



Institute
and Faculty
of Actuaries

EXAMINERS' REPORT

SP7 - General Insurance Reserving and Capital Modelling Specialist Principles

April 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
July 2023

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

The aim of this General Insurance Reserving and Capital Modelling Specialist Principles subject is to instil in successful candidates the ability to apply, in simple reserving and capital modelling situations, the mathematical techniques and the principles of actuarial planning and control needed for the sound financial operation of general insurers.

Candidates who pass the exam are expected to analyse hypothetical situations, within the context of general insurance, including using judgement to assess the implications of possible actions and to develop appropriate proposals or recommendations relating to reserving and capital modelling.

Candidates who are well prepared generally appear to perform reasonably well on SP7, although a number of candidates do not appear to be adequately prepared and are unable to generate sufficient distinct points in their answers or show low exam technique.

Candidates are reminded to carefully read questions to understand the specific scenarios given in the questions and tailor their answers accordingly, rather than relying on pre-prepared lists of generic points, which may not be applicable in certain scenarios.

Calculation questions will come up on a regular basis within SP7 papers. Candidates should always be prepared for such staples as balance sheet preparation, triangle manipulations and projections and reinsurance layer calculations (along with being able to carry out any necessary adjustments including inflation, exposure, earning distortion and time period issues). All workings and rationale should be clearly shown to allow credit to be given for workings even where the figures are incorrect.

Candidates should expect the examiners to set questions from all parts of the syllabus with a view to test as wide as possible a range of skills and, in particular, to achieve a fair balance between capital and reserving, including reinsurance. It is important to note that the questions are designed to be able to test how candidates can apply these concepts in a given scenario.

The depth and breadth of an answer needs to be in line with the command verb and marks allocated to the question.

While the marking schedule is discussed extensively to cover as many points as possible, 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.*

The paper was generally well attempted except for Question 6 (iii) and Question 8. Candidates particularly scored low in Question 8, which was a numerical question requiring discounted reserves and risk margin to be calculated, which are commonly used calculations in actuarial work. However, the responses suggested a limited ability to perform the calculations even though the candidates appeared to understand the concepts well. Question 6 tested the candidates' ability to demonstrate an understanding of the differences in capital requirement for companies with different risk profiles, and

candidates did not perform well in part (iii) of the question, which was a higher order question.

Responses to knowledge-based questions were generally good. Questions that tested application and higher order skills proved more challenging, and candidate responses to these questions often lacked the breadth and the detailed understanding needed to score well. A common theme that came through was candidates not being able to generate sufficient distinct points relevant to the specific information or situation given in the question.

The comments that follow the questions concentrate on areas where candidates could have improved their performance. Candidates are advised to include these areas in their revision.

C. Pass Mark

The Pass Mark for this exam was 59
342 presented themselves and 146 passed.

Solutions for Subject SP7 - April 2023

Q1

General points:

- The insurance companies and policyholders will be impacted depending upon what the nature of the regulations issued by the statutory regulatory body is going to be [1/2]
- GWP may not necessarily be the best measure to do this split for regulation purposes [1/2]
- E.g. higher GWP may not necessarily mean higher NWP [1/2]
- Higher GWP may not necessarily mean a higher number of policies being issued and the impact on the policyholders in the general population might not be as high (e.g. commercial insurers with large ticket size policies) [1/2]
- Run off companies will not have any GWP [1/2]
- Depending upon what the distribution of GWP of the insurance players in the market is, the median GWP may not necessarily be the best measure to divide the market players [1/2]

Advantages for insurance companies:

- There will be a more level-playing field for the insurance companies below the median GWP threshold as the regulations will be set consistently by an authority with no vested interest [1/2]
- The regulatory body will be able to provide a better representation for the smaller players [1/2]
- The regulatory body might come up with regulations which protects the interests of the smaller players better than the current arrangement [1/2]
- For the insurance companies above the median GWP threshold they could continue to have rules that suit them the best [1/2]
- E.g. due to the economies of scale they have, they should be regulated differently and there will be no additional compliance cost for them due to the new regime [1/2]
- Having independent oversight will make them better managed (for the small ones) [1/2]
- Increased confidence in the system leading to more business opportunities [1/2]
- Any other suitable advantages for insurance companies (*1/2 mark each*) [1]

Disadvantages for the insurance companies:

- The large insurance companies are not subject to the same regulations as the smaller ones, and might continue to have unfair advantage over the smaller ones [1/2]
- Might be further disadvantaged if the onerous regulations are applied to the smaller players [1/2]
- Additional compliance costs for the companies below the median GWP threshold which is likely to further affect the smaller companies that might already be constrained financially [1/2]
- If insurance companies move between the two regimes due to the year-on-year increase/decrease in the GWP, it might make it operationally quite onerous for them [1/2]
- Loss of business opportunities that arise from such statutory restrictions [1/2]
- Any other suitable disadvantages for insurance companies [1]

Advantages for Policyholders:

