

Exam C

Study Program Guide

Fall 2009 exams



*Get the most
from your
study
program...*

... see page 7

This document contains important information

Please read this document carefully before starting your study.

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Welcome

We're confident that this BPP Exam C study program will have a very positive impact on the way you study for the actuarial exams. We believe that students should spend their time focusing on learning and preparing for the exam, not juggling their time between textbooks, separate solution manuals and then additional study manuals to re-explain those textbooks and solution manuals!

No other provider of actuarial education offers such a wide range of coordinated support, including:

- introductory online lectures
- comprehensive course notes
- online multiple choice tests
- exam-style question & answer banks
- email tutor support.

We've designed the course to cover all the learning objectives in an order that's right for you. Our course notes provide clear explanations of the syllabus, and include over 430 worked examples and practice questions, all with full solutions.

Our introductory online lectures and online multiple-choice tests are fully coordinated with the course notes. They will ensure that you can get a good introduction to each topic as well as test your knowledge and understanding.


Our Question and Answer bank contains over 690 exam-style questions to give you the practice necessary to maximize your opportunity for success in the actual examination.

For BPP, providing a study program means providing a commitment to support students all the way through to the exam. Our full-time tutors will answer any questions you may have by email so that you always have the support you need. We also offer seminars to give you the very best chance of success in the exam.

Passing the actuarial exams is difficult enough. We understand that you're competing against some very bright people and that it's always hard to find time for studying between working and spending time with friends and family. BPP's study programs organize your study effectively and provide the very best support. They will help you to maximize your chances of success in the exam and to make good progress towards qualification.

As you have more contact with BPP, you'll find us to be a very friendly and proactive company. We are committed to providing high quality study support. We respond quickly to students' requests and will do all we can to meet your specific needs. We look forward to helping you.

Good luck with your studying.



David Wilmot
Director of Education

** Note to CAS students: We know that this subject is called "Exam 4" by the CAS, but we'll use the description "Exam C" throughout this Study Program Guide. We think this makes the text easier to read than using the rather awkward "Exam C/Exam 4".

1 About the BPP Exam C study program

BPP's Exam C study program has everything you need to know, containing 5 coordinated sources of help. Use our study session planner (in Section 6 of this guide) to make sure you get the most from your BPP study program.

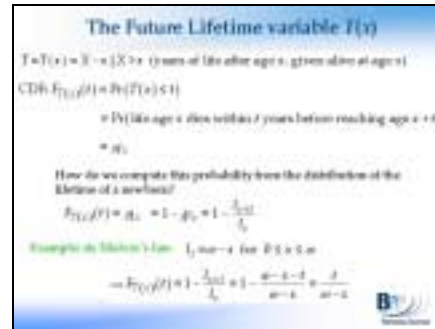
Online lectures

Our introductory online lectures give you a quick start by introducing all of the main topics.

The lectures are coordinated with the BPP course notes to give you the most comprehensive study support available.

You can watch them as many times as you like – as an overview before you study the course notes, or to help you review the material you've just covered.

Either way, together with the course notes they will help you to understand even the most difficult areas of the syllabus.



Course notes – “Construction of Actuarial Models”

These comprehensive notes are divided into separate chapters so as to help you structure your progress through the session leading to the exam.

Chapter	Title	Chapter	Title
1	Loss models	9	Classical credibility theory
2	Severity models	10	Bayesian credibility
3	Frequency models	11	Bühlmann credibility
4	Aggregate models / reinsurance	12	Empirical Bayes estimation
5	Estimation	13	Simulation
6	Model selection and evaluation	14	No longer on syllabus
7	Empirical estimation	15	No longer on syllabus
8	No longer on syllabus	16	Risk measures

These course notes include clear explanations of all the main theory plus over 430 worked examples and practice questions (all with full explanatory solutions).

The course notes fully meet the learning outcomes of the Exam C syllabus.

Online tests

After having read the course notes you can quickly check your knowledge and understanding using our online multiple-choice tests, which include a wide variety of conceptual, computational, and knowledge-based questions. Their online nature is not conducive to long computational problems and so the online test questions are a little more straightforward than you might expect to see on the actual exam. However, they are a great way to work up to the more difficult questions that appear in the Question and Answer bank.



BPP's online tests contain original short questions with full solutions. They're coordinated with the course notes and are designed to test all the key concepts that you'll need to know and work you towards answering exam-level questions such as those in our Question and Answer Banks.

Question & Answer Bank

The Question & Answer Bank contains over 690 exam-style questions. This includes a mix of past exam questions (taken from recent SOA Course C/4 exams) and over 330 original questions written by our team of instructors. We provide a detailed line-by-line solution to every question, to help you learn the techniques required to pass the exam.

