

Subject SP8

CMP Upgrade 2023/24

CMP Upgrade

This CMP Upgrade lists the changes to the Syllabus, Core Reading and the ActEd material since last year that might realistically affect your chance of success in the exam. It is produced so that you can manually amend your 2023 CMP to make it suitable for study for the 2024 exams. It includes replacement pages and additional pages where appropriate.

Alternatively, you can buy a full set of up-to-date Course Notes / CMP at a significantly reduced price if you have previously bought the full-price Course Notes / CMP in this subject. Please see our 2024 *Student Brochure* for more details.

We only accept the current version of assignments for marking, *ie* those published for the sessions leading to the 2024 exams. If you wish to submit your scripts for marking but only have an old version, then you can order the current assignments free of charge if you have purchased the same assignments in the same subject in a previous year, and have purchased marking for the 2024 session.

This CMP Upgrade contains:

- all significant changes to the Syllabus and Core Reading
- additional changes to the ActEd Course Notes and Assignments that will make them suitable for study for the 2024 exams.

0 Changes to the Syllabus

There have been a significant number of changes to the wording of the syllabus objectives, although the underlying meaning is essentially unchanged. However for completeness, since there have been many such changes, the full list of syllabus objectives is included below.

1. General insurance products and general business environment (25%)

Understand the main features of general insurance markets and both insurance and reinsurance products, along with consideration of customer needs and risks posed to the insurers. Understand the implications of key aspects of the general business environment on general insurance companies:

- 1.1 The main types and features of general insurance markets and products considering: (Chapters 2 and 3)
 - the needs of customers
 - the financial and other risks for the general insurer including their capital requirements and possible effect on solvency.
- 1.2 The main types of reinsurance products for general insurers and the purposes for which they may be used. (Chapters 5 and 6)
- 1.3 Implications of the general business environment on general insurers in terms of: (Chapters 7 and 8)
 - marketing strategies
 - fiscal regimes
 - inflation and economic factors
 - legal, political and social factors
 - climate and environmental factors
 - professional guidance
 - technological change.

2. Data, risks and risk management (25%)

Understand the major areas of risk and uncertainty in relation to pricing within general insurance companies, along with the use of data in pricing, key actuarial investigations on pricing and the collective risk model:

- 2.1 The major areas of risk and uncertainty for general insurers with respect to pricing, in particular those that may threaten profitability or solvency. (Chapter 9)

- 2.2 The use of data in pricing: (Chapter 10)
- types of data that are used
 - main uses of data
 - requirements for a good information system
 - possible causes of data errors
 - effects of inadequate data.
- 2.3 The major actuarial investigations and analyses of experience undertaken with regard to pricing for general insurers. (Chapter 19)
- 2.4 The collective risk model and its applications in a general insurance environment, including the derivation of the aggregate claim distribution for the collective risk model and its approximations using stochastic simulation. (Chapter 11)

3. Rating bases and methodologies (35%)

Understand bases and methodologies used in rating general insurance products, and the main approaches to pricing general insurance products. Understand generalised linear models, multivariate modelling and machine learning techniques:

- 3.1 The components of a general insurance premium. (Chapters 12 and 13)
- 3.2 The basic methodology used in rating general insurance products. (Chapters 12 and 13)
- 3.3 The factors to consider when setting rates. (Chapters 12 and 13)
- 3.4 Appropriate rating bases for general insurance contracts in relation to: (Chapters 12 and 13)
- underwriting considerations
 - policy conditions such as self-retention limits
 - reinsurance considerations
 - expenses
 - investment
 - capital allocation
 - return on capital.
- 3.5 The main approaches to pricing, including the determination of relevant assumptions and practical considerations for use: (Chapters 14 and 15)
- burning cost approach
 - frequency / severity approach
 - original loss curves.
- 3.6 Generalised linear models, multivariate modelling and machine learning techniques to pricing. (Chapters 16 and 17)