- Quite likely that the new statutory regulations could be better at keeping the

policyholder interests in mind, e.g.:	[½]
Higher security	[½]
Better policy coverage	[½]
Better T&Cs	[½]
meaning the regulation provide more confidence in the insurance industry to the policyholders of the smaller insurance companies	[½]
The insurance companies, being self-regulated in the past, might have engaged in anti-competitive practices to the disadvantage of the policyholders	[½]
which might improve with a segment of insurance companies regulated by a statutory body	[½]
The smaller insurance companies might be able to price their products more competitively with the support of the regulator	[½]
This might allow them to provide better choice of products to the policyholders (e.g. mandatory covers)	[½]
Any other suitable advantages for policyholders (<i>½ mark each</i>)	[1]
Disadvantages for Policyholders	
The cost of regulation might mean that insurance becomes more expensive	[½]
Those policyholders serviced by the large companies may continue to suffer from the previous unfair practices	[½]
Possible that the larger insurance companies may cover a large proportion of the policyholders	[½]
Any new regulations will affect the policyholders only for the insurance companies below the median GWP thresholds	[½]
which may put them at a disadvantage compared to if they had a policy with the larger insurers	[½]
There might be less innovation in the industry with increased regulation for the smaller players	[½]
Restrictions on the small companies could result in them pulling out of the market meaning less coverage available	[½]
or may disincentivise new players to set up insurance companies	[½]
Any other suitable disadvantages for policyholders (<i>½ mark each</i>)	[1]
	[Marks available 22, maximum 8]

Overall this question was generally well answered. Those who did not score highly did not generate enough distinct points from the perspectives of the two stakeholders, while good answers brought up a broad set of considerations from the government's proposed decision.

Q2

(i)

(Assume IBNR includes both pure IBNR and IBNER on the reported claims (based on the core reading)

Most actuarial techniques depend upon stable loss development data, and the introduction of the new claims settlement is going to affect it [½]

The new claims settlement process may attract a different mix of customers (e.g. more younger policyholders) [½]

The impact on the process will also depend upon what the criteria for selecting the 90% claims are	[1/2]
Overall impact on IBNR reserves will vary by the product's claim reporting and settlement delays	[1/2]
e.g. the impact on IBNR estimation will be different depending upon whether it is own damage, third party property damage or third party liability product	[1/2]
It is unlikely that all claim types will be able to be settled automatically using the ML technology	[1/2]
e.g. bodily injury liability claims	[1/2]
likewise for the claims above the median value, it is unlikely to have any impact on the IBNR estimation	[1/2]
the insurer is likely to split the loss triangles between losses below the median value and those above the median value	[1/2]
Splitting the data will result in an increase in the volatility in triangles	[1/2]
which is likely to affect the IBNR estimation	[1/2]
If a large part of the IBNR comes from claims with values larger than the median value of the claims, there might be limited impact on the IBNR reserves	[1/2]
e.g. liability claims might still have the similar estimate for IBNR	[1/2]
For the claims below the median value, it is likely to result in faster claim notifications as the insured might report claims quicker if settlement is promised within 12 hours	[1/2]
Likely to lead to shorter settlement delays from the use of ML approaches to automate and review claims	[1/2]
which will change the loss development factors being used in the standard actuarial techniques	[1/2]
and 90% of the claims will be settled within 12 hours resulting in no OS, and hence no IBNER	[1/2]
This should reduce the IBNR	[1/2]
However, it is possible that the insured are not happy with the settlement amount arrived at by the ML technology	[1/2]
Might not agree with the claims that are rejected by the new technology	[1/2]
Different mix of rejections and disputes since predefined claims would need to be in line with a prescribed submission.	[1/2]
Resulting in more litigation and re-opened claims compared to the current situation	[1/2]
All of which could affect the LDF patterns, and result in a higher IBNR	[1/2]
Likely to follow the existing reserving process for the claims already reported, so might have to split the data accordingly	[1/2]
The remaining 10% of the claims which are not settled automatically might partially offset the reduction in the IBNR for the remaining 90%	[1/2]
Higher fraud risk depending on quality of data and underwriting controls, and ability of advanced fraud detection mechanisms	[1/2]
e.g. photos can be falsified and an error in the claim assessment made	[1/2]
increasing uncertainties requiring more IBNR	[1/2]
equally ML might be able detect fraud activity better and reduce fraud risk, resulting in lower IBNR	[1/2]
Systematic delays arising out of complexities from errors in the ML code	[1/2]
especially in the earlier versions of the ML algorithm while it is still calibrating	[1/2]
This can extend the tail in the reported claims	[1/2]
likely resulting in a higher IBNR	[1/2]
Iterative nature of the ML algorithm could result in an improvement over time	[1/2]

Marks available for other sensible comments (<i>1/2 mark each</i>)	[1]
	[Marks available 18, maximum 7]
 (ii)	
Operational risk should increase, at least initially	[1/2]
There is higher technological risk	[1/2]
due to an increased reliance on the IT systems and ML algorithm to work well	[1/2]
Increased cyber risk	[1/2]
Risk when the program or coding has a systematic error that causes losses or results in legal liability.	[1/2]
Administration risk from the old manual claims processes should reduce	[1/2]
due to reduced human involvement on the relatively smaller and standard claims.	[1/2]
hence lower chances of manual errors	[1/2]
Possible reliance on third parties for providing the ML algorithm, and there are delays or unexpected costs from these suppliers	[1/2]
for example, the server shutdown or cyber attack of a vendor will disrupt the insurer's claims process	[1/2]
Lower risk of internal fraud	[1/2]
Increased compliance risk relating to AI ethics or personal data protection issues which may unknowingly get triggered	[1/2]
risk of not adhering to the extant regulatory guidelines on use of ML technology	[1/2]
Increased governance risk if the senior management doesn't have sufficient understanding of the new ML algorithm, resulting in incorrect decision making	[1/2]
Marks available for other sensible comments (<i>1/2 mark each</i>)	[1]
	[Marks available 8, maximum 3]
	[Total 10]

The majority of candidates did not score well on part (i) as they did not generate sufficiently distinct points with a range of considerations. Good answers gave points on the attritional smaller claims being affected, addressed the larger/liability claims that would not be affected, and issues from applying the median threshold.

