



Institute
and Faculty
of Actuaries

EXAMINERS' REPORT

SP8 - General Insurance Pricing

Specialist Principles

September 2023

Introduction

The Examiners' Report is written by the Chief Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

For some candidates, this may be their first attempt at answering an examination using open books and online. The Examiners expect all candidates to have a good level of knowledge and understanding of the topics and therefore candidates should not be overly dependent on open book materials. In our experience, candidates that spend too long researching answers in their materials will not be successful either because of time management issues or because they do not properly answer the questions.

Many candidates rely on past exam papers and examiner reports. Great caution must be exercised in doing so because each exam question is unique. As with all professional examinations, it is insufficient to repeat points of principle, formula or other text book works. The examinations are designed to test "higher order" thinking including candidates' ability to apply their knowledge to the facts presented in detail, synthesise and analyse their findings, and present conclusions or advice. Successful candidates concentrate on answering the questions asked rather than repeating their knowledge without application.

The report is written based on the legislative and regulatory context pertaining to the date that the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

Sarah Hutchinson
Chair of the Board of Examiners
November 2023

A. General comments on the *aims of this subject and how it is marked*

Subject SP8 deals with applications of general insurance pricing techniques across many different types of products. Candidates should expect the examiners to draw these applications from all parts of the syllabus in order to test as wide as possible a range of skills and, in particular, to achieve a fair balance between personal and commercial lines.

Examiners will sometimes require the use of standard general insurance actuarial and statistical techniques that are covered in earlier subjects. Candidates should ensure that they are familiar with these when preparing for the SP8 examination.

As well as pricing techniques, SP8 also covers the workings and use of reinsurance products, so candidates should also expect the examiners to set questions on these aspects.

In questions with an element of calculation, different numerical answers may be obtained from those shown in these solutions depending on whether figures obtained from tables or from calculators are used in the calculations. Candidates are not penalised for this. However, candidates may not be awarded marks where excessive rounding has been used or where insufficient working is shown. Where questions require looking up values in tables, candidates are expected to interpolate between two values if reasonable to do so, even when this is not stated in the question.

Where examples are given in the solution to illustrate the points made, marks were awarded to candidates who gave these particular examples or an equally valid alternative.

Candidates who give well-reasoned points, not in the marking schedule, are awarded marks for doing so.

B. Comments on *candidate performance in this diet of the examination.*

This paper was generally well attempted. Only a few scripts had any questions not attempted or showed evidence of “time trouble”, suggesting that most candidates planned their time well. Many candidates demonstrated a good knowledge of the relevant subject material. It is good to see that many candidates are modifying their answers to address the scenario described in the questions. However, some candidates are failing to gain marks by giving answers that are too generic or not relevant to the specifics given.

C. Pass Mark

The Pass Mark for this exam was 60
389 presented themselves and 171 passed.

Solutions for SP8 - September 2023

Q1

In supervised learning, labelled training examples are provided	[1]
As well as a data set of features/factors	[½]
Supervised learning involves searching the feature space	[½]
to find patterns that are predictive of the target labels	[½]
The model can then use these learned patterns to make predictions on unlabelled data	[½]
There is a specific response variable that the modeller trying to predict.	[1]
The two types of supervised learning models are classification and regression	[½]
When this response is a categorical or binary variable it is a classification problem	[½]
E.g., a quote could be converted to sale, or it could be rejected by a customer	
This is a binary response	[½]
When this response is a continuous variable, it is a regression problem	[½]
E.g., the severity of a claim	[½]
Common examples are GLMs, neural networks, support vector machines, decision trees	[½]
In unsupervised learning, labelled training examples are not required.	[1]
The modelling algorithm is free to seek whatever structures in the data it can find.	[½]
The algorithm infers a relationship between the data points. This inferred relationship could be predictive.	[½]
like finding a previously unknown cluster.	[½]
E.g., an algorithm could be given incomes for a set of policyholders. It may be able to split them into clusters of students and professionals.	[½]
There is no predicted response variable for the algorithm	[1]
as often the aim of unsupervised learning is to find structures in the data.	[½]
Two types of models - clustering and association.	[½]
Common examples are clustering algorithms (k-means clustering), anomaly detection.	[½]

[Marks available 12½, maximum 5]

[Total 5]

Generally, well answered with many candidates giving a sufficiently detailed explanation to score highly. Some answers were not expressed very clearly, hence not giving sufficient evidence that the candidate understood the two types of learning.