The questions are coordinated with the course notes through our study session planner in Section 6 of this Study Program Guide. We list there the questions that you can attempt after completing each chapter of the course notes.

Email tutor support

Our email support service is designed to help you with the more difficult areas of the course. We'll answer your questions thoroughly and quickly so that you can get on with your studying with no worries. Please refer to the FAQ's section of our website for further guidance regarding email support.

Getting help with your studying by email

Before submitting questions we do expect students to work through the material carefully and to check first the Course C student mailbag at www.bpptraining.com, as we put answers to **frequently asked questions** about the course material on our website.

If you remain stuck, you can email technical questions about the course material to our team of tutors at: examCsupport@bpptraining.com

Please help us to help you by stating your name and your question clearly, with page references if appropriate.

If you have any non-technical questions about BPP's study programs, you should send an email to: info@bpptraining.com



2 *Additional help from BPP*

Practice exams

BPP's practice exams are designed to give you a realistic test of your exam preparation. Each practice exam contains brand new exam-style questions and is supplied with full explanatory solutions. The practice exams are another helpful source of exam-style questions, especially for students who have worked through all the other questions.

Flashcards

BPP offers user-friendly flashcards to supplement the study program. They'll help you review and remember the most important formulas, lists, concepts and other pertinent information. Memorizing the important formulas and knowing how to use them are the most effective exam preparation approach for many students, and our flashcards are very helpful in this regard.

Find out more at www.bpptraining.com

For more information on BPP's full range of products and services, visit our website at **www.bpptraining.com**.

Our website includes many free samples to download, including course notes, online lectures, and online tests.

You'll also find information on how you can order our products.



3 *Getting the most from your study materials*

Order of study

To help you plan your study, we've divided the course into 6 study sessions. The detail of each session appears later in this Study Program Guide, however, each of your study sessions should include four main activities:

1. Introduction – Watch an online lecture

The online lectures are designed to introduce the main conceptual ideas and to help you towards understanding the most difficult areas. These introductory online lectures are not a replacement for reading the comprehensive course notes, but they will help you to study more efficiently by identifying the important topics and explaining how the parts of the course are related.

2. Key learning – Read the related section of the course notes

The course notes include detailed explanations of the topics covered by the Learning Outcomes, along with a large number of worked examples and practice questions. As you work through the course notes, you should try to study actively and think about what you're reading. (Active study is discussed in the Study Skills section of this Study Program Guide.)

3. Evaluate learning – Test your understanding

At the end of each reading there are a number of practice questions. In addition, the online tests include a wide variety of conceptual, computational, and knowledge-based questions. These questions are designed to test your understanding of the syllabus. Most of them are shorter and more straightforward than genuine exam-style questions, but every question is designed to test a concept, technique or formula that you will need to know in order to pass the exam.

4. Practice answering exam-level questions – Question & Answer Bank

After learning the important concepts and formulas, the most important way to prepare for the exam is to practice exam-style questions. The other tasks in each study session are designed to help you reach the standard required to attempt these longer and more difficult questions. The Question & Answer Bank contains a large mixture of relevant past exam and brand new questions, all with full explanatory solutions plus hints and tips.

It's a fact that people are more likely to remember something if they review it periodically. So, do look over the chapters you have studied so far from time to time. You may also find it useful to review the online lectures and online tests.

The secret to success in preparing for actuarial exams is to practice, practice, and then practice some more!

Focus of study

When studying, it is generally worth remembering that certain areas of the syllabus are often more important than others. One measure of importance is the frequency at which exam questions appear on each topic. Although past performance is no guarantee of the future (!) we have reviewed past administrations of Exam C and made an assessment of the learning outcomes added subsequently.

The following table gives you a rough indication of where future exams may focus. Remember, however, that past performance is no guarantee of the future!

Chapters	Subject	Number of questions in past exams*
1-4	Loss models	10 out of 35 questions
5-7	Estimation and model selection	11 out of 35 questions
9-12	Credibility	10 out of 35 questions
13 & 16	Simulation and risk measures	4 out of 35 questions

* Approximate past appearances in Exam C, adjusted to reflect syllabus changes.

Un-examinable topics

While you study, it is worth bearing in mind that knowledge of proofs is highly unlikely to be tested within a multiple-choice examination. Although memorizing the proofs of key theorems may not be good use of your time, working through such proofs is sometimes worthwhile as you will learn something that may be required in a new style question that is highly conceptual and requires first principles thinking.

A number of areas of the syllabus are not amenable to writing questions with a numerical answer. So you will see several questions on the exam asking which of the five answer choices is a true statement (or which is the false one). These questions are usually based on conceptual understanding at a basic to intermediate level.