Part (ii) was answered better overall with well-prepared candidates covering the different elements of operational risk.

Q3

 (i)	
Members (also called Names) conduct business at Lloyd's	[1/2]
Members accept the liability for (and profits from) the risks underwritten in their name	[1]
Liabilities or profits from that year's insurance activities are allocated to the members proportion to their agreed participation at the start of the year	[1/2]
and on a 'several' basis, which means that members are not liable for any other member's liabilities	[1/2]
Nowadays the majority of the members (measured by premium volume) are companies (corporate members) rather than private individuals	[1/2]

Private members may have unlimited or limited liability, no new unlimited liability members are admitted	[½]
Corporate members have limited liability and must be a separate legal entity to the managing agent, although they are often owned by the same insurance group	[½]
Marks available for other sensible comments (<i>½ mark each</i>)	[1]
	[Marks available 5, maximum 3]

(ii)

It might be the right decision to not participate in those syndicates as they have been loss making on average	[½]
Syndicates B and D have a CR of 100% or over, but have had improved CRs in the most recent year	[½]
Which may mean that they may provide higher profitability in the future	[½]
Syndicate B is the least volatile and therefore may not reduce the volatility of the arrangement if removed	[½]
Syndicate D has the highest volatility of results and removing it might reduce volatility, which is what the shareholders want	[½]
The volatility in Syndicate D may actually be a trend resulting in higher CRs for 2019 and 2020, as it has reduced in 2021	[½]
Average CR will be affected by extreme values, and may not necessarily be the best metric to base this decision on	[½]
Especially since the objective of the shareholders is to reduce volatility	[½]
The impact of reinsurance on the movement in combined ratios should also be considered	[½]
CR does not capture investment return which when included could show that syndicates B and D are profitable	[½]
Should also consider where in the underwriting cycle the market currently is as this is likely to have a bearing on the profitability of the Syndicates	[½]
We are only seeing the current split of the participation in the four Syndicates, the past split should also be considered while deciding upon it	[½]
Depending upon the business the Syndicates write, 5 years of history may not be enough	[½]
Should also consider that if they pull out, they might not be able to replace it with something better	[½]
Should also consider the type of business each of the Syndicates write, and how it fits with Company Q's risk appetite/guidelines	[½]
could result in loss of diversification benefit	[½]
The more recent underwriting years are unlikely to be fully developed yet depending upon the tail of the business	[½]
So the ULRs may not necessarily be what they are projected to be	[½]
The management should also consider the different components underlying the CR before deciding	[½]
e.g. the volatility could be driven by one-off expenses	[½]
Marks available for other sensible comments (<i>½ mark each</i>)	[1]
	[Marks available 11½, maximum 3]

(iii)

Company Q should consider the projected financial results for the future years for each of the syndicates	[½]
e.g. 3-year business plan with projected CRs and investment income	[½]

Any remedial actions taken going forward to address previous declining results	[½]
Should also consider how much volatility does the Lloyd's business contributes to Company Q's overall book of business	[½]
As reducing the overall participation then a different set of Syndicates may help with the situation	[½]
Will need to consider the opportunity cost of reducing the participation	[½]
What proportion of the Combined Ratio is comprised of IBNR and how much prudence is built into the 2021 and prior CRs	[½]
They could consider scaling back on less volatile Syndicates and participate more on less volatile syndicates in general, e.g. Syndicates B and C but there will likely be less scope for high profits	[½]
When considering syndicates they should attempt to avoid or monitor accumulation of risk	[½]
e.g. some syndicates might also write the same risks as Company Q and this would limit the diversification and volatility reducing benefits of the Lloyd's participation	[½]
Consider if there are any statutory requirement which restricts such participation into the future	[½]
Should also account for the future strategy of Company Q, and how the participation aligns to this strategy	[½]
Risk appetite of the Company Q's shareholders	[½]
They should keep up to date with any emerging trends, such as	[½]
Latent claims	[½]
Increasing social inflation which may impact Lloyd's results in the future	[½]
Consider impact and extent of reinsurance cover for each Syndicate	[½]
Consider the costs to Company Q involved in arranging the participations	[½]
Marks available for other sensible comments (<i>½ mark each</i>)	[1]
<i>(Part (ii) and (iii) could lead to similar points being generated, hence allow marks for relevant points made either in part (ii) and (iii), ensuring the same point is not marked twice)</i>	

[Marks available 10, maximum 4]

[Total 10]

Overall this questions was well answered, especially for parts (i) and (ii).

Some candidates answered the question thinking Company Q was directly involved in the underwriting of risks at Lloyd's, which wasn't the case. Candidates were not awarded marks for giving generic answers not related to the question. Good candidates were able to generate a wide range of answers around the observed past and possible future profitability trends, the opportunity cost, risk appetite and diversification.

