

# **INSTITUTE AND FACULTY OF ACTUARIES**

## **EXAMINERS' REPORT**

September 2020 Examinations

### **Subject SP8 – General Insurance Pricing Specialist Principles**

#### **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.

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

Mike Hammer  
Chair of the Board of Examiners  
September 2020

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

1. The aim of this General Insurance: Pricing Principles subject is to instil in successful candidates the ability to apply, in simple pricing analysis situations, the mathematical and economic techniques and the principles of actuarial planning and control needed for the operation on sound financial lines of general insurers.
2. Subject SP8 deals with applications of general insurance pricing techniques across many different types of product. 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.
3. 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.
4. 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.
5. 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 lose 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.
6. 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.
7. Candidates who give well-reasoned points, not in the marking schedule, are awarded marks for doing so.

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

8. Most candidates demonstrated a good knowledge of the subject areas examined and scored well in basic knowledge based questions. Questions that required application of this knowledge and tested higher order skills proved more challenging, and candidate responses to these questions generally lacked breadth and detail. There was no evidence of time pressure in this paper, though there was some evidence that candidates spent a lot of time on shorter questions and may not have left enough time for the longer questions. There was also some evidence of candidates mis-reading the question and not giving answers specific to the information given in the question.
9. Knowledge based questions were generally well answered, and better prepared candidates successfully tailored their answers to the questions, and were able to generate a wide range of points. Candidates did not score so well on application and higher order skills questions, in particular questions 7(ii), 9(iii) and 11(ii). Those who did well on these parts tended to do better overall.
10. The comments that follow the questions concentrate on areas where candidates could have improved their performance. Candidates approaching the subject for the first time are advised to concentrate their revision in these areas.

**C.                    Pass Mark**

The Pass Mark for this exam was 57.  
337 candidates presented themselves and 125 passed.

## Solutions for Subject SP8

### Q1

Catastrophe losses are usually removed from historical losses and analysed separately. [½]

We can estimate the load using this historical information if sufficient data is available. [½]

The losses would have to be trended due to the changes in business mix, level of exposure and claims inflation. [½]

Even if no historical catastrophe losses are observed, a cat loading is usually calculated since the return periods for such losses might be higher than the years of history. [½]

Catastrophe models have a significant advantage in calculating low frequency, high severity risks (because they use the latest scientific knowledge/research) [½]

Hence, we rely on these models to calculate the loading for such risks. [½]

Different models cater to the specific risks of each country and peril. [½]

The model provides results in the form of Event Loss Tables (ELTs), simulated losses or Exceedance Probability (EP) curves. [½]

OEPs – an occurrence exceedance probability file, which considers the probability that the largest individual event loss in a year exceeds a particular threshold. [½]

AEPs – an aggregate exceedance probability file, which considers the probability that the aggregate losses from all loss events in a year exceeds a particular threshold. [½]

We will have to calculate the Annual Aggregate Loss (AAL), which is the average expected cat losses for the class of business. [½]

Depending on the data available and the complexity of the catastrophe model, loadings could be made to differ for each risk based on factors like location, construction type, etc. [½]

If historical losses are not credible, and the company does not have a catastrophe model available, realistic scenarios / industry data are used to calculate the loading [½]

Possibly consider the volatility of the modelled peril/location - an allowance over and above the AAL may be required... [½]

... and could be based on the standard deviation of the results or cost of capital. [½]

Market loss consideration (Shelby or tunnel mon blanc for MTPL) [½]

**[Total 3]**

*This question was reasonably well attempted, but only a few did very well. A common mistake for candidates was to focus their response purely on catastrophe models. Those that considered a wider variety of approaches scored better.*