Q2

(i)

Pricing can account for the profit loading by either:

Targeting a return on capital over and above the risk-free rate; or [1]

Taking account of investment income on capital in the calculation of projected profitability. [1]

The required return should be appropriate to the shareholders' risk/return appetite also account for factors like brand image, growth strategies, etc. [½]

and could vary by line of business depending on objectives e.g., required return could be lower for a line that we want to expand.	[1/2]
Target return will generally be higher on long-tail lines of business as they are generally riskier than short-tail lines and capital needs to be held for a longer time.	[1/2]
Alternatively, capital should be calculated based on the capital requirement over the entire lifetime of the policy.	[1/2]
Company's capital will need to be allocated to each line of business.	[1/2]
The allocation should reflect the underlying volatility of the risks being covered adjusted for the effect of reinsurance protection using a measure like standard deviation or Value at Risk and rating factors can be used to further divide the portfolio between risky and less risky segments.	[1/2]
and the volume/size of the portfolio could also consider regulatory or rating agency capital requirements	[1/2]
However, it is common to have the same required return on capital (built into the premium) across many or all classes of business or cross-subsidize one class using another if the total capital requirement is being met	[1/2]
because the capital allocation to classes is notional rather than explicit.	[1/2]
	[Marks available 10, maximum 4]

(ii)	
Price elasticity curves (customer retention model) / price sensitivity.	[1]
Competitor prices for each renewal customer predicted customer behaviour with respect to competitor prices predicted competitor reaction to change in price.	[1/2]
Cross-subsidies between classes and cross-selling opportunities.	[1/2]
Customer lifetime value e.g., if concerned with long-term profitability, might want to reward persistency more.	[1/2]
Position in underwriting cycle / motor insurance supply & demand.	[1/2]
Likely for the floor to be pure risk premium + expense loading to avoid selling contracts at a theoretical loss.	[1/2]
though expense loading might need to change if the model predicts a higher/lower business volume.	[1/2]
Impact on the company's solvency and capital.	[1/2]
Regulatory restrictions e.g., requirement for renewal premium to be within a certain range of new business premium.	[1/2]
e.g., not allowed to use age even though older customers may be less price-sensitive.	[1/2]
Market acceptability conditions e.g., acceptance towards similar risks being charged different renewal premium.	[1/2]
The company reputation and brand e.g., avoid price shocks that lead to low retention of existing customers.	[1/2]
Broker relationships e.g., commissions might be affected.	[1/2]
May only be possible to deploy over some distribution channels, and/or elasticity and competitor prices might vary by channel.	[1/2]
Time required to setup / update the algorithm.	[1/2]
System limitations / time to process quotes.	[1/2]

Additional risk/rating factors that may not have been considered in the theoretical office premium.	[1/2]
e.g. customer's own loss history.	[1/2]
Effect of reinsurance in place i.e., maximize net profit.	[1/2]
Quality / Credibility / Volume of data available for prediction.	[1/2]
Documentation of the model.	[1/2]

[Marks available 12½, maximum 5]

[Total 9]

Part (i) was not very well answered by most candidates, although a few did very well. Some answers explained how to allow for a profit loading generally, rather than referring to 'target return on capital', and so did not do well.

Part (ii) Success varied a fair bit on this question. The question required candidates to take a step back and think about how such a model might work. The better answers focussed on "optimising renewal premiums", using an "algorithm" and allowing for "market conditions".

Q3

(i)

Clearly defines the risk.	[1/2]
Low correlation / uncorrelated with other rating factors.	[1/2]
Measurable / Easy / practical to obtain and record.	[1/2]
Objective / Not subjective.	[1/2]
Can be verified / non-manipulatable.	[1/2]
Acceptable to the market / policyholder / regulator.	[1/2]

(ii)

(Allow credit for points made in part (ii) that are given in part (iii) and vice-versa)

Correlation analysis / comparison between the new factors and existing factors using two-way or multivariate analysis.	[1/2]
Check the completeness of the data, i.e., is it known for all existing and potential customers / low levels in the unknown category.	[1/2]
Perform one-way analyses	[1/2]
to ensure that the data is well spread out i.e., not concentrated in one rating category	[1/2]
to see if there is a trend	[1/2]
and ensure the trend /or lack thereof is in line with expectations.	[1/2]
Analyse interaction with calendar periods to see if trend / relativities are consistent over time.	[1/2]
Is it possible to check accuracy against existing or other data.	[1/2]
Try adding the factors to existing models and test significance	[1/2]
does it remove further residual heterogeneity?	[1/2]
use chi-squared tests, F-tests, AIC or lift curves.	[1/2]
For any analysis an appropriate sample will have to be chosen and agreed with the third party.	[1/2]
Any benefit the factors add would have to be weighed against the cost	[1/2]

and the actuary will have to determine how that benefit can be assessed. [½]
 [Marks available 7½, maximum 3]