4 *Study skills*

Overall study plan

A good study plan is one that is:

- developed right at the start of your studies
- realistic
- builds in time for relaxation
- allows for known future busy work periods that will restrict your study time
- allows some time for contingencies.

Once you have set your plan, be determined to stick to it.

Manage your study to allow plenty of time for the concepts you meet in this course to become ingrained in your mind. The most successful students will have completed the course in good time, and left 6-8 weeks for question practice and review. By finishing the course as quickly as possible, you will have a much clearer view of the big picture. It will also allow you to structure your review so that you can concentrate on the important and difficult areas of the course. How often do you think “*I’m just getting the hang of this, I wish the exam was two weeks later*”?

An old rule of thumb that many students use when preparing for actuarial exams is to allocate 100 hours of study time for each hour of exam time. While some students don’t need this much time to prepare, other students require more. It is difficult actually to invest this much time over the study cycle, so it is imperative that you start your studies early and stick to your study plan. We provide a model study plan in Section 6 of this Study Program Guide. Of course, you should monitor your progress over time so that you can determine whether or not you need to significantly ramp up your study time at some point before the exam.

Study sessions

DO only those activities that will increase your chance of passing, *eg this might not include repeated re-reading of the course notes!*

DO have a specific purpose for each study session, *eg “Read pages 117-126 and attempt questions 35-42 from the Question & Answer Bank”*.

DON’T include non-specific activities, including those using just a time-based target *eg “Three hours studying the material in Chapter 2”*.

DON’T spend too much time reviewing material that you already understand. *You will only improve your chances of passing the exam by getting on top of the material that you currently find difficult.*

DO study somewhere quiet and free from distractions, *eg a library or a desk at home dedicated to study.*

DO study at the time of day (or night!) when you operate at your peak.

DO take short breaks during your study to remain focused. *It’s definitely time for a short break if you find that your brain is tired and that your concentration has started to drift from the information in front of you.*

Active study

Whether you are learning new material or answering questions, you should try to study as actively as possible. This will help you to remain focused on the task, and to ensure that you learn from the process. Here are some techniques that will help you to study actively.

- **Don't believe everything you read!** Good students tend to question everything that they read. They will ask "why, when, how?" when confronted with a new concept, and they will apply their own judgment.
- As you read the course notes, **think of possible questions that the examiners could ask.** This will help you to understand the examiners' point of view and should mean that there are fewer nasty surprises in the exam room. Try to think of possible variations to existing questions too. Designing your own questions on a topic that you find difficult will help you understand it better when you see what it takes to write a reasonable question. Share these questions with colleagues preparing for exam C.
- **Annotate your notes** with your own ideas and questions. This will make your study more active and will help when you come to review the material. Do not simply copy out the notes without thinking about the issues.
- Attempt the end-of-chapter questions as you work through the course. Write down your answer before you check against the solution. Attempt other questions on a similar basis, *ie* write down your answer before looking at the solution provided. **Attempt questions under exam conditions** so as to force you to think and act in a way that is similar to how you will behave in the exam.

Review stage

- **Attempt as many exam-style questions as you can** – make sure you write down your answers before looking at the solutions provided! It is crucial at this stage that you attempt questions under exam conditions so as to force you to think and act in a way that is similar to how you will behave in the exam.

Recent exam questions require greater conceptual understanding than the older ones. So don't try to memorize your way through this test. Conceptual understanding is vital to your success on exam day when the questions you are confronted with are not easily identified as variations on past questions that you have practiced on.

- **Take a practice exam** a few weeks before the real exam to identify your weaknesses and work to improve them. You could use a past exam paper or one of the original practice exams written by BPP.

5 *Calculator advice and general exam tips*

Calculator advice

For Exam C you should use the same calculator that you used for Exam M (MLC/MFE). There are no great new calculator tricks to learn for Exam C.

Examination tables

You should practice working questions using the tables you will receive in the examination room. **Examination tables can be downloaded from the SOA's website (www.SOA.org).**

Appendix A, An Inventory of Continuous Distributions, is often used in exam Questions concerning estimation, loss models, and credibility. Many of these distributions have PDF and moment formulas that are simply too complex for the exam.

The information in Appendix B, An Inventory of Discrete Distributions, is useful on the exam. Many of these probability function and moment formulas should be familiar from Course P study. They should eventually be part of your memory so that you don't have to waste excessive amounts of exam time looking them up and then writing them down before you begin plugging in numbers.

Familiarity with the distributions in Appendices A and B (along with their quirks - for example, in the binomial distribution m is the number of trials and q is the probability of success) is vitally important.

General exam tips

Our booklet '**The BPP Guide to Exam Success**' contains lots of great tips for maximizing your chances of success in the exam. Take time to look at this now, so you can practice the appropriate skills throughout your studying, rather than leave it until close to the exam when it will be too late to do so. The booklet can also be viewed freely on our website.