## Q2

- If the losses reported are those that are currently over \$1m, then the dataset will be missing losses that have exceeded the \$1m threshold in the past, but now have an incurred value below the threshold [1]
- Development factors assessed from such a dataset will tend to overstate the actual future development [1]
- If we use this method each year, the past triangle of the cedant's large losses will keep changing (as losses move over, or under, \$1m) so the implied development patterns to use could change markedly from one year to the next ... [½]
- ... and on a practical note, it will be hard to reconcile with past data. [½]
- By only considering losses over \$1m the reinsurer is missing out on losses that are currently under the threshold but may develop to be over the threshold [½]
- If the reporting threshold is the same for all years, then without adjustment, the volume of data for the different years will be inconsistent / missing claims from all but the most recent years. [1]
- Eg consider a claim that occurred in 2019 and settled for \$1,000,000. The same event in 2009 would have settled for a lower amount due to claims inflation [1]
- Hence due to inflation any assessment of frequency of losses over \$1m is likely to be too low [½]
- The data might not be fully-ground up [½]
- Historical loss data not always representative, e.g for low frequency high severity losses, or for some other reason(s). [½]

**[Total 5]**

*Most candidates made a good attempt at this question, but not many managed to score well. There was a tendency for candidates to repeat the same point in different ways, but these only score once. Those that scored well considered a wide range of disadvantages.*

## Q3

- Cost of repairing new technology exceeds reduction in claim frequency [1]
- Repairs take longer as technology is more sophisticated so labour costs higher / requires specialist repairers which comes at a premium [½]
- New technology makes drivers take less care, or take more risk [1]
- If cars are more secure, more damage may occur when thieves try to break in [½]
- ... and despite being more secure, the new technology may make them more attractive to thieves [½]
- Two years is probably not sufficient to demonstrate perceived benefits ... [½]
- ... and insurers may have loaded premiums for uncertainty [½]
- Car parts and wage inflation may be much higher than national rate of inflation [½]
- Court award inflation for liability coverage exceeds national rate of inflation [½]

- The value of the cars themselves may be substantially higher than new cars 2 years ago [½]
- Decrease in the discount rate used for periodic payments or other increases to compensation payments [½]
- Market has been hardening following years of loss-making business [½]
- Rising expenses / cost of reinsurance / reduced investment returns / increase in IPT / increased levies for industry compensation schemes [½]
- Regulatory requirements to increase levels of cover for bodily injury / or changes to road traffic rules [½]
- Number of cars on the road has increased over the last 2 years leading to more accidents in general [½]
- Extreme weather events have become more common, leading to more dangerous driving conditions and damage due to flood/hail [½]
- Lack of investment in the road network causes more accidents and/or damage to cars [½]
- The more secure cars are not being bought, or the technology is not being used. [½]
- The type of drivers who are attracted to these new technologies may be generally higher risk, e.g. younger drivers [½]
- Increased risk/frequency of losses if the technology can be hacked or susceptible to cyber risk or simply fails/stops working correctly [½]

**[Total 6]**

*This question was generally answered well, with quite a few generating enough different and relevant points to score full marks. It was pleasing to see most responses focussed on the “technological advances” specified in the question, although a number did simply talk about general reasons why premiums may increase and did not score well.*

## Q4

- Professional indemnity tends to be long-tailed ... [½]
- ... and ultimate losses may be considerably more than expected ... [½]
- ... especially given poor performance of the business to date [½]
- Latent claims could arise leading to higher than expected losses [½]
- ADC helps compared to not buying any cover [½]
- Other forms of run-off solutions, e.g. Loss Portfolio Transfer, may be too expensive [½]
- To obtain immunisation against future volatility. [½]
- There may be attractive commercial incentives to place the ADC via existing brokers, or with existing reinsurers [½]
- Existing reinsurers may not go along with an alternative such as LPT [½]
- It gives the insurer greater control of the premium for the cover as it will have some choice over the excess and limits (compared to an LPT) [½]