(iii)
 Source / type of data used to derive the factors [½]
 Are the factors actual observations, outputs from models, or a mix? [½]
 Can this data / proxy be sourced through own distribution channels. [½]

Do they meet the good qualities of a rating factor?
 Measurable / easy / practical to obtain and record [½]
 Objective / not subjective [½]
 Can be verified / non-manipulatable [½]
 Acceptable to market / policyholder / brokers [½]
 (maximum 1)

Do the factors discriminate (directly or indirectly) on any protected characteristics, [½]
 can they be used legally / are allowed by regulators. [½]
 Do we know if competitors are using the data. [½]
 How much systems development is required [½]
 can quotes be returned within required response times (e.g., on PCW). [½]
 How regularly is the data refreshed? [½]
 Which lines of business are they available for?
 How the introduction of these factors could impact renewing business [½]
 and whether some form of “smoothing” will be necessary. [½]
 Back up options if the data is temporarily unavailable [½]
 or mitigating actions if the third party stops supplying it altogether. [½]
 Reputation of the third party. [½]
 Expense of obtaining the new factors. [½]

[Marks available 8½, maximum 4]

[Total 10]

Part (i) was a knowledge-based question. Generally answered very well, with many fully correct answers.

Part (ii) A few candidates missed the fact this was about analysing new rating factors. Some gave great detail on only one or two analyses, rather than outlining a number of different analyses, which was expected.

Part (iii) Answers and success varied. Some candidates referred to statistical methods to show that the rating factors were predictive. This was already covered in (ii) so wouldn't receive marks again in this part. Better candidates were able to identify the more practical concerns regarding the third-party rating factors.

(Many answers to part (ii) were given in part (iii) and vice versa. Appropriate credit was given in these cases. However, each separate point can only score once.)

Q4

(i)

Considerations:

Which distribution is likely to have the best fit to the provided data.	[½]
What is the shape of the distribution / how skewed is the data?	[½]
What tail is likely to be needed?	[½]
Is there a maximum and/or minimum value?	[½]
Market practice i.e., common distributions used by other actuaries, competitors.	[½]
Distributions selected/rejected in previous analysis, if applicable.	[½]
What method to use for estimating the parameters e.g., MLE.	[½]
Limitations of the software used for fitting.	[½]
Expenses required to upgrade/purchase new software.	[½]
Complex distributions with more parameters need more judgement and better volume of data	[½]
and good quality of data.	[½]
Time constraints.	[½]
Purpose of analysis / level of accuracy required.	[½]
Time-series models / trends in data that need to be fitted.	[½]
Different distributions needed for attritional / large/cat and property damage/business interruption	[½]
and by occupation type / other rating factors.	[½]
Approval by the auditors/regulators.	[½]

[Marks available 9½, maximum 4]

(ii)

Use a statistical goodness of fit test.	[½]
<i>(maximum 1½ marks for naming tests, maximum 1 mark for explaining two tests)</i>	
Chi-squared test	[½]
Sampling distribution is a chi-squared distribution when the null hypothesis is true or the sampling distribution can be made to approximate a chi-squared distribution as closely as desired by making the sample size large enough.	[½]
Kolmogorov-Smirnov test	[½]
tests whether a one-dimensional sample comes from a specified probability distribution	[½]
quantifies a distance between the empirical distribution function of the sample and the cumulative distribution function of the reference distribution.	[½]
Anderson-Darling test	[½]
measures the distance between the empirical distribution function and the CDF of the reference distribution.	[½]
places more weight on differences in the tails of the distribution than the K-S.	[½]
Cramer-von Mises test.	[½]
Use a visual method to assess the fit.	[½]
<i>(maximum 1½ mark for examples)</i>	
E.g., CDF plot of the fitted distribution and the empirical distribution.	[½]
Or plot of the density function of the fitted distribution with the histogram of the empirical distribution.	[½]
Or a Q-Q plot of the empirical quantiles against the theoretical quantiles to emphasise the fit at the tail.	[½]

Or a P-P plot of the empirical distribution function at each data point against the fitted distribution to emphasise the fit at the centre. [½]
 Or use a tabular form of the data to check the fit by eye. [½]
 [Marks available 8½, maximum 4]

(iii)

Sources of parameter uncertainty:
 Since model is artificial representation of a real-life situation / parameters must be estimated from inherently variable data. [½]
 Fire losses are generally not that frequent [½]
 Data may not be enough - number of sites, number of years, etc. [½]
 Large fire losses are even more rare / lack of data in the tail. [½]
 Many possible catastrophe losses will not be in the data. [½]
 Lack of expertise in parameter fitting. [½]
 Estimation of IBNR/IBNER. [½]