Q4

(i)

Infectious diseases were not earlier included in the coverage provided by Company M, so these may not necessarily be covered by the existing reinsurance program [½]

The loss experience from infectious diseases could be quite different to the existing

PA cover	[1/2]
Company M may, on its own, expose itself to unwanted insurance risk in the absence of adequate reinsurance cover	[1/2]
The extension, therefore, is likely to change the reinsurance coverage requirements	[1/2]
Hence requiring a review of the design and adequacy of the existing RI arrangements	[1/2]
The reinsurer could have experience with writing such policies for other cedants and might have a good view on what reinsurance coverage is required for the extended PA cover	[1/2]
With regards to adequacy of reinsurance arrangements, it can help Company M with providing clarity on the extent of coverage the current reinsurance program provides what it does or does not cover	[1/2]
Pricing assumptions such as frequencies and loss ratios for the infectious diseases	[1/2]
Support on policy wordings, exclusions, underwriting terms and conditions with a view to obtain adequate reinsurance	[1/2]
Expert advice on claims management and potential disputes	[1/2]
Reserving assumptions and methodology	[1/2]
The reinsurer might be able to suggest some bespoke reinsurance arrangement which might help reduce the new business strain for Company M	[1/2]
There could be a regulatory requirement to approval from the reinsurer when writing infectious disease cover	[1/2]
Marks available for other sensible comments (<i>1/2 mark each</i>)	[1]
	[Marks available 8, maximum 4]

(ii)

Confirming that the infectious disease is indeed covered by the extended PA coverage	[1/2]
Consider whether the government makes it compulsory for insurers to provide the cover and the claims will not be paid for by an industry pool	[1/2]
There might be specific industry requirements or regulatory requirements specific to this pandemic to adopt	[1/2]
Adopting a certain level of prudence	[1/2]
Compliance on reporting and disclosures to be made to the regulator	[1/2]
Requirement to honour and pay out the benefits in the event of disputes or where coverages are unclear	[1/2]
Extent of recoveries that will be provided by the reinsurer depending on the reinsurance arrangement agreed	[1/2]
Since it has been only a month since the pandemic started, there is likely to be significant uncertainty around both the incidence of claims and the cost of such claims	[1/2]
The incubation period of the disease might not be fully known	[1/2]
Benchmarks from other countries or from reinsurance providers could be considered while setting up the IBNR	[1/2]
requiring adjustments as per the situation for Company M	[1/2]
Benchmarks might still be unreliable due to limited pandemic events	[1/2]
As the event might still be developing so an exposure-based approach based on the total policies in-force and could be a sensible approach	[1/2]
This would involve finding out the aggregated total limits and number of policies for the exposures and calculating the expected loss amount	[1/2]

Consider accumulations from any specific infection cluster and hot spots	[½]
Alternatively a frequency-severity approach could be used	[½]
Since it is a fixed benefit cover, the maximum loss amount is known.	[½]
Establishing the frequency can be challenging.	[½]
Leverage on any past similar events to estimate the IBNR reserves.	[½]
Since it is a global pandemic, the company might be able to factor in any observed trends from other countries	[½]
Reporting lags could increase due to strain on healthcare providers, and the uncertainty around the new disease	[½]
Consider the insurer's own operational delays as the pandemic affects working arrangements and staff work from home, claims processes could be slower	[½]
Refer to specialized pandemic and epidemic studies available, for example medical studies on infection rates from WHO	[½]
Incidence of fraudulent claims can go up which will need to be accounted for	[½]
Consider what reserving practices other players/competitors in the industry are adopting	[½]
Since the extended PA cover was launched recently, it is likely that Company M may experience higher claims experience compared to its peers as the insureds would have purchased the cover specifically for this coverage	[½]
A range of reserves could be calculated, e.g. using a distribution and a higher percentile of the distribution could be selected instead of the mean	[½]
Any macroeconomic impact arising as a result of the pandemic (e.g. interest rates changing if the claims are discounted, inflation caused by demand surge)	[½]
Purpose of the calculating the reserves (e.g. for regulatory reporting vs internal management estimates)	[½]
Marks available for other sensible comments (<i>½ mark each</i>)	[1]
	[Marks available 15½, maximum 8]

(iii)

The commutation price is based on a gross ultimate loss analysis of the pandemic losses for the reinsurer, including future going loss developments	[½]
Insurer would likely take a more optimistic view of the final settlement value of the claims resulting in a lower premium for itself	[½]
There could be information asymmetry between the insurer and reinsurer which could result in a different gross ultimate view	[½]
Reinsurer's expectations of expenses	[½]
and loadings for profit margin it expects	[½]
Differences in assumptions of the likelihood of court rulings resulting in claims needing to be re-opened if declined earlier	[½]
Difference in views on the price depends on the reinsurance run-off solution structure, extent of clauses and how simple or complex it is (run-off LPT / ADC or simple quota share)	[½]
Divergence in liability valuation basis when the reinsurer is too conservative resulting in a high price that is above Insurer M's budget based on their realistic view of the expected cost	[½]
For example (<i>maximum 1 mark for examples</i>):	
Using a higher initial loss ratio in an exposure-based approach	[½]
Higher coefficient of variation as part of a risk margin or any loss distributions	[½]
Different development patterns	[½]

