) most candidates did not state that R is a proxy for risk and therefore lost marks.*
- *Several candidates could not derive the mgf for Y properly or used the incorrect pdf for the uniform distribution.*
- *Some candidates used mgf for X rather than mgf for Y in solving for the adjustment co-efficient.*

QUESTION 5

i. A deductible is the amount deducted from a claim which would otherwise have been payable, i.e. it is borne by the policyholder.

An excess is the sum that the insured bears before any liability falls on the insurer.

The primary difference is that the deductible eats into the sum insured whereas the excess does not, and sits below the sum insured.
Hence on a policy with a deductible the maximum the insurer will be liable to pay is the sum insured less the deductible.

ii. a. $L - S + D$

b. E if $L < S + E$

$L - (S + E) + E = L - S$ if $L > S + E$

iii. This is the practice whereby in the event of a partial loss

the claim amount is reduced

in the proportion that the sum insured bears to the amount deemed to have been the appropriate sum insured

This was a straightforward bookwork question for which well-prepared candidates should have scored full marks. Bearing this in mind, performance was generally poorer than expected.

QUESTION 6

Initial underwriting checks:

- Tighten underwriting criteria, such as checking previous claims history of the policyholder at inception

Claim checks:

- Check policy cover dates against date of accident
- Look for multiple claims from the same claimant, surname, address, postcode, etc.
- Review previous claims history – any repeat claims in internal data
- Spot checks on claims of various sizes
- Send out claims handler to view claim incident where economically viable
- Attempt to identify any oddities about the claim, such as flood damage on a dry day
- Corroborate info provided by claimant with independent sources. E.g. witnesses
- Require original receipts to demonstrate value
- Require medical evidence of injuries from recognised professionals

Industry initiatives:

- Consider data sharing with other companies — E.g. to highlight any double coverage
- Collaborate with police, media and other insurers to advertise penalties for fraud using specific example cases previously discovered
- Maintain good links/relationships with relevant police and related authorities and share information

Contract design:

- Introduce some form of experience rating
- Increase / introduce excesses
- Write indemnity only policies
- Settle claims by replacement items rather than cash settlement
- Ensure policy wording is as tight as can be
- Highlight penalties for fraud on policy wording

Additional internal controls:

- Set up fraud department
- Set up confidential fraud line with possible incentives
- Use of in-house / appointed repairers / loss adjusters
- Use of own sales force
- Ensure claims handlers are well trained and receive regular refresher training
- Ensure staff complement is in line with economic conditions so as to be able to cope rigorously with potential spikes in fraudulent claim numbers
- Use of voice recognition techniques and recording of telephone calls for purposes of lie detection / claim verification
- Use of rating factors which are proxies for propensity to defraud, e.g. credit scoring
- Physical interviews with clients where there is a suspicion of fraud rather than telephonic claims settlement.

This question was generally poorly answered with even strong candidates failing to generate sufficiently many ideas to score well. A number of candidates did not read the "outline briefly" instruction and went into unnecessary detail regarding the actions that the insurer could take to reduce fraud. Some candidates focused on the costs of fraud prevention actions rather than the actions themselves.

QUESTION 7

Unusually heavy or light experience in the investigation period:
- Claims experience may go in cycles
- For some classes unusually heavy or light years may be experienced in isolation, especially if the risk is affected by climate

Action:
- If experience is felt to be untypical then choose another base year
- Or aggregate more years' experience
- Or apply an adjustment factor to the base year (subjective)
- Although industry data may be available.

Large or exceptional claims in the base period:
Action:
- May be left in the data
- Or truncated and spread
- Or removed
- Action will depend on the extent to which similar claims are expected to occur in the future

Trends in claims experience:
- Important to understand the reasons for any trends so that these can be allowed for

Action:
- If trends are detected in the base data, it is important to attach more weight to recent experience
- Allow for inflation
- Trends should also be investigated to see whether or not they are likely to continue into the future or if they are the results of a one-off change in company or market practice.
- If they are expected to continue then an assumption will be needed to allow for them.
- It may be necessary to adjust past data.

Changes in risk:
- Changes in risk can be difficult to deal with.

Actions:
- They may show up as trends and be dealt with as such.
- Alternatively, major elements of the risk could be separated in the base data and projected separately and combined with an assumption about the future mix of risks.

Changes in cover:
- Changes in cover can be difficult to allow for.
- Major changes are likely to involve the perils covered or the limits and excesses applied to each claim.
- They may also arise from changes to underwriting or to claims settlement procedures.