- The insurer may believe that it will be able to make healthy investment returns on the reserves held [1]
- Or does not wish to realise, or has difficulty in realising, assets in order to pass across the value of the reserves in a LPT [½]
- The insurer would prefer to handle the claims to ensure good service to its customers, ... [½]
- ... who may well have other products sold by the insurer [½]
- Similarly, it may want to avoid any potential reputational risk were the new insurer in an LPT default [½]
- The insurer does not want to have to obtain court approval which may be needed if they used another solution [½]
- There is no requirement for the insurer to inform shareholders or policyholders [½]
- Rather than using an LPT, the insurer could still benefit, at least in the short term, from any diversification that the professional indemnity cover might offer the insurer [½]
- There will be capital benefits from ADC which can be realised more quickly than other forms of run-off management. This capital saving can then be used to write more profitable business. [½]
- Possible future market re-entry, compared to for example an LPT. [½]

**[Total 6]**

*This question was generally well done. Those that considered the advantages compared with other run-off solutions, such as LPT, tended to score better. Similarly, those who generated a wide range of points did better than those that went into lots of detail on a narrower range. Many appeared to spend a lot of time describing ADC which was not asked for.*

## Q5

(i)

- The insurance company may have limited internal data... [½]

*Max 2 for*

- ... history is very short [½]
- ... small book of business [½]
- ... insufficient data to split into homogeneous groups [½]
- ... data fields not recorded correctly / errors in the data [½]
- ... data not structured or easy to analyse [½]
- ...the company may wish to enter a new segment of the market for which it doesn't have any data [½]

- Lack of credibility of internal data ... [½]

*Max 2 for*

- ... significant changes in business mix [½]
- ... changes in claims handling / underwriting standards [½]
- ... changes in cover (e.g. changes in excess/limits) [½]
- ... processing delays [½]
- ... legacy systems [½]
  
- The consultant may also use benchmark data to validate the analysis carried out using internal data ... [½]
- ... and compare the company’s experience with the industry/competitors [½]
  
- The consultant may have good data from comparable peers in the industry ... [½]
- ... and might be able to increase consultancy fees by selling this benchmark data as an add-on product/service. [½]
  
- In order to use a credibility weighted approach [½]

(ii)

- The benchmark data may not be based on the type of ships/cargo insured by the insurance company. [½]
- The insurance company may be insuring ships operating in locations not covered by the benchmark data [½]
- Other differences could be in the terms of policy cover offered, loadings included for expenses and profit (if benchmark data includes premium information). [½]
- Companies also differ in processes like claims settlement, reserving, etc. [½]
- Benchmark data may not have the granularity required for a pricing analysis [½]
- The benchmark data might be out of date. [½]
- Benchmark data will be invalid if any of the underlying insurance companies has errors in its data. [½]
- Not many companies may contribute to the benchmark data and so it may not give a representative view of the market [½]
- Consideration of data ownership – is the consultant allowed to share the data? [½]
- Potentially lose benefit of price differentiation at more than just a basic level [½]

**[Total 7]**

*Part (i) was generally well answered and most managed to get a good number of the main points.*

*Part (ii) was generally done well, with a significant number scoring full marks. It was noted that some candidates appeared to spend the same or more time on this question part as they did on part (i) despite the marks being much lower, and only four concerns being asked for.*



## Q6

(i)

Wind/hurricane/tornado/storms	[1/2]
Hail	[1/2]
Flood	[1/2]
Drought	[1/2]
Disease	[1/2]
Infestation / Wildlife	[1/2]
Wildfire	[1/2]
Snow / Frost	[1/2]
Landslides / Earthquake	[1/2]
Theft of crops / vandalism	[1/2]

(ii)

type / mix of crops	[1/2]
location	[1/2]
amount e.g. area km <sup>2</sup> , hectares, or expected yield / Sum Insured	[1/2]
claims history	[1/2]
excess and/or exclusions	[1/2]
hail / flood protection mitigation measures	[1/2]
use of pesticide	[1/2]
type/availability of irrigation	[1/2]
measures to mitigate fire risk	[1/2]

(iii)