Changes in:

Claims handling / case estimate philosophy. [½]
 Mix of business if not performed at the right granularity. [½]
 Fire claim inflation different to expected. [½]
 Changes in fire safety regulations. [½]
 Variation in legal rulings / precedent. [½]
 Property construction technology. [½]

With an inappropriate model (model uncertainty), there is further risk of parameter uncertainty. [½]
 Due to data uncertainty / poor or incomplete data / third party claim handlers / format of data. [½]

[Marks available 7½, maximum 3]

[Total 11]

Part (i) Most candidates did reasonably well. However, some candidates gave points that did not directly answer the question - for example, describing adjustments or checks to be made to the data - rather than focusing on the selection of the distribution.

Part (ii) Better prepared candidates considered two different approaches, namely statistical tests and visual methods, giving examples of each as asked. Many answers only gave examples of statistical tests, which limited their marks. Several candidates spent time describing these tests in much more detail than required, but limited credit was given for a (brief) description.

Part (iii) Most candidates scored well here. Better answers adapted the knowledge to the specific situation (commercial fire losses). Some answers focussed mainly on uncertainty around data, but a wider range of ideas was required to do well.

Q5

(i)

An interaction occurs, say between factors A and B, when the effect of factor A varies by each level of factor B. [1]

For example, in motor insurance, younger drivers are generally higher risk, however the magnitude of this difference is greater for more powerful cars. [1]

Alternatively, an interaction exists between two or more factors if the model is made better by including extra factors for each combination of the levels of the factors. [1]

[Marks available 3, maximum 2]

(ii)

May be a useful way of detecting errors in the data. [1/2]

E.g., if missing values for a factor are more prevalent in a particular year. [1/2]

Check if the trend / relativities are consistent over time (factor should be included). [1]

Check if the trend is inconsistent / changes every year [1/2]

factor should be excluded [1]

or data needs to be adjusted / excluding certain years / investigate. [1/2]

Detect trends in a factor that should be exploited. [1/2]

For example, if trend is getting steeper over time, you may want to use the factor prediction over the last couple of years as opposed to an average over a longer period which may dampen the effect of the factor as it is now. [1]

Choosing a calendar year (as opposed to other time periods) removes the effect of seasonality. [1/2]

Identify the impact of specific events e.g., Covid19 lockdowns, change in claims settlement procedures. [1/2]

[Marks available 6½, maximum 3]

(iii)

All calendar years suggest that frequency generally increases with age [1/2]

2019 is more like 2020; and 2021 is more like 2022. [1/2]

Frequency for 2020 is the lowest [1/2]

About half of 2019's frequency [1/2]

and has been increasing since 2020 (2021 > 2020 & 2022 > 2021) [1/2]

But frequencies for ages less than 45yrs still remains low in 2021/22 / frequencies for greater than 46 is nearly back to 2019 levels. [1/2]

The significant drop in 2020 frequency needs to be investigated [1/2]

Might be due to Covid-19 lockdowns (or other possible explanations) [1/2]

As people were at home more often and so there was a general reduction in thefts across all ages [1/2]

Claim frequency remained lower for younger age groups (<45) due to larger proportions working from home. [1/2]

The factor doesn't seem to be consistent, might have to exclude some years [1/2]

The actuary will have to decide which trend is going to be most appropriate in the future. [1/2]

i.e., will younger age groups continue to work from home and therefore experience fewer thefts. [1/2]

Business mix has remained consistent over time / similar exposure in each age group [1/2]

Exposure levels for <=25 and >75 are very low [1/2]

Therefore, less credibility / confidence in the frequency for these ages and how they compare year on year. [1/2]

[Marks available 8, maximum 3]

(iv)

A holdout sample should be used which neither model should have been built on.	[½]
The sample should be large enough to produce credible results.	[½]
Obtain predicted frequencies from the model for each record in the sample.	[½]
Rank in ascending order.	[½]
Divide into 10 groups of equal exposure based on this ranking.	[½]
For each group determine the average actual claims frequency.	[½]
Plot this for each group.	[½]
Repeat with the other model.	[½]

[Marks available 4, maximum 3]

[Total 11]

Part (i) Most candidates scored at least 1 mark. However, some explanations were too unclear or vague to score. Some answers suggested confusion between interaction and correlation, but most did well.

Part (ii) Some candidates did not appear to understand the analysis being undertaken - for example, discussing “parameters” rather than factors or commenting on interactions with other factors (not with calendar year). The best answers made clear that they were considering how trend or relativities of each factor varied over time and went on to suggest actions to be taken if these do vary over time.