4. Credibility, reinsurance and catastrophe modelling (15%)

Understand credibility theory, the application of credibility models, differences in pricing direct and reinsurance business, determining reinsurance premiums, and an outline of catastrophe models:

- 4.1 The fundamental concepts of credibility theory. (Chapter 18)
- 4.2 Comparison of the classical and Bayes credibility models. (Chapter 18)
- 4.3 The applications of credibility models to pricing. (Chapter 18)
- 4.4 The similarities and differences between pricing direct and reinsurance business. (Chapter 20)
- 4.5 Appropriate premiums for each of the following types of reinsurance, including their data requirements: (Chapter 20)
 - proportional reinsurance
 - non-proportional reinsurance
 - property catastrophe reinsurance
 - stop loss.
- 4.6 The basic structure of a catastrophe model and the key perils that it can be used to model. (Chapter 21)

Additionally, the split between knowledge, application and higher order skills has changed. The syllabus now says:

As a guide, in the examination of this subject, you can expect that approximately 15% of the total number of marks for this examination be allocated to the demonstration of knowledge, 60% to application and 25% to higher order.

1 Changes to the Core Reading

This section contains all the *non-trivial* changes to the Core Reading.

Chapter 3

Section 1.1

Under the section entitled “Directors’ and Officers’ liability”, the following sentence has been added at the end of the first paragraph of Core Reading:

This is sometimes referred to as management liability insurance.

Chapter 4

Section 0

This section has been extensively re-written. We believe that the key message behind this content remains the same, however for completeness we have included replacement pages 1-2 at the end of this document.

Section 2

This section has been deleted, along with the associated ActEd text.

Section 4

This section, entitled ‘Suggested reading’, has been deleted.

Chapter 6

Section 6.2

Some content has been added to third paragraph of Core Reading. It now reads:

Usually it is only possible to reinsure a layer above a specified amount. This specified amount may be in excess of the current level of reserves (out of the money), equal to the current level (at the money), or below the current level (in the money). There could be an upper limit. If the ultimate cost of losses is in excess of this, the insurer is liable for the excess. The reinsurer may also insist that the insurer has a small participation in the layer, to retain a commercial interest in keeping claims costs down.

Chapter 7

Section 1.3

On page 6, the paragraph under the heading ‘Syndicates’ has been updated. The second sentence of this paragraph now reads:

At the end of 2021 there were 90 syndicates at Lloyd’s.

Chapter 8

Section 1.5

The following sentence has been added to the end of the section entitled 'Currency hedging':

Where there is a mismatch between the reporting currency of an insurer and the majority of their liabilities, this can increase the capital requirements to reflect the currency mismatch.

Section 4

The following bullet point has been added to the list of bullet points on page 42:

- **increasing pressure for faster and more detailed regulatory reporting, which creates a need for more effective approaches to actuarial work.**

Chapter 10

Section 1.2

The final bullet under the heading 'Possible reasons for heterogeneity' now reads:

- **the coding used for the rating factors may vary from company to company.**

Section 2.2

Under the section entitled 'Data protection', the following sentence has been added at the end of the fourth paragraph of Core Reading:

One example of a data protection law is the EU general data protection regulation (GDPR).

Additionally, a new paragraph of Core Reading has been added at the end of the section entitled 'Data protection' as follows:

The increased public and regulatory scrutiny over cyber-attacks and the insurance coverage protecting organisations against such attacks is continuing to evolve. This makes data protection an important topic in the context of insurance undertakings both from the perspective of protecting their own customer information as well as considering the risk of insurance losses as a result of potential cyber-attacks on their customers where coverage is provided.

Section 3.2

The following sentence has been deleted from the second paragraph of the section entitled 'Legacy systems':

It is rare in such circumstances for it to be possible to transfer all historical data from one system onto the other.

The following sentence has been added onto the end of this paragraph:

Alternatively, the insurer may build a new system that is able to better cope with the differences in the data available.