Data from 30 years ago may not be very credible	[1/2]
There may be no way of verifying the accuracy of the exposure data ...	[1/2]
... or its relevance for the model	[1/2]
The policy data has been provided by brokers and so may lack completeness ...	[1/2]
... and may lack granularity	[1/2]
Although the data covers a 30-year history, there will be events not in the data that the model needs to allow for ...	[1/2]
... or how things may change in the future, e.g. climate change	[1/2]
... or the history includes events that are too extreme	[1/2]
The format of the data may lead to errors or inconsistencies	[1/2]
There may have been changes in processes over the 30-year history, e.g. changes in claims handling/underwriting/reserving philosophy, that may have distorted the data	[1/2]
Changes in locations insured over time	[1/2]
The cover may have changed over the 30 years which may not have been accurately recorded	[1/2]
Different brokers have different data collection method / data definition / data classification/ changing mix of business	[1/2]
Pesticides and other protection measures may have changed over the 30 year period	[1/2]
The type and mix of crops insured could also be very different	[1/2]
Industry changes/advances such as a move towards specially bred crop strains to survive drought/infestation	[1/2]

It might be hard to accurately adjust the data over such a long period [½]

**[Total 8]**

*Part (i) was generally well answered, although a number of candidates gave fewer than 6 perils.*

*Part (ii) was also answered well, however a number of candidates gave rating factors that would not be practical to obtain or measure.*

*Answers to part (iii) were generally good, with many candidates using the specifics of the question to generate a wide range of relevant points.*

## Q7

(i)

- NB heavily discounted to attract new customers [1]
- If business sold on price comparison websites then this is more likely as easy to compare competitor premiums ... [½]
- NB acquisition costs likely to be higher than renewal costs ... [½]
- ... especially if commission paid to 3<sup>rd</sup> parties for new business [½]
- Price walking – insurers steadily increase renewal costs to recoup NB costs [½]
- Insurance company may have rate capping and collaring at renewal ... [1]
- ...meaning NB premiums could change more than renewal premiums following a rate review [½]
- There may be other regulatory restrictions on how premiums are set which force them to be different. [½]
- Risk premiums may be statistically different between NB customers and renewing customers [½]
- If the insurer has introduced new rating factors then it would not be possible for the NB and RN premiums to be equal ... [1]
- ... unless the additional information was requested from the policyholder. [½]
- Loyalty discounts may be offered to renewing customers [½]
- Other discounts may be applied at renewal e.g. NCD/No Claims Bonus [½]
- New GLM deployed for NB [½]
- Insurers may be taking account of inertia pricing/customer LTV, likely to affect longer tenure customers and vulnerable customers [½]
- Different price optimisation strategies between NB and RN [½]
- More underwriting may be possible at renewal compared to NB [½]

(ii)

- The practice of heavy discounting at NB leads to high levels of churn ... [½]
- ... so some form of regulation is welcome [½]
- More consistency between renewal and new business premiums likely to be welcomed by consumers / loyal customers will see a decrease in premiums ... [½]

- ... however does mean that cheaper rates are less likely for those who shop-around. [½]
- ... which may reduce take-up of insurance amongst the most price sensitive customers/least well-off [½]
- ... may mean customers are less likely to shop around more generally ... [½]
- ... this could lead to reduced innovation / competition in the market. [½]
- New companies or new entrants will struggle to grow business because they cannot rely on price alone to attract customers. They have to charge a fair price because the same price would be charged for renewals [½]
- Insurers may deliberately launch new cheaper products with marginally different levels of cover to get around the regulation [½]
- This may mean customers are induced to buy new cheaper products which may not be appropriate for their needs... [½]
- The rating may be operationally difficult if new business and renewal pricing are computed independently. [½]
- Could put pressure on certain sales models, e.g. where commission is paid to brokers/partners who introduce new business. [½]
- There may be operational efficiencies if the insurer only needs to maintain a single rating structure (rather than one for new business and one for renewals) [½]
- When new GLMs are deployed, renewing customers may see shocks in the premiums [½]
- If it means not taking advantage of loyal customers that are likely to renew then fairer to customers. [½]
- Due to Treating Customers Fairly (TCF) some may already include such initiatives from an individual insurer perspective [½]
- Could lead to a lower percentage of NB on insurers' books which could result in a drop in insurers' expenses across the industry. [½]