Part (iii) Generally well answered, with a wide range of mostly valid comments. However, some answers discussed in detail the effect of age on theft rates, rather than the interaction of age and calendar year as asked. There were a number of noticeable ‘careless errors’, such as referring to the wrong years. However, a pleasing number of candidates suggested valid possibilities for the interactions seen, such as the impact of the Covid pandemic in 2020 and thereafter.

Part (iv) Most candidates scored well on this knowledge-based part. Candidates described the steps correctly, but in some cases not precisely enough to score full marks - for example, some answers did not make clear that actual claim frequency is being plotted for each group. Some answers implied that the same ranking applied to both models, rather than making clear that the whole exercise is repeated for each model.

Q6

(Max 3 marks for each reinsurance type)

Common adv/dis-adv for all types: (to be awarded marks only once)

Advantages:

Reduces capital requirement / improves solvency ratio / efficient use of capital [½]

Which allows the cedant to write more business and improve diversification / spread risk.	[1/2]
Reinsurer may share expertise.	[1/2]
Disadvantages:	
Requirement to cede premium / profit to reinsurer.	[1/2]
There is an additional risk of default.	[1/2]
Quota Share advantages:	
Allows the insurer to write more business / move from a medium-sized portfolio to a large one	[1/2]
gaining due to economies of scale and diversification.	[1/2]
Could spread risk via a reciprocal quota share arrangement, e.g., with another insurer insuring construction projects in a different geographical area.	[1/2]
It is administratively simple to implement compared to other RI types.	[1/2]
The reinsurance commission may help with the cash flow.	[1/2]
Quota Share disadvantages:	
It cedes the same proportion of small and large projects.	[1/2]
and low-variance and high-variance risks	[1/2]
but construction projects are likely to have a wide range in terms of sum insured and complexity.	[1/2]
hence, doesn't directly reduce volatility of the portfolio.	[1/2]
Surplus advantages:	
Useful for this class where there can be a huge variation in the size of construction projects.	[1/2]
Surplus reinsurance allows the insurer to insure larger projects which might otherwise be outside its capacity.	[1/2]
The insurer may cede a higher proportion of large projects and retain more of small projects / fine tune exposure	[1/2]
write business to meet risk appetite.	[1/2]
Or to remove concentration to certain types of projects e.g., shopping centres to gain a more diversified exposure to various construction types.	[1/2]
Overall less premium/profit is ceded (compared to Quota Share)	[1/2]
while maintaining a similar overall level of risk.	[1/2]
The commission may help with the cashflow (same as Quota Share).	[1/2]
If the surplus treaty is facultative-obligatory, it allows the cedant to choose which risks to cede.	[1/2]
Surplus disadvantages:	
Surplus contracts are administratively complicated compared to QS.	[1/2]
May need additional cover for risks outside the terms of the surplus.	[1/2]
The insurer is not well protected against large claims from smaller projects.	[1/2]
It passes a share of the profit to the reinsurer (though it's smaller than QS)	[1/2]
the terms offered may be less favourable than quota share due to the risk to the reinsurer or being selected against.	[1/2]
If the surplus treaty is facultative-obligatory, there is a risk that the insurer may forget to insure a large risk.	[1/2]

Risk Excess of Loss advantages:

Allows insurer to accept larger projects that could lead to large claims	[½]
but cedant is protected even from large claims from smaller projects.	[½]
It stabilises technical results of the insurer by reducing claims fluctuation	[½]
and reduces risk of insolvency from a large claim.	[½]
It is administratively more simple than surplus reinsurance.	[½]

Risk Excess of Loss disadvantages:

The premium charged by reinsurers might be high as compared to the expected recoveries in the long run.	[½]
And the insurer is still exposed to the risk of claims falling outside the terms of the XoL	[½]
either above the exit point or once any reinstatements have exhausted.	[½]
Since construction projects are long-term and risk excess of loss is often based on losses occurring during, there could be a mismatch between when the risk is written, and reinsurance cover is purchased.	[1]

Stop Loss advantages:

It protects against poor claim performance due to any reason	[½]
hence capping the downside from aggregation of small or large claims	[½]
this is particularly useful since it's a medium sized portfolio	[½]
and subject to potential large claim variations.	[½]

Stop Loss disadvantages:

It doesn't provide protection for single large claims which don't trigger the aggregate.	[½]
The insurer is still exposed to losses beyond the upper limit.	[½]
Such coverage may not be available	[½]
or might be too expensive.	[½]
There could be a mismatch between the coverage period and the underlying portfolio if purchased on a Loss Occurring basis.	[½]

[Marks available 24, maximum 12]

[Total 12]

Well attempted by nearly all candidates, and usually in a good structure. Many answers were tailored to the specifics in the question, and this appeared to help in generating relevant points. The main reason for not doing well seemed to be lack of points (especially for Risk XoL and Stop Loss), suggesting that not enough time was allocated to this question. General advantages and disadvantages common to all reinsurance types were only awarded once.