Actions:
- If a peril is no longer to be insured it may be possible to exclude these claims from the data.
- If a new peril is to be insured it may be necessary to use external data, such as market statistics, consumer or manufacturer data, government statistics.
- Changes to limits or excesses are more complicated to allow for.
- If there is a detailed database allowing all claims to be separately considered, it may be possible to adjust each claim to the original gross amount and project the gross data to the new rating period.
- Otherwise it will be necessary to make more approximate adjustments based on any knowledge of the underlying claims cost distribution.
- Either way the information will be incomplete as many insureds will not notify claims below or near the excess points.
- Future changes in the risk environment other than normal trends will need to be identified.

Changes in reinsurance:
- It will be necessary to allow for changes in reinsurance programmes and the cost thereof.

Other problems:
- May be necessary to incorporate IBNR
- Margins in reserves (positive and negative)
- Errors in data
- Changes in claim definition including treatment of NIL cost claims

This question required the application of a fairly commonly examined bookwork topic. Well-prepared candidates scored very well on this question but these were a distinct minority. Weaker candidates failed to organise their responses coherently and hence ended up repeating points. Some candidates wasted time by giving too many examples of the reasons why adjustments would need to be made and as a consequence did not suggest enough actual adjustments.

QUESTION 8

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

Perils are largely grouped as:

- Accidents caused by negligence of the employer or by other employees
- Exposure to harmful substances
- Exposure to harmful working conditions

Public Liability:
The insured is indemnified against the legal liability for the death or bodily injury to a third party or for damage to property belonging to a third party, other than those liabilities covered by other liability insurance.

Perils include:

- compensation for injury from falling objects
- pollution, etc.

Motor Fleet Third Party Liability:
Third Party Liability indemnifies the owner of a motor vehicle against compensation payable to third parties for personal injury or damage to their property.

Motor Property Damage:
Indemnifies insured against loss or damage arising to their vehicle from specified perils such as theft, subject to any limits or excesses.

Commercial Fire/Property Damage:
As per motor property damage.

Perils include:

- fire
- explosion
- lightning
- theft
- storm
- flood

- vandalism

Pecuniary Loss:
Protects the insured against bad debts or other failure of third parties or effects of recession, as specified in the policy.

Fidelity Guarantee:
Covers the insured against financial losses caused by dishonest actions by its employees, including loss of money or goods owned by the insured or for which the insured is responsible, and reasonable fees incurred in establishing the size of the loss.

Business Interruption Cover / Consequential Loss:
Indemnifies the insured against losses made as a result of not being able to conduct business

Perils will include items such as:

- fire at insured's property
- fire at neighbouring properties

Product Liability
Indemnifies insured against legal liability for death or injury to third party, or damage to property belonging to a third party arising from product fault.

Perils include:

- faulty design
- packaging
- misleading instructions etc.

Group Medical and Personal Accident Insurance:
Indemnifies the insured against some or all of the costs for medical treatment and fixed amounts for loss of limbs etc. respectively.

Crop insurance:
Indemnifies the insured against losses made to the crop

Perils include:

- disease
- fire
- storm
- Drought

ii. Rating factors:

Employers' and Public Liability:

- Payroll / number of employees
- Type of business
- Claims experience

- Location of workforce
- Equipment used / Processes involved
- Materials handled
- Health & Safety measures / procedures
- Training
- Turnover
- Deductible

Motor Fleet:

- Use of vehicle
- Age of vehicle
- Number of vehicles
- Value of vehicles
- Type of cover
- Excess
- Occupation of drivers
- Sex of driver
- Age of driver
- Type of vehicle
- Location of vehicle overnight
- Weight / capacity
- Area of use (local / national)
- Maintenance procedures
- Level of use
- Claims experience

Commercial Property:

- Size of farm / number of buildings / sum insured
- Use of buildings
- Construction design
- Location
- Value of stock
- Age / condition of buildings / machinery
- Excess
- Claims experience / training provided
- Fire precautions
- Security measures

Pecuniary Loss, Fidelity Guarantee, Business Interruption:

- Type of business
- Turnover / earnings / sum insured / profits / projected sales
- Value of work in progress
- Materials handled

- Equipment Used
- Indemnity period (3-5 years)
- Years trading to date
- Previous bankruptcies
- Financial Controls / Security (Cash kept on site)
- Product Liability
- Size of trees
- Associated components
- Packaging
- Chemicals used in farming process
- Location of sales (country)

Medical / Personal Accident:

- Age
- Sex
- Cover
- Number of people covered
- Region
- Medical history
- Sum insured for PA
- Activities in workplace

Crop Insurance:

- Location
- Past claims
- Variety of tree
- Use of pesticides
- Sum insured / crop value
- Security measures
- Exclusions
- Tree density
- Fire prevention measures

This question was generally well answered. Weaker candidates demonstrated only a superficial understanding of the types of insurance products. Although candidates were generally able to identify six different categories, a surprising proportion failed to provide complete descriptions/definitions of the products chosen. Candidates generally struggled to generate enough rating factors to score well in the second part of the question.

END OF EXAMINERS' REPORT