**[Total 9]**

*Part (i) was generally well attempted, and those that generated a wide range of points did better. Some candidates only focussed on the technical reasons without thinking about practical and strategic reasons and therefore did not score well.*

*Answers to part (ii) were varied. Whilst it appeared to be fairly challenging too many, these questions are fairly standard, and typical of the questions Actuaries face in their professional life. Candidates should be aware of current practices, and think about what the implications would be if these were to change.*

## Q8

(i)

- Current losses =  $500,000 \times (2.9 - 2.5) = 200,000$  [1]
- Indicated losses =  $500,000 \times (3.0 - 2.75) = 125,000$  [1]
- Company's experience was better than expected for this layer [1]

(ii)

- Company did not experience any losses greater than \$750,000, but the current ILFs suggest this is possible [1]

Indicated ILFs are not appropriate since the ILFs for \$750,000 and \$1m are the same [1/2]  
... which means that the company will not be charging any additional premium for increased coverage [1/2]  
... data in these higher layers is likely to be sparse, so these ILFs may not be very credible [1/2]  
As a medium-size company it may not write enough of the larger limit policies to give credible ILFs for those limits [1/2]  
What is included in the benchmark data and its appropriateness given the mix? - the indicated may be more or less suitable [1/2]  
Indicated ILFs may be more suitable for pricing the layer from 250k to 500k, where current rates may be too cheap. [1/2]

(iii)

Approaches to calculate the ILFs:  
Curve fitting using the company's own experience [1/2]  
... and extrapolate. [1/2]  
The company would not have such data especially as the company data cuts off at limits of \$750k. So they would need to get data externally. [1/2]  
Use industry ILFs or benchmarks for policies with limits greater than \$1m, e.g. ISO curves [1/2]  
Use Riebesell curves [1/2]  
Credibility weight the company's extrapolated ILFs with industry ones [1/2]  
Calculate the ILFs for policies with limits greater than \$1m using ground up loss data [1/2]  
Simulate losses in excess of \$1m and calculate ILFs using the simulated loss data for new policy limits [1/2]

(iv)

Implementation challenges:

The ILF for \$750k and \$1m being the same will cause policyholders to prefer the higher limits without additional premium [1/2]

In some segments, the new premiums might be lower, hence leading to higher strike rates. [1/2]

The change in premium structure might invite a different mix of risks. [1/2]  
... which might cause anti-selection if the new structure is not appropriate. [1/2]

The ILFs will have to be updated to allow for inflation [1/2]

Brokers and intermediaries may be unhappy with the new ILF and pricing structure [1/2]

... underwriters will have to be trained. [1/2]

If the ILFs are based on benchmarks, they may prove unsuitable for certain territories or classes [1/2]

Rating software/algorithm will have to be extended to permit the higher limits [½]

The new ILFs may cause renewal premiums to be higher which may result in difficulties at renewal [½]

**[Total 9]**

*The majority performed the calculations correctly in part (i), but a significant number did not draw any comparison.*

*Responses to part (ii) were varied. Those that commented on the appropriateness of the two higher Indicated ILFs being equal tended to score best.*

*Part (iii) was generally answered well. A number of scripts only described one approach, however the question asked for approaches.*

*Most candidates had a good attempt at part (iv) though few did very well. Several candidates missed the fact that the question was about “implementing” the new ILFs, and therefore made points that did not answer the question.*

## Q9

(i)