Q7

(i)

Perils: (Capped at 3 marks)

Fire	[½]
Explosion	[½]
Lightning	[½]

Earthquake	[½]
Tsunami	[½]
Storm / cyclone / hurricane	[½]
Tornado	[½]
Flood	[½]
Volcanic eruption	[½]
Accidental damage / impact	[½]
Malicious damage	[½]
Theft	[½]
Power surge / electric malfunction	[½]
Other malfunction causing system / machinery breakdown	[½]
Subsidence	[½]
Terrorism/War	[½]

Benefits:

Indemnity equivalent to cost of restoring to previous condition subject to excess and deductibles.	[½]
Damage due to fighting a fire (e.g., sprinklers) is also covered.	[½]
Business interruption caused due to damaged property.	[½]
Cost of repairing system / plant / machinery if it breaks down and loss of production due to such breakdown.	[½]

[Marks available 11, maximum 5]

(ii)

Sum Insured / value of plant	[½]
split between building / machinery / contents	[½]
BI sum insured / revenue / turnover / number of employees	[½]
PML, MFL values	[½]
Type of plant - solar, wind, coal, etc.	[½]
Technology employed e.g., large turbine or multiple small turbines.	[½]
Power generation capacity	[½]
Hazardous material	[½]
Number of plants covered	[½]
Size of plant / area covered	[½]
Expected changes in size/capacity e.g., any upgrades planned	[½]
Age of plant	[½]
Location for each plant	[½]
Other details - type of construction, no. of floors, soil type, etc.	[½]
Limit/Excess	[½]
Exclusions / Level of cover e.g., business interruption	[½]
Risk Mitigation procedures in place - e.g., sprinklers	[½]
Previous Loss Experience	[½]
Policy term	[½]

[Marks available 9½, maximum 4]

(iii)

A captive could insure the risks for which insurance is not available	[½]
By retaining some of the primary risk in the captive, Company P might be able to find insurers willing to insure the remaining coverage and/or tailor the risks being passed on the insurance market	[1] [½]

If the Company P has many coal plants, the risks could be pooled	[½]
hence reducing volatility and making the portfolio more insurable	[½]
Some captives could insure external risks to make the pool larger e.g. coal plants of other energy companies	[½]
The captive will gain access to the reinsurance market	[1]
who might have additional capacity	[½]
Based on its domicile, the captive might also gain access to (re)insurance companies in regions outside Country X	[1]
Better focus on risk management based on the claims seen through the captive	[½]
which makes it easier to get coverage	[½]

[Marks available 7, maximum 4]

[Total 13]

Part (i) Nearly all candidates scored the 3 marks for 'perils. Answers varied for 'benefits'; some answers included benefits that were not related to 'property damage' and so did not score.

Part (ii) This question was very well answered, with most candidates scoring full marks.

Part (iii) was more challenging, and success varied. Many knowledge-based answers were seen, giving benefits of captives in general, many of which did not score here. The points that scored related to how the captive would obtain 'adequate insurance coverage'. Only better prepared candidates tailored their answers accordingly, but those that did so scored well.

Q8

(i)

Statement might not be true because:

Initial premium is likely to be higher with more reinstatements because the coverage is more	[1]
particularly if reinstatements are free	[½]
or less than 100% of initial premium	[½]
because the reinstatement premiums will not be enough to cover the additional risk of multiple losses	[½]

Statement might be true because:

If there are full reinstatement premiums to be paid, then the initial premium with multiple reinstatements can be lower	[½]
because the expected additional reinstatement premiums can outweigh the higher expected losses	[1]

Other comments:

The impact will be driven by the frequency / probability of multiple losses	[½]
if multiple losses are expected, the initial premium for multiple reinstatements could be significantly higher	[½]

e.g., in a working layer [½]
 If the probability of multiple losses is small, the initial premium may be quite similar
 (on the two policies) [½]
 There could be other factors that cause premium to be higher/lower e.g. broker/RI
 relationship [½]
 [Marks available 6½, maximum 3]