Higher unexpired risk reserves due to uncertainties in the premium liabilities	[½]
The reinsurer may want to factor in its experience from other countries	[½]
The reinsurer could be factoring in its experience from other cedants	[½]
The insurer may have a more favourable view on the likelihood of the pandemic affecting the cohort of individuals it insures	[½]
Reinsurer would be affected globally so has priced in a higher margin for uncertainty to achieve the target profitability.	[½]
Different views on potential accumulations of clusters which can cause re-emergence of cases	[½]
Disagreements on the extent of a stress to apply to determine the PML as an impact to capital as part of any triggers in the run-off solution	[½]
The reinsurer could adopt higher claims admin costs and legal expenses, since it is responsible for the full settlement	[½]
Costs of any services provided would also be included in the loadings	[½]
The reinsurer might assume a more unfavourable interpretation of ambiguous product wordings, clauses and coverages	[½]
e.g. if the coverage is silent, Insurer M might assume it is not covered while the reinsurer could consider as included in the cover and make an allowance	[½]
Extra loadings for silent pandemic claims assumed to be emerging from policies or products which did not have a clearly defined exclusion for pandemic claims	[½]
These could potentially take longer to develop and would need to be reflected separately if material	[½]
Could also depend upon the bargaining power of the two parties involved	[½]
The desire of the reinsurer to take on this specific risk	[½]
Financial strength of the reinsurer	[½]
<i>(If candidates have interpreted this as a run-off/LPT question, they should still be awarded marks for it. The factors to be considered in this case shouldn't be different to the ones above)</i>	
Marks available for other sensible comments (<i>½ mark each</i>)	[1]
	[Marks available 13½, maximum 7]
	[Total 19]

This was a topical question on an insurance product impacted by a global pandemic.

The majority of candidates did not score well, most notably on parts (ii) and (iii). Many marks were available but most candidates did not score highly as they could not give sufficient breadth in their answers.

Good candidates showed an understanding of approaching the reserving for a new uncertain event with limited data, as well as the different ways a reinsurer can provide support to the cedants.

Q5

(i)

As the hurricane has just occurred the claims information available will be very uncertain, hence a different treatment would make sense [½]
It is possible this claim will develop differently to the historical claims information

in the reinsurer's data	[½]
since the reinsurer has recently started to write XoL coverage	[½]
For example the claims may cause demand surge and the loss costs may not be the same as non-catastrophe claims experience	[½]
Typically catastrophes report more quickly so should be reserved for separately	[½]
The reinsurer may not get to see the ground up losses for some time	[½]
The development may need to be analysed and monitored closely than for other claims as the financial impact of the claims from hurricane is likely to be material	[½]
For example, looking at monthly or weekly development, rather than quarterly/annually	[½]
The company might have always reserved for catastrophes separately and for consistency purpose would like to continue doing it that way	[½]
Any retrocessionaire is likely to require separate IBNR estimates for such major events	[½]
Management might want to have a separate estimate for financial planning, reinsurance planning	[½]
Management might not want to fully reflect these claims in published accounts due to the uncertainty involved and would rather have a footnote	[½]
The regulator might require for them to be reported separately	[½]
Marks available for other sensible comments (<i>½ mark per point</i>)	[1]
	[Marks available 7½, maximum 3]

(ii)

Loss recovered from XOL policy = 160m - 100m = 60m	[½]
Upfront premium = 20% x 100m = 20m	[½]
Reinstatement premium = 20m x (60m/100m) = 12m	[1]
<i>(Give full credit if the candidate has used pro-rata as to time for arriving at the reinstatement premium)</i>	
Marks for suitable assumptions	[1]
	[Marks available 3, maximum 2]

(iii)

31 st May 2021 is half way through policy therefore:	
<i>(31st May is strictly not half way - allow marks if the candidate uses exact number of days since policy inception to calculate the earnings)</i>	
Full premium earned = 0.5 x 20m = 10m	[½]
Full premium unearned = 0.5 x 20m = 10m	[½]

Assuming the risk was priced adequately the premium of 20m should be a fair representation of the underlying exposure. Therefore, the unearned premium should not change because of the loss and hence the reinstatement premium should be earned immediately [1]

Total premium (upfront and reinstatement) at 31 st May 2021:	
Earned = 10m + 12m = 22m	[½]
Unearned = 10m	[½]
<i>(Please provide follow through marks if the candidate has calculated the reinstatement premium incorrectly in part (ii) but the calculations in part (iii) are correct)</i>	
	[Marks available 3, maximum 3]

[Total 8]

Parts (i) and (ii) were well answered by most candidates. A good level of understanding of how to calculate reinstatement premiums was demonstrated.

Part (iii) was not well answered with most candidates incorrectly assuming reinstatement premiums should be earned over the remaining policy period without any explanation.

Q6

(i)

General points (*maximum 2 marks*)

Branch B has a higher required capital at \$390m vs Branch A at \$295m which is reasonable since Branch B is newly set up with less information to underwrite and price and is operating in a more uncertain environment than Branch A [1/2]

Total insurance risk split is consistent with Branch A having a large stable portfolio as compared to Branch B having a rapidly growing new portfolio [1/2]

Branch A has higher insurance risk likely due to having no reinsurance in place, whereas Branch B has reinsurance [1/2]

E.g reduced accumulation risk in Branch B from a suitable reinsurance structure (e.g. CAT XOL or event limit clauses in a proportional reinsurance) [1/2]

Reduced claims volatility resulting in lower reserve risk [1/2]

QS treaties to help in business strain and XOL covers to reduce claim volatility [1/2]

It seems a bit odd that Branch A has no allowance for diversification benefit between the risks, which could result in a lower overall risk [1/2]

Accumulation/CAT Risk (*maximum 2 marks*):

Branch A may have higher risk due to different portfolio mix and concentration risk from presence of larger commercial risks [1/2]

which would include having more property catastrophe insurance exposures than Branch B [1/2]

Branch A is likely to have higher exposures to clash accumulation across multiple classes [1/2]

Branch B is smaller in size as seen in the lower premiums, and likely to have risks more spread out and of smaller size as a personal lines portfolio [1/2]

Reserving Risk (*maximum 2 marks*)