Section 4.4

The following paragraph has been deleted from the section entitled 'Cross-selling':

Cross-selling is the selling of similar insurance products or the selling of products that can be incorporated with the actual insurance cover being sold.

A new paragraph has been added to this section, immediately after the first paragraph, as follows:

Cross-selling is the selling of additional insurance products to existing customers.

Section 4.5

The second last paragraph of Core Reading on page 24 now reads:

An insurer whose only reserves are aggregate reserves for the risk group will not be able to record individual outstanding claim estimates. In all other cases, the reserve amount should be recorded on the system and the date when it was set. To compile loss-development statistics, they should be retained, even when they are superseded by revised estimates.

Section 5.2

The following sentence has been added after the first paragraph under the heading 'Case estimates':

In particular, when claims are settled and fully paid, it is important to update the case values down to zero.

The section entitled 'Return premiums' is now entitled 'Return premiums or reinstatement premiums'. The first sentence of the section now reads:

Return premiums or reinstatement premiums can be recorded as a claim on occasion.

Chapter 11

Section 0

The following paragraph of Core Reading has been added at the end of this section:

Note that there are a number of mathematical proofs in this chapter. They are included to build the concepts and understanding but are not directly examinable.

New section

A new section, Section 7, has been added to the chapter. It reads as follows:

Limitations

This Chapter has looked at the mathematical foundations of risk models. These theoretical approaches do not always work well in the real world and so we tend to use bespoke solutions based on the underlying concepts.

Simulation methods still tend to be widely used for pricing especially where data is not perfect. It is important to be aware of the mathematical basis of the models in order to determine the appropriate choice of distribution and assumptions. Discretising data is less popular now due to easy access to significant computing power but it still forms the theoretical basis of many models.

Distributional choices are very specific to the context, data and purpose of the modelling, and there can be no one standard solution that fits all exercises. The main focus of this Chapter is to provide insight into identifying relevant distributional needs depending on the situation, rather than to cover all forms and types of distributions.

Chapter 16

Section 1

The following sentence has been deleted from the first bullet point at the top of page 4:

The output can be a class label or a probability.

Chapter 17

Section 8

The 'References' subsection, at the end of page 35, has been deleted.

Chapter 18

Section 0

The following paragraph of Core Reading has been added at the end of this section:

Note that there are a number of mathematical proofs in this chapter. They are included to build the concepts and understanding but are not directly examinable.

Section 4.1

The first paragraph of Core Reading in Section 4.1 has been changed (to add an extra bullet point), and now reads as follows:

The actuary must consider several issues when choosing the complement:

- **practical issues**
- **competitive market issues**
- **regulatory issues**
- **statistical issues**
- **modelling issues.**

A new subsection has been added at the end of Section 4.1 as follows:

Modelling issues

The classical method carries forward strong distribution-based assumptions which imply that, in practice, data with a certain value of 'n' can never have full credibility simply because random variation exists.

Additionally, the modelling issues existing in the external data used as complement can never be specified, which adds another layer of plausible errors, especially when the internal and external data approaches could be based on very different assumptions.

Chapter 20

Section 3.2

The first sentence of the final paragraph on page 18 has been split into two sentences as follows:

The IBNER development from the cedant's large loss experience can be achieved by using reporting year triangles. This involves arranging historical loss developments into development triangles aggregated by year and then comparing the (trended) incurred at time t for losses for year n reported at time t , with the (trended) incurred at time $t + 1$ for losses for year n reported at time t .

2 Changes to the ActEd material

This section contains all the *non-trivial* changes to the ActEd text.

ActEd Course Notes

Chapter 4

Section 2

This ActEd text in this section has been deleted, along with the associated Core Reading.

Chapter 6

Section 5.3

Much of this section has been deleted. Only the final list of bullet points remains, so the section now reads:

Specific types of financial reinsurance (or finite risk reinsurance) include:

- time and distance deals
- spread loss covers
- financial quota share
- industry loss warranties.