(ii)
 Considerations:
 The terms of the RPP cover [½]
 E.g., how many reinstatements does the RPP cover? [½]
 which XoL layers of the program can be covered [½]
 term of the contract [½]
 alignment with the XoL - coverage territories, exclusions, period of cover. [½]
 Past experience of losses hitting the XoL policy [½]
 and paying reinstatement [½]
 and the cedant's expectations regarding future losses [½]
 How much is the RPP premium [½]
 and compare it to the (expected) reinstatements. [½]
 Is an alternative XoL policy available with free reinstatements? [½]
 will such XoL policy be better value than purchasing the RPP [½]
 The insurer will remove its financial interest in losses ceded to the reinsurance
 layer / stabilizing of results [½]
 Consider liquidity issues [½]
 if RPP is purchased, the insurer does not have to pay for the reinstatement premium
 at the same time as losses from an event [½]
 Consider increase in reinsurer counterparty risk [½]
 will depend on strength / credit rating of the RPP reinsurer [½]
 Impact on capital requirement [½]
 compare the total impact based on reduced outflow (reinstatements) and additional
 reinsurance counterparty risk [½]
 and calculate savings in cost of capital vs the RPP premiums [½]
 Risk appetite of the company [½]
 current solvency ratio / free reserves [½]
 Acceptable to the regulator? [½]
 Are other alternatives to this cover available e.g., Group if part of a larger company [½]
 [Marks available 12, maximum 6]

(iii)
 Approach:
 Obtain historical loss data from the cedant [½]
 including details of reinsurance treaties and terms previously in place [½]
 There should be a minimum number of years of history [½]
 this should include losses regardless of whether reinstatements are covered or not,
 and FGU losses [½]
 Project frequency and severity separately [½]
 using standard actuarial methods / fitting distributions [½]
 accounting for trends [½]
 using simulation / stochastic methods [½]
 split large / cat losses and model separately [½]

Allow for IBNR / IBNER / IBNYR	[½]
Adjust for: (<i>Capped at 1 mark</i>)	
Inflation	[½]
Change in exposure	[½]
Change in underlying business mix.	[½]
Calculate expected losses to the XoL policy by combining frequency and severity	[½]
calculate the RPP risk premium	[½]
by mimicking the RPP structure and predicting the reinstatements / payouts under the contract	[1]
adjust if the policy has a limit on the number of reinstatements.	[½]
Load the calculated RPP risk premium for profit, commission, expenses, etc.	[½]
	[Marks available 9½, maximum 5]
	[Total 14]

Part (i) This part appeared challenging for most candidates. Those that performed best thought widely and considered different possible levels of reinstatement premiums (e.g., full or free) and explained how each would affect the initial premium. Some answers failed to recognise that the policies were 'similar' and so gave lots of possible differences between the two policies.

Part (ii) Wide range of answers. Many candidates appeared to understand the product, with most answers scoring at least a few marks. The better answers considered a wide range of different considerations.

Part (iii) Generally well answered, with several scripts scoring full marks. Most candidates showed a good knowledge of using a frequency-severity approach and attempted to adapt this to the RPP product. The main reason for not doing well seemed to be mentioning only generic points, which would score limited marks.

Q9

(i)

New business volume:

Summarise and monitor the number of new policies and total premiums [½]

and compare against business plan / assumed increase due to marketing. [½]

New business may also grow because of lower prices, higher competitor premiums, etc. [½]

actuary will need to be able to split out the impact purely as a result of the campaign [½]

New business rate:

Number of new policies issued compared to number of renewals invited in the month (or other relevant exposure base) [½]

will allow us to screen out the effect of seasonal variation in the volumes of new business to see the effect of marketing campaign more clearly [½]

could do a projection by month of notification to allow for delays, e.g. in receiving data from intermediaries	[1/2]
Quote volumes:	
Monitor the change in number of quotes generated in a given period	[1/2]
Successful marketing campaign is likely to lead to increased quote volumes	[1/2]
Need to be careful about how multiple/duplicate quotes for the same customer are counted	[1/2]
Quote information may not always be available, depending on what point in the quote journey the customer abandons the quote	[1/2]
Strike rates / Conversion rates / Not taken up rate:	
Defined as the number of written policies divided by the number of quoted policies in a given period (can be adjusted for declinatures)	[1/2]
The marketing campaign may or may not cause an increase in strike rates though a constant strike rate along with increased quote volumes would mean higher new business volume	[1/2]
Renewal rates (or lapses at renewal):	
Defined as the number of renewals divided by the number of expiring policies in a given period (although this can be adjusted for cancellations)	[1/2]
Must allow for time lag between the renewal date and point at which it becomes apparent that a policy has lapsed	[1/2]
could estimate this lag from recent past experience, though this may not be valid anymore	[1/2]
if there are processing delays, we can estimate ultimate number of renewals / lapses using standard chain ladder techniques	[1/2]
If the marketing campaign targets existing customers, higher renewal rates might be seen (and lower lapses at renewal)	[1/2]
The actuary might also specifically review the renewal rates for the increased customers following the marketing campaign	[1/2]
a low renewal rate would mean that new customers are growing but not staying very long with the insurer	[1/2]
maybe taking advantage of the financial discounts that may have been offered on inception	[1/2]
as with new business renewal rates may vary for reasons other than the marketing campaign, e.g. rating action, competition, etc.	[1/2]
Mid-term cancellations:	
Generally, don't expect much impact to mid-term cancellation rates although the actuary might monitor cancellations during the 'cooling-off period' (e.g., within 14 days of inception)	[1/2]
The actuary could report statistics by period - monthly, quarterly or annually.	[1/2]
Loss Ratios:	
Loss ratios assessed for the overall portfolio or for just the new business	[1/2]
to confirm whether marketing campaign is bringing profitable business	[1/2]
though it may take time for impact on the loss ratios to become obvious	[1/2]
Similarly, the insurer might want to measure new business in terms of Customer Lifetime Value (CLV)	[1/2]