Branch A's higher reserving risk could result from it writing long-tailed classes such as liability, while Branch B lower reserving risk being mostly short-tailed portfolio as most are property [1/2]

Branch A is more CAT exposed resulting in a higher reserving risk [1/2]

Statutory valuation requirements in Branch A could be more complex and having more requirements than Branch B [1/2]

For example, requirements and restrictions on how the business is segmented (e.g. Motor TPBI has to be reserved separately to Motor OD) [1/2]

Inflationary environment could be different for the two branches [1/2]

Branch B started writing business rather recently, and the reserve risk will build up over time [1/2]

Underwriting Risk (*maximum 2 marks*)

(*Since the CAT & accumulation is captured above separately, this section excludes the catastrophic risks*)

- Possible higher uncertainty reflected in the pricing for Branch B than Branch A higher for Branch B due to being a new market with less history and hence more uncertainty as compared to Branch A [½]
- The underwriting cycle could be softer in Branch B requiring more capital than Branch A [½]
- Branch A has a bigger stable portfolio with 90% combined ratio over the past 15 years, which suggests better diversification benefits compared to Branch B which is monoline [½]
- Good underwriting control and maybe selectively writing business in areas prone to natural peril events [½]
- There might be an error in Branch A's or Branch B's Underwriting Risk modelled result some of this is reflected in the CAT & accumulation risk [½]

Market & Credit Risk (*maximum 2 marks*):

- Higher market risk as Branch A has possibly in conservative investments while Branch B has invested in local assets which are more volatile and have higher risk charge [½]
- Perhaps Branch A has achieved a good asset liability match over time, whereas Branch B is still stabilizing its investment portfolio [½]
- Branch B has reinsurance default risk, while Branch A having no reinsurance. [½]
- Possibly higher broker balances for Branch B as it could be sourcing its business through brokers, being new in the country [½]
- resulting in higher credit risk [½]

Operational Risk (*maximum 2 marks*):

- Depends how the Group Capital model calculates operational risk since this is not a simple risk to model due to lack of data and difficulty in understanding. [½]
- The Group Capital model's interpretation of country specific operational risk results might be wrong [½]
- There could be errors in the model [½]
- Branch B is new and is subject to higher compliance risk from changing regulations [½]
- Branch B could have higher fraud activities than Branch A. [½]
- Branch B is generally more complex including having reinsurance, having less market experience and expert inputs to validate the models [½]
- Greater likelihood of over/understating the model outputs than for Branch A [½]
- Branch B is new so higher uncertainties from external and strategic aspects of the country since insurance is a new industry. [½]
- Branch A might have lower Group risk from operating for 15 years and having local staff with experience and no dependency on the Group, while Branch B is new and likely relies on Group more. It is not clear where this is being captured by the model [½]
- Branch A may have likely built up a cash position locally and will have no liquidity risk while Branch B have higher liquidity risks should there be a need for a large cash outflow. It is not clear how this is being captured by the model [½]
- Marks available for other sensible comments (*½ mark each*) [1]

[Marks available 20, maximum 8]

(ii)

The individual branch target solvency levels would need to reflect and be supported by each branch's risk profile	[½]
The Group target solvency ratio may not therefore necessarily be appropriate for the two branches	[½]
Solvency Ratio is a function of two elements - Required Capital and Available Capital, and both need to be factored in when comparing the Solvency Ratios	[½]
The RC is being calculated using the Group internal model, it is possible that the Group considers the branches to be having the same risk parameterisation as the Group	[½]
which may not necessarily be true	[½]
and hence the branch's own risk assessment may result in a different SR compared to Group's	[½]
Also, the AC is determined by the Group and has been set to be the same for both branches regardless of their risk profile	[½]
This can result in the SR being different to the Group's target even if the risk profile for the two branches was similar to that of the Group	[½]
Branch A, for example, has a larger and more complex portfolio with bigger risks from commercial lines, while Branch B only has smaller personal lines risks.	[½]
On the other hand, Branch B being newer has higher uncertainty and should have a higher target solvency.	[½]
If a branch has a higher AC than required, it possibly resulting in capital not being used efficiently	[½]
The rating agencies might necessitate the branches to be holding a higher SR as the competitors hold a higher Solvency Ratio	[½]
Each branch being smaller with less assets at branch level would be expected to have higher target solvency ratios than the Group target.	[½]
Group target solvency reflects consolidated risk profile across all units while local branch target solvency reflects risk profile only for the entity	[½]
Group risk profile likely benefits from diversification benefits unlike for each local branch	[½]
Opportunity cost of investing the capital elsewhere	[½]
What Solvency Ratio is being held by other players/competitors in the market	[½]
The current solvency ratios might be a one-off anomaly, so the trends in the SRs could be looked at too	[½]
Consider the local regulatory minimum capital requirement	[½]
Marks available for other sensible comments (<i>½ mark each</i>)	[1]

[Marks available 10½ , maximum 5]

[Total 13]

Lots of information was provided in this question and candidates were able to pick up many marks by using the information to tailor their answer.

Part (i) was generally answered well with candidates considering the differences in the risk profile of the branches well.

Part (ii) was not answered very well with many candidates showing only limited understanding of the difference between capital held at group level and capital held a branch level, and the drivers for the differences between the same. Good answers exhibited this understanding.