Chapter 15

The solution to Practice Question 15.3(i) has been rewritten. Please use replacement pages 47-50 at the end of this document.

Chapter 18

Practice Question 18.4 and the corresponding solution have been deleted.

3 Changes to the X Assignments

Overall

There have been minor changes throughout the assignments.

More significant changes are listed below.

Assignment X1

Question X1.6

Part (i) of the question has been reworded as follows:

Compare the terms exposure measure, risk factor and rating factor.

Question X1.7

Part (i) of the question has been reworded as follows:

Compare the terms 'losses-occurring basis' and 'claims-made basis'.

Assignment X4

Question X4.5

Part (i) of the question has been reworded as follows:

Compare supervised and unsupervised machine learning, and state which category the use of a GLM for pricing would fall into.

Assignment X6

Question X6.2

The question has been reworded as follows:

Explain what is meant by a *stochastic event set* and how it is used within a catastrophe model.

Question X6.6

At the end of the third paragraph of the question, after the word 'underwriter' and before the colon, the words 'which reads as follows' have been added. In the text immediately below on the same page, 'John' and 'Regards, Julie.' have been deleted.

4 Other tuition services

In addition to the CMP you might find the following services helpful with your study.

4.1 Study material

We also offer the following study material in Subject SP8:

- Flashcards
- Revision Notes
- ASET (ActEd Solutions with Exam Technique) and Mini-ASET
- Mock Exam and AMP (Additional Mock Pack).

For further details on ActEd's study materials, please refer to the *2024 Student Brochure*, which is available from the ActEd website at **ActEd.co.uk**.

4.2 Tutorials

We offer the following (face-to-face and/or online) tutorials in Subject SP8:

- a set of Regular Tutorials (lasting a total of three days)
- a Block (or Split Block) Tutorial (lasting three full days)
- an Online Classroom.

For further details on ActEd's tutorials, please refer to our latest *Tuition Bulletin*, which is available from the ActEd website at **ActEd.co.uk**.

4.3 Marking

You can have your attempts at any of our assignments or mock exams marked by ActEd. When marking your scripts, we aim to provide specific advice to improve your chances of success in the exam and to return your scripts as quickly as possible.

For further details on ActEd's marking services, please refer to the *2024 Student Brochure*, which is available from the ActEd website at **ActEd.co.uk**.

4.4 Feedback on the study material

ActEd is always pleased to receive feedback from students about any aspect of our study programmes. Please let us know if you have any specific comments (*eg* about certain sections of the notes or particular questions) or general suggestions about how we can improve the study material. We will incorporate as many of your suggestions as we can when we update the course material each year. If you have any comments on this course, please send them by email to **SP8@bpp.com**.

4

Problem solving

Syllabus objectives

There are no syllabus objectives specifically covered in this problem solving chapter.

0 Introduction

The ability to look at a problem, solve it and then communicate the results clearly is a very important skill that actuaries need in their day to day work, whichever field they work in. The examiners will test your ability to solve such problems in the exam.

As part of their preparation for the assessment, candidates must demonstrate knowledge and understanding of the subject as a whole, in order to apply and produce solutions to problems relating to general insurance pricing as follows:

- **Analyse hypothetical examples and scenarios in relation to the application of general insurance concepts.**
- **Propose solutions and actions that are appropriate to the given context, with justification where required.**
- **Suggest possible reasons why certain actions have been chosen.**
- **Assess the implications of actions within a given scenario.**
- **Discuss the advantages and disadvantages of suggested actions, taking into account the perspectives of different stakeholders.**

Examiners will expect candidates to be able to apply the knowledge and understanding that they have developed through the study of the Core Reading for this subject to produce coherent advice and recommendations for the overall management of a general insurer.

Candidates will be expected to solve problems that may be set in novel or unfamiliar circumstances or for which there are no generally recognised solutions by:

- **drawing upon knowledge and understanding of similar products, situations and current issues**
- **applying actuarial techniques and concepts**
- **exercising judgement**
- **utilising the information provided in the question.**

In Section 1, we illustrate how to put these techniques into practice by considering an unusual product which is unlike any of the products you will have seen in Chapters 2 and 3.