Assessing performance against the organisation's goals / actual versus expected analysis	[½]
Managing risk	[½]
Gaining market intelligence / get information about competitors' strategies	[½]
Satisfying regulators / regulatory requirement	[½]
To influence the market	[½]
Input into the reserving process / help to assess capital adequacy	[½]
As a part of the Actuarial Control Cycle	[½]
To measure the extent to which different parts of the portfolio are growing or contracting	[½]
Gives an early indication of undue losses or gains that might indicate that rates are out of line with the market	[½]
Use in marketing materials / reports / commercial negotiations	[½]
Help with business planning / strategy	[½]
Reinsurance planning	[½]
Monitoring/detecting fraud	[½]

(ii)

When the markets are hardening, we generally expect rate change to be positive.	[½]
The opposite happens when rates are softening.	[½]
But it is not straightforward to assess the insurance cycle –	[½]
... at any time, different products could be at different stages of the insurance cycle.	[½]

Different products may be more or less exposed to extremes in the insurance cycle [1/2]  
 ... factors affecting the insurance company's portfolio might be different, causing rate change to deviate from the insurance cycle. [1/2]  
 e.g. if the company has been improving its market image or hiring good underwriters, the rate change could be positive even in a soft market. [1/2]  
 Underwriters may concede rate (or charge a smaller rate increase) to retain good business (even in a hard market) [1/2]

**(iii)**

The formula is a simple comparison of this year's rates against last year's... [1/2]  
 ...this can be done at the policy level or the aggregated portfolio level. [1/2]  
 Easy to explain to a non-technical audience [1/2]  
 Premium rates can be defined in different ways –premium per unit of exposure or limit or expected loss ... [1/2]  
 ... so would need to ensure consistency of definition throughout [1/2]  
 Premium rates could be on a gross (of commission) basis or a net basis. If calculated on a gross basis, change in commission should also be separately assessed. [1/2]  
 An aviation portfolio could include different kinds of risks– airlines hull, liability, airports, etc. which will be rated differently [1/2]  
 If sufficient data is available, the rate change for each sub-category should be calculated separately. [1/2]  
 The portfolio needs to be adjusted for any change in mix before calculating rate change. [1/2]  
 Alternatively, rate change can be calculated for each policy and results aggregated to the portfolio level. [1/2]  
 We will need to standardise all factors ... [1/2]  
 (max 2 marks)  
 ... change in volume of exposure [1/2]  
 ... duration of the policies [1/2]  
 ... changes in cover [1/2]  
 ... change in limits and deductibles [1/2]  
 ... exclusions and policy conditions [1/2]  
 ... changes in brokerage, commission and other direct expenses. [1/2]  
 ... changes in percentage coinsured [1/2]  
 ... changes in claims inflation [1/2]  
 Aviation risks are heterogeneous in nature... [1/2]  
 ... could use its rating factors based model to calculate as-if premium for different risk types, ... [1/2]  
 ... or, for renewing business, we could estimate the rate change without determining the absolute level of the premium [1/2]  
 Rate change using this method can be calculated for renewal business.... [1/2]  
 ... new contracts could be assessed by capturing underwriter's views. [1/2]  
 Qualitative factors like risk mitigation, competence of management could be captured using underwriter's judgement.... [1/2]  
 ... however, given subjectivity it is difficult to ensure consistency. [1/2]  
 The formula wouldn't apply to new business (due to the heterogeneous nature of aviation). [1/2]

[Total 13]

*Part (i) was generally answered very well.*

*Many gave a description of the underwriting cycle in part (ii), but only those that described its interaction with price changes scored. Very few explained why this interaction might not be straightforward.*

*Answers to part (iii) were very varied. Many identified the key concerns and those that generated lots of different ideas tended to do better. Some candidates gave very brief answers to this part, suggesting they didn't know where to start.*

## Q10

(i)

Advantages (*max 1 mark*)

Generally simpler than frequency-severity / easier to calculate ...	[½]
... and quicker to perform.	[½]
Does not require as much data	[½]
Easier to communicate/explain	[½]

Disadvantages (*max 1 mark*)