Q7

(i)

Product Liability	[½]
To protect it from the death and injury arising out of a defective toy	[½]
Public Liability	[½]
for its operations, industrial operations can cause damage to third party property or bodily injury	[½]
Employers Liability	[½]
The company has employees across its different manufacturing and distribution channels, and will likely need employers' liability insurance for them	[½]
It is often compulsory in many jurisdictions	[½]
D&O Liability	[½]
For its key staff to protect against any wrongful act they do	[½]
Environmental Liability - as it is plastics etc.	[½]
Because it deals with plastics which are a pollutant	[½]
Runs manufacturing facilities, which could result in damage to the environment	[½]
Property insurance	[½]
To protect its fixed properties worldwide	[½]
As well as any movable properties	[½]
Motor Fleet insurance	[½]
For the fleet of motor vehicles it uses to transport the toys to different locations	[½]
Marine, Aviation, Transport insurance	[½]
Given the large scale of its operations, it might be using its own cargo containers / planes etc. for shipment of goods as it is operating globally	[½]
Engineering insurance	[½]
Since it runs toy manufacturing facilities	[½]
Trade Credit insurance	[½]
for its dealings with business partners to whom the toy company sells to	[½]
given the scale of operations, it is likely it will be undertaking business transactions on credit	[½]
Cyber insurance	[½]
Since it is a company operating in multiple geographies, it is more prone to cyber-attacks as there is a cross-country exchange of information	[½]
Any other suitable insurance covers with justification (<i>½ mark each</i>)	[1]
<i>(Maximum 3 marks to be provided for just listing out the names of the types of insurance covers)</i>	

[Marks available 14, maximum 7]

(ii)

Maintaining good track record of safe employment practices	[½]
e.g. a quick response time for any accidents at workplace	[½]
Aiming for limited injuries to workers, and sufficient recovery time	[½]
Suitable safeguards in the manufacturing process to avoid product liability claims, e.g. following the safety laws in each country it sells toys in	[½]
Working with reliable third-party sellers in different countries who understand the local laws and regulations better	[½]

Having a good understanding of the compliance / regulatory requirements in the different geographies it operates in	[1/2]
Good risk mitigation for property and engineering insurance	[1/2]
e.g. sprinklers in all properties	[1/2]
Good training to workers operating the machinery	[1/2]
Regular servicing of the machinery and equipment	[1/2]
Working closely with the insurance companies in accurate estimation of the claim amounts	[1/2]
High excesses/Loss participation in the insurance covers it purchases as it will reduce the cost of insurance	[1/2]
Better Risk management practices at the management level	[1/2]
Set up its own captive insurance company- it can be cheaper to set up its own captive insurance if the size and scale of operations is large enough	[1/2]
Purchase umbrella policies which provide global coverage as it might be cheaper than purchasing multiple policies in different jurisdictions	[1/2]
Buying less insurance would directly lower the cost	[1/2]
Marks available for other sensible comments (<i>1/2 mark each</i>)	[1]
	[Marks available 9, maximum 3]

(iii)

Arguments for:

It is possible that there is little correlation between the liability lines and the property lines which they have been writing, leading to a good diversification benefit	[1/2]
The overall capital requirement will not reduce though	[1/2]
as it is unlikely that adding more risk is going to reduce overall capital requirements	[1/2]
Although it is possible for the capital requirement to be lower than if a similar amount of new business was for the same lines Company X has been writing so far	[1/2]
Company X's reinsurer may prefer this diversification	[1/2]
The capital requirements for liability lines in the country Company X operates in might not penalise liability lines with a high capital charge	[1/2]
Any other sensible comments for arguments in favour (<i>1/2 mark each</i>)	[1]

Arguments against:

However, long tailed lines like liability can actually be quite capital intensive due to possibility of latent claims and the inherent volatility	[1/2]
Offsetting any benefit achieved through diversification	[1/2]
Might not be within the appetite of the management	[1/2]
which is likely to be the case since the company is small	[1/2]
Suitable reinsurance may not be immediately available	[1/2]
New lines of business may lead to inaccurate pricing etc. resulting in a higher underwriting risk	[1/2]
Operational risks arising from new Line of business can increase the capital requirements	[1/2]
Liability lines can be more volatile resulting in a higher reserve risk	[1/2]
Investments of longer duration might be needed to be held against the new long-term liabilities	[1/2]
this could result in an increased Market Risk	[1/2]
may need authorisation to do it	[1/2]
Any other suitable arguments against (<i>1/2 mark each</i>)	[1]

[Marks available 10½, maximum 4]
[Total 14]

This question was very well answered with the majority of candidates scoring full or almost full marks for part (i), demonstrating a good knowledge of insurance products. Some candidates who simply listed down the products with only brief notes without clearly describing the insurance cover were not awarded full marks.

Candidates performed relatively less well on part (iii) where they were expected to show an understanding of the impact on capital of introducing a new line of business by an insurance company.

Q8

(i)

Deriving the discounted actuarial reserves:

Step 1: Obtain Financial Discount Factors based on the yield curves.