Although there is significant overlap in underlying content between this exam and Subject SA3, the level of understanding expected of candidates is different. Candidates are expected to have a solid grasp of the technical aspects of general insurance work and some understanding of the broader commercial, regulatory and operational context; the non-technical elements are the focus of Subject SA3.

- 15.2 Firstly, adjust the individual losses for inflation, secular changes *etc*, from the experience period to the period for which the ILFs will be applied.

Consider only closed claims, but from several accident years.

Group these claims by payment lag, *ie* the time in years from accident to settlement. Where multiple payments are made, use the average lag weighted by amount paid.

For each payment lag, construct an empirical survival function for the claim size:

- split data into (hopefully more than 50) discrete loss-size intervals
- for each interval, estimate the probability that the loss will exceed the upper bound, given it exceeds the lower bound (*ie* the conditional survival probabilities)
- estimate discrete points on the survival probability by multiplying these conditional survival probabilities together.

In practice, lags beyond a certain period, say five years, are grouped and the same loss distribution assumed.

Estimate the proportion of the number of loss occurrences for an accident year that are settled at each payment lag.

Combine these proportions with the empirical survival functions at each lag to estimate the combined survival function for all claims.

Smooth the tail of the combined survival function (*eg* by fitting a truncated Pareto distribution above a selected threshold) and then fit a parametric distribution to the smoothed curve (*eg* using a mixed exponential).

We can then derive limited average severities (and hence ILFs) from the fitted loss distribution.

- 15.3 (i) ***Calculation of cost to the layer***

Assumptions:

- (1) sums insured (SIs) are distributed evenly within each sum insured band, so that each band is represented by the average sum insured for the band
- (2) the same loss ratio applies to each band
- (3) the same risk profile (*ie* distribution of SIs) will apply in Year 2
- (4) the data given is for the middle of Year 1, and hence exactly one year's inflation can be applied
- (5) the (single) exposure curve given can be applied to all the business to be reinsured
- (6) the same claim distribution (as represented by the exposure curve) will apply in Year 2
- (7) the same inflation figure (5%) can be applied to all policies (*eg* irrespective of size)
- (8) there are no features of the original business, such as deductibles or stacked limits, that would complicate the calculation

- (9) there are no features of the reinsurance treaty, such as reinstatements or inuring reinsurance, that would complicate the calculation
- (10) intermediate points on the exposure curve can be obtained by linear interpolation.

Working in £000s throughout.

To allow for 5% inflation, we can reduce the attachment point and exit point of the layer by 5%, ie:

$$\text{Adjusted attachment point: } \frac{200}{1.05} = 190.48$$

$$\text{Adjusted exit point: } \frac{500}{1.05} = 476.19 \quad [1]$$

Calculations for each band that falls within the treaty are as follows:

Average SI (£000s)	Original premium (£000s)	Attachment point % of SI	Exit point % of SI	Attachment point % of loss cost	Exit point % of loss cost	Cost to the layer (£000s)
250	14,500	76.2%		90.9%		923.7
350	12,000	54.4%		80.7%		1,621.2
450	10,000	42.3%		74.0%		1,820.0
625	15,000	30.5%	76.2%	66.0%	90.9%	2,614.5
875	8,000	21.8%	54.4%	58.5%	80.7%	1,243.2

Calculate a SI value to represent each SI band, such as the average (shown in the table above). [1]

(Marks awarded for correct averages as above or any sensible assumption, eg taking upper points, where justified; deduct ½ mark for each error).

For bands below £190k, there is no cost to the layer. Hence, if the band £150k to £200k is represented by the average (£175k), this will not contribute to the layer. [½]

For higher bands, we need to calculate the attachment point as a proportion of the assumed sum insured. For example, for the band £200k to £300k, this is:

$$\frac{190.48}{250} = 76.2\% . \quad [½]$$

Similarly, for all other bands [1]

(See table above, deduct ½ mark for each error.)