Not as easy to spot or allow for trends/outliers	[½]
Adjusting past data more difficult	[½]
Not as easy to adjust for changes in limits/deductibles	[½]
Not as easy to allow for complex features such as aggregate deductibles	[½]
Data on extreme losses may not be available.	[½]
Adjusting data for changes in mix of business may be difficult	[½]
Expenses that relate mainly to frequency or severity can be dealt with more accurately when pricing using the frequency-severity approach	[½]

(ii)

Apply excess (single or aggregate), or increase existing excess	[½]
Apply limits (single or aggregate), or reduce existing limits to e.g. numbers of claims/aggregate totals	[½]
Apply exclusions	[½]
e.g. certain product types/faults/territories/other valid example	[½]
Require a waiting period	[½]
Require new or improved staff training	[½]
Insist upon more robust research & development ...	[½]
... and better testing of new products	[½]
Ensure that parts are fully guaranteed so that recoveries may be made if they are found to be faulty	[½]
Require a minimum standard of quality, e.g. use of high quality raw materials	[½]
Encourage a staged release of new products so that any issues can be identified before too many are sold	[½]

- Ensure manufacturer makes it clear what is and what is not covered by any guarantees/warranties to avoid costly disputes [½]
- Require authorisation by the insurer of the repairer [½]
- Introduce a profit share arrangement, or experience rating / participation clause [½]
- Specify exchange rates to be used for overseas claims [½]

(iii)

Policy year	Washing machines sold	Amount paid	Proportion of ultimate paid	Ultimate	Inflation factor	'On-level' claims
1	235,583	2,493,458	0.98	2,544,345	1.159274	2,949,593
2	247,362	2,779,469	0.96	2,895,280	1.125509	3,258,663
3	257,257	2,520,225	0.93	2,709,919	1.092727	2,961,202
4	272,692	2,889,005	0.87	3,320,695	1.0609	3,522,926
5	280,873	2,626,803	0.8	3,283,504	1.03	3,382,009
Total	1,293,767					16,074,393

Table marks (1 for each row years 1-5) [5]

Burning cost =  $16,074,393 / 1,293,767 = £12.42$  [1]

Year 6 risk premium =  $£12.42 \times 300,000 = £3,726,000$  [½]

(Unrounded figure is £3,727,347)

Assumptions (max 1½)

- Inflation remains at 3% into the future [½]
- The last 5 years is representative of mix ... [½]
- ... expected claims experience, ... [½]
- ... cover provided, and ... [½]
- ... claims handling [½]
- No adjustment necessary for large or unusual events [½]
- No reinsurance [½]
- No changes in underwriting appetite [½]

(iv)

Standard loadings applied (max 1 for)

- Expenses [½]
- Reinsurance [½]
- Profit/cost of capital [½]
- Investment return [½]
- Commission [½]
- Tax [½]
- Contingencies [½]

Premium paid in previous years [½]

Competitor rates [½]

Position in underwriting cycle [½]



Manufacturer's plans to offer new products	[½]
Regulatory / legislative changes	[½]
Relationship with manufacturer / distributor / broker	[½]
E.g. existing cross-holdings or opportunities for cross-selling	[½]
Current strategy / target market / brand strength	[½]
Availability of capital	[½]

**[Total 17]**

*Part (i) was very well answered, with many candidates scoring full marks.*

*Part (ii) was well attempted and generally well answered. The question asked for conditions that could be placed on the policies, and many made points about what the insurer could do to internal processes which did not score.*

*Most candidates did well on the calculation in part (iii) though a number of candidates applied the claims development factors to the wrong years.*

*The better scoring answers to part (iv) considered more than just the standard premium loadings.*

## Q11

(i)

Coverage for loss / property damage /or failure of satellite	[½]
... in transit before launch	[½]
... at launch,	[½]
... and in-orbit	[½]
Third party or public liability...	[½]
...covering bodily injury and property damage to third parties as a result of launch and in-orbit activities	[½]
Additional costs arising from the delay of a launch	[½]
Business interruption cover for loss of revenue should satellite not perform to the manufacturer's specification	[1]
May be ancilliary covers for satellite owners / operators	[½]
Risks in manufacture / construction	[½]
Environmental liability	[½]