Calculation of discount factors					
	2022	2023	2024	2025	2026
Yield	3.10%	4.00%	4.50%	5.00%	5.20%
v	96.99%	96.15%	95.69%	95.24%	95.06%
Discount	98.49%	94.29%	89.58%	84.30%	79.60%

Correct calculation of the discount factor for each financial year [2]

Example:

$$\text{FY 2022} = (1/1.031)^{(2022-2021-0.5)} = 98.49\%$$

$$\text{FY 2023} = (1/1.040)^{(2023-2021-0.5)} = 94.29\%$$

$$\text{FY 2024} = (1/1.045)^{(2024-2021-0.5)} = 89.58\%$$

$$\text{FY 2025} = (1/1.050)^{(2025-2021-0.5)} = 84.30\%$$

$$\text{FY 2026} = (1/1.052)^{(2026-2021-0.5)} = 79.60\%$$

Step 2: Projection of payment cashflows for each future financial year using paid CL method:

Cumulative Payments						
Development						
AY	1	2	3	4	5	Ult
2017					105.00	105.00
2018				95.00	109.25	109.25
2019			72.00	94.32	108.47	108.47
2020		45.00	99.00	129.69	149.14	149.14
2021	20.00	80.00	176.00	230.56	265.14	265.14

Incremental Payments						
Development						
AY	1	2	3	4	5	Ult
2017						0.00
2018					14.25	0.00
2019				22.32	14.15	0.00
2020			54.00	30.69	19.45	0.00
2021		60.00	96.00	54.56	34.58	0.00

For each future year apply the paid LDF

Example for AY 2021

Cumulative DY3 = $80 \times 2.20 = 176$

Incremental DY3 = $176 - 80 = 96$

- Correct calculation of the ultimate losses for each accident year [1]
- Correct cumulative payments for each future accident year and development year [1]
- Calculation of the incremental payments for each accident year and development year [1]

Step 3: Derive discounted reserves:

	2022	2023	2024	2025	2026	Total
Undiscounted Reserves Using Paid CL	150.57	140.84	74.01	34.58	0.00	400.01
Discounted	148.29	132.79	66.30	29.15	0.00	376.54
			Total Undiscounted Unpaid Reserves =			400.01
			Total Discounted Unpaid Reserves =			376.54
				Discount Factor =		94.13%

- Calculation of the undiscounted financial year incremental payments by summing the diagonals [2]
- Derivation of the discounted incremental payments for each financial year [1]
- Stating total undiscounted reserves at \$400.0 [½]
- Stating the total discounted reserves at \$376.5 [½]
- Calculations underlying the results shown (*½ mark for each calculation shown*) [2]
- (*A maximum of 9 marks for the numerical part if no calculations are shown as the question specifically says 'showing your workings'*)

Stating suitable assumptions (*up to two, capped at 1 mark*):

- payments are made in the middle of the year [½]
- past pattern of claims is a representative of the future [½]

credit for any other reasonable assumptions [1/2]

(Provide full marks if the candidate has assumed payments are made at the end of the year. Marks for the calculation of discount rates to be 0 if the candidate has used the rates as if they are forward rates, but follow through marks to be provided)

[Marks available 12½, maximum 12]

(ii)

The calculation of the risk margin assuming a lognormal distribution is as follows:

Using discounted reserve of 377 to derive the same risk margin percentage 19.35%

For $X \sim \text{LN}(a, b^2)$, $a = 5.9007$, $b = 0.2462$

cov	25.00%
Mean	376.54
Std	94.13
Var	8,861.23

$X \sim \text{LN}(a, b^2)$

$$\begin{aligned} \text{mean} &= \exp(a + b^2/2) \\ \text{var} &= \exp(2a + b^2) * (\exp(b^2) - 1) \\ &= \text{mean}^2 * (\exp(b^2) - 1) \end{aligned}$$

Solving:

$$\begin{aligned} 8,861.2 &= [(376.54)^2] * (\exp(b^2) - 1) \\ 0.0625 &= \exp(b^2) - 1 \\ 0.0606 &= b^2 \\ 0.2462 &= b \end{aligned}$$

$$\begin{aligned} 376.54 &= \exp(a + b^2/2) \\ a &= 5.900702 \end{aligned}$$

$X \sim$	LN	a	5.9007
		b^2	0.0606
		b	0.2462

Prob ($X < 80\%$)

Percentile	80.00%
Pr[$\text{LN}(X) < A$]	0.841621
A	449.41
Mean	376.54
Risk Margin	72.87
as %	19.35%

Stating the reserves X is a lognormal distribution with two parameters LN(a,b) [1/2]

Obtaining standard deviation from the coefficient of variation [1/2]

Setting out correct equivalent equations for mean and variance to derive a and b

Mean = $\exp(a + b^2/2)$ [1/2]

Var = $\exp(2a+b^2) * (\exp(b^2)-1)$ [½]
Correct derivation of a [1]
Correct derivation of b [1]

Selecting correctly the 80th percentile ultimate loss:
(discounted) 449.41 [1]

Expressing risk margin percentage correctly:
Using discounted $72.8 / 376.54 = 19.35\%$ [½]

Suitable Assumptions:
Skewness of the lognormal distribution is appropriate to the loss experience [½]
Data is sufficient to parameterise the coefficient of variation [½]

(Provide full marks if the candidate has been penalised once in part (i) for interpreting the interest rates as forward rates instead of spot rates)

[Marks available 6½, maximum 6]

[Total 18]

Being a standard reserving calculation question, with most assumptions provided, those candidates who were well-prepared were able to pick up many marks for performing standard calculations. Marks were generally not awarded for an incorrect interpretation of the yield curve, not discounting the reserves across the financial years, lack of providing workings and not writing down suitable assumptions.

Part (ii) was not answered well by the majority of candidates, perhaps many may have run out of time to attempt this question fully. As this was a standard question, reasonably prepared candidates scored highly on this part.

Candidates need to be prepared for numerical questions in SP7, and they should try to plan out their thought process, workings and the overall sequence of answering all questions within the paper.

[Paper Total 100]

END OF EXAMINERS' REPORT



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