Marketing metrics:

customer metrics on company perception (NPS)	[½]
market sales comparisons or market share reports	[½]
website statistics: Number of visits, page views, time on site, point of quote abandonment, etc.	[½]
If the marketing is done online (e.g., Google ads), it may be possible to directly track the new quotes, new business rates, etc. that are coming in due to the marketing efforts	[1]

Marketing Expenses:

Monitor the costs of the marketing campaign	[½]
and how these compare with other metrics to assess its success, e.g., measure cost of acquiring each new customer (cost-per-acquisition)	[½]

All of the metrics can be broken down further to see the impact on particular:

(½ mark for each breakup, maximum 1)

Line of business	[½]
Territory	[½]
Distribution channel	[½]
Demographics	[½]
Business mix, etc.	[½]
to show the impact on each of these parts of the portfolio	[½]

[Marks available 22½, maximum 8]

(ii)

There are several reasons why this might not hold true:

Variable cost increases in line with volume so the profit margin doesn't increase with a larger portfolio	[1]
e.g., claims handling expenses	[½]
Fixed costs increase in steps. As volume grows, there might need for additional fixed investment which increases the overall cost per policy	[1]
e.g., more staff, requiring a larger office, investment in better actuarial software, etc.	[½]
A larger company/portfolio sometimes must follow additional regulatory requirements	[½]
e.g., simplified capital calculations may not be applicable above a certain premium volume	[½]
If growth involves moving into new territories, separate product lines and compliance units may be needed, adding to costs	[½]
Higher number of staff and complexities in the business could lead to diseconomies	[½]
there could be duplication of effort	[½]
increased staff communication costs	[½]
Larger portfolios could be administratively more difficult to manage	[½]
so we may not be able to monitor profitability for each segment very closely	[½]
New business is often acquired at lower profits or even losses	[½]
due to lower premiums, discounts, undercutting competition, lenient policy wordings, etc.	[½]
and acquisition cost could be high, e.g., due to higher commissions	[½]
The portfolio may have also grown due to mergers & acquisitions	[½]

in which case there may be many inefficiencies due to the corporate structures and systems	[½]
New customers may not be loyal and lead to fewer renewals, which could mean a higher expense ratio overall	[½]
Growth in the unprofitable (or less profitable) segments of the portfolio could reduce overall profit margins	[1]
An increase in business volume could lead to reduced free capital, hence lower investment return	[½]
or additional expenses in raising capital	[½]
or spending on risk mitigation. e.g., reinsurance costs	[½]
Larger portfolios could also reduce diversification benefits, hence increasing capital costs	[½]
e.g., if motor business is a higher proportion of the portfolio, it could lead to a higher capital cost as the other lines are not large enough to provide diversification	[½]
If growth is not carefully planned, it can dilute a brand and reputation	[½]
which causes reduction in customer loyalty or higher business acquisition expenses.	[½]
Claims are volatile - profitability might reduce even if more profitable business is written (results may not be visible immediately).	[½]

[Marks available 15, maximum 7]

[Total 15]

Part (i) Answers varied. Most candidates considered the key metrics, but only well-prepared candidates discussed these in sufficient detail. Some good answers discussed a wide range of different metrics in good detail and connected their answer to how the metrics could be used to understand the impact of the marketing campaign. Many answers suggested how these could be broken down (e.g., by line of business or by month), which fetched additional marks.

Part (ii) Generally not very well attempted, but most got a few points. Many answers spent time explaining why the statement is true, which was not asked for. A few points were too brief or not clear enough to be understood, and hence could not score. The better answers considered a wide range of different reasons.

[Paper Total 100]

END OF EXAMINERS' REPORT



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