(ii)

Model to price XoL program:	
Use the portfolio of the insurance company	[½]
though the historical data is likely to be sparse	[½]
For satellites already in orbit, the current health of the satellite is the best indicator of the risk of a future failure	[1]
Information on the rate and type of failures and anomalies for satellites and launch vehicles can be obtained from publicly accessible sources as well as from commercially available compilations.	[1]
Brokers can also provide info on failure rates and specific info relating to the individual risks being placed, including the history of anomalies and the latest diagnostics for satellites	[1]

As most losses occur during launch, the reliability of the launch vehicle can significantly impact the expected losses [1]  
 For launch failure frequency, use historical performance of each launch vehicle [1/2]  
 Group related launch vehicles together as appropriate to increase credibility [1/2]  
 Judgmentally adjust the probabilities if it is deemed that the recent launch statistics are more relevant than stats from older years. [1/2]  
 ... use space underwriters'/industry experts' knowledge too [1/2]  
 If launch vehicle is not specified in contract, then use either an average loss frequency or the loss frequency for the launch vehicle most likely to be used [1]  
 Post-separation and in-orbit failure frequency - based on the historical failure stats for satellites that have achieved successful orbits [1]  
 Selected probabilities of loss by age and satellite based on the historical performance of all satellites following an active life approach, i.e. assuming that exposure takes place over a multiple year time period and that the probability of loss changes over time. [1]  
 For satellites still to be launched, we determine the probability of satellite failure during launch and during each year following launch. [1]  
 Probability of failure during a given year is the prob that the satellite survives to the beginning of the year times the conditional probability of failure during the year [1]  
 This procedure generates a discrete probability distribution of failure for each satellite, depending on its age and launch status [1]  
 All launch failures are total losses [1/2]  
 Launch: we simulate losses for all satellites exposing the portfolio [1/2]  
 Attachment of coverage: given a simulated failure, the model attaches all applicable insurance contracts to the loss. [1]

Following information is needed for each policy in the portfolio (*max 1 mark, 1/2 each*):

Policy number  
 UW year  
 Insured satellite  
 Coverage offered  
 Sum insured  
 Policy inception and expiry dates  
 Other valid suggestions [1]

Apply the reinsurance program details [1/2]  
 ... e.g. attachment points / limits and their erosion / aggregate retentions and their erosion / reinstatement premiums [1/2]  
 Run the simulation many times and estimate the expected losses related to the portfolio (and their variance) [1]  
 Could use appropriate set of ILFs [1/2]

(iii)

Limit the number of reinstatements [1/2]  
 The reinsurer could insist that the insurer:  
     Improves required testing before launch [1/2]  
     Exclude losses arising from faulty parts or poor design [1/2]  
     Set limits on weather conditions at launch e.g. windspeed < x mph ... [1/2]

... and excludes war risk and non-weather cat that could affect launch	[1/2]
Require build of satellites and/or launch plans to be approved by appropriate space agencies	[1/2]
Incentivise the insurer for not claiming, e.g. with an element of return premium	[1/2]
Require the insurer to pay a proportion of claims in the reinsured layer	[1/2]
Purchase retrocession	[1/2]
Co-insure the layer with another reinsurer	[1/2]
Diversification of their overall portfolio by writing broader risk types	[1/2]
Increase the attachment point / reduce the upper limit	[1/2]
Stability clause	[1/2]

**[Total 17]**

*Part (i) was reasonably well answered. Most candidates described the standard property type covers, but those who thought more widely about satellites scored better.*

*Part (ii) was not well attempted, and scores for this question part were particularly low. Solutions tended to be very generic and were not tailored to the XoL cover for satellite insurance. Those that did give more detail tended to be narrow in scope.*

*Part (iii) was generally well answered, though a common error was to suggest four things the insurer could do, rather than the reinsurer.*

## END OF MARKING SCHEDULE