Also, for bands above £500k, calculate the exit point as a proportion of the assumed sum insured. For example, for the band £500k to £750k, this is:

$$\frac{476.19}{625} = 76.2\% \quad [1/2]$$

For the layer £750k to £1,000k, this is:

$$\frac{476.19}{875} = 54.4\% \quad [1/2]$$

Use the values from the exposure curve to convert the exposure proportions into the proportions of the loss cost for each layer (related to the ground-up losses).

For example, to calculate the cost of the attachment point as a proportion of the loss cost for the layer £200k to £300k, we could use interpolation to estimate $G(76.2\%)$, ie:

$$88.3 + \frac{6.2}{10} \times (92.5 - 88.3) = 90.9\% \quad [1/2]$$

Similarly, for all other attachment points and exit points. [1]

(See table above, deduct ½ mark for each error, but any reasonable approximations permitted.)

For each band (for which the reinsurance will apply), the original loss cost can be estimated by applying the loss ratio (70%) to the original premiums.

For bands with midpoint below £500k, the cost to the layer is the proportion $(100\% - G(190.48 / M))$ applied to the original loss cost, where M is the midpoint of the band.

So, for example, the cost of the band £200k to £300k is calculated as:

$$(100\% - 90.9\%) \times 70\% \times 14,500 = 923.65 \quad [1]$$

Similarly for the next two bands. [1/2]

(See table above, deduct ½ mark for each error.)

For bands above £500k, we use the proportion $(G(476.19 / M) - G(190.48 / M))$, where M is the midpoint of the band.

Hence, for example, the cost of the band £500k to £750k is calculated as:

$$(90.9\% - 66.0\%) \times 70\% \times 15,000 = 2,614.5$$

Total cost to the layer is the sum of this final column, ie £8,222.6k. [1/2]

As a percentage of the original premium this is:

$$\frac{8,222.6}{93,500} = 8.8\% \quad [1/2]$$

[Maximum 10]

(ii) ***Appropriateness of the assumptions***

Assumption (1) may not be realistic. For example, for most bands, we might expect more policies with lower than average SIs, because the volume of business in each (equal width) band is decreasing with size of SI. [1/2]

On the other hand, there may be a significant number of policies at the very top of each band, eg 200k or 300k, because 'round' SI amounts may be popular. [1/2]

A particular issue here is that we have excluded the £150k to £200k band in the calculation, whereas some policies above £190k will contribute to the cost of the layer. [1/2]

Also, the result may be very sensitive to this assumption, particularly as the band widths here are quite large. [1/2]

Ideally, we should obtain exposure data in more detail to investigate this assumption in more detail. At the very least, sensitivity testing should be carried out. [1/2]

Assumption (2) may not be true if:

- claims experience varies by sum insured (eg SI may be a proxy to socio-economic group and hence the tendency to claim) [1/2]
- the insurer's pricing basis has cross-subsidies by policy size (eg large policies subsidising smaller ones). [1/2]

For assumption (3), the distribution of sums insured by premium may be affected by the insurance cycle. [1/2]

For assumption (4), even if data is not mid-year, it is probably reasonable to assume one year's inflation, but we should check how the dates of the treaty compare with the data we have. [1/2]

Assumption (5) is unlikely to be realistic, unless the business being ceded is quite homogeneous. Ideally, we should split the data by risk groups and apply different exposure curves (and loss ratios) to each. However, the approach we've made may be the best we can do with the (limited) data we have. [1]

Assumption (6) may be rather simplistic. We should investigate whether large claims are affected by inflation differently from small claims. This may be the case, because different types of claims will be affected by different types of inflation to varying extents. [1]

Similarly, for assumption (7), large policies may be affected by inflation to a different extent than small ones. [1/2]

However, the inflation adjustment may have a relatively small impact as it is only for one year. [1/2]