Further hints, tips and advice is contained within the individual study session pages in the next section of this Study Program Guide.

Questions from 2006 onwards have been *much more conceptual* and demanding than those on prior exams where many questions could be answered by plugging numbers into memorized formulas. So you must strive to attain a solid conceptual understanding throughout the syllabus.

6 *Your study session planner*

Overall study plan

Set a study plan that is *realistic for you*, based on when you start studying for the exam, your prior knowledge, and other commitments. Here is a *sample* study plan based on a start date in June 2009. There is a lot of material to get through so *an earlier start date would be prudent*.

Week #	Week beginning	Activity
1	June 15	Start study session 1
2	June 22	Complete study session 1
3	June 29	Start study session 2
4	July 6	Complete study session 2
5	July 13	Start study session 3
6	July 20	Complete study session 3
7	July 27	Review study sessions 1-3 (Work in Q&A Bank)
8	August 3	Start study session 4
9	August 10	Complete study session 4
10	August 17	Start study session 5
11	August 24	Complete study session 5
12	August 31	Start study session 6
13	September 7	Complete study session 6
14	September 14	Review study sessions 4-6 (Work in Q&A Bank)
15	September 21	Six-week review period Focus on practicing exam-style questions from the Q&A bank under time pressure and memorizing unintuitive formulas that cannot be written down from conceptual understanding. Attempt a BPP practice exam. Identify your weaknesses and work to eliminate them.
16	September 28	
17	October 5	
18	October 12	
19	October 19	
20	October 26	
21	November 2	Exam C examination

Planning your study sessions

The following pages are designed to help you plan each of your study sessions in order to make steady progress through the course. Take care! It is much more important to get through all of the material, reviewing it several times, and to work through a lot of exam-style questions. The potential trap is for you to get bogged down in one area with the result that you don't then have time for a thorough review of all of the material.

Study record

Use this table to record your progress. Enter the date you complete each task and study session.

	Study Session												
	1	2	3	4	5	6							
<p>Online lectures</p> <p>Watch BPP's online lecture for each study session. Each lecture provides an overview of the relevant topics.</p>													
<p>Reading</p> <p>Read the relevant section of the course notes (the session pages that follow tell you what to read). Work through end-of-chapter questions to test your understanding.</p>													
<p>Online multiple choice tests</p> <p>Attempt BPP's multiple choice test for each study session. The tests focus on the key concepts you'll need to pass the exam through a series of short, multiple choice questions.</p>													
<p>Question & Answer Bank</p> <p>Attempt questions from the Question & Answer Bank for the chapters you have just read. The Question & Answer Bank contains exam-style questions, including a mixture of past exam and brand new questions.</p>													

Study session 1



This study session covers the following Exam C Learning Outcomes (see syllabus at end of this Study Program Guide for details of the numbered sub-sections):

- A. Severity models
- B. Frequency models – bullets 1, 2
- C. Aggregate models – bullet 1
- D. Severity, frequency and aggregate models

Required reading: Chapters 1 and 2 of the BPP course notes.

Hints, tips and advice

Approximately **4-6** of the **35** exam questions on an average Exam C examination paper might be expected to come from this part of the syllabus.

Important topics (*ie* most examined) in this area are:

1. compound sum moment formulas
2. the double expectation theorem
3. discrete and continuous mixing of distributions
4. expected value and variance of the payment per loss and payment per payment event random variables when the insurance involves deductibles, limits, and co-insurance factors.

In the course notes, we've placed a box around the important formulas to help you identify them for your review. (During the exam, you won't have time to derive many formulas, so by the exam it is important to be able to write them down from solid conceptual understanding or to have memorized the most difficult and unintuitive ones!).

Less important topics:

- Tail weight

References to prior knowledge:

- De Moivre's law (Exam M)
- Survival Model Theory (Exam M)

Calculator techniques/shortcuts/exam hints:

1. Exam question wording describing a continuous mixing of distribution is always vague, but consistent. Get used to it. If a question states:
 - (i) a newborn life follows a constant force model
 - (ii) over the population the forces vary uniformly on the interval $[a, b]$

Then the intent is:

$$f_X(x|M=\mu) = \mu e^{-\mu x} \quad , \quad f_M(\mu) = 1/(b-a) \quad \text{for } a \leq \mu \leq b$$

2. The amount of a loss in the "layer" $[a, b]$ is equal to $X \wedge b - X \wedge a$. For complicated insurance payment per loss formulas, the insurer will be responsible for a percentage of the loss in various layers. So the expected insurance payment per loss is a sum over layers of the layer-percentage multiplied by $E[X \wedge b] - E[X \wedge a]$, which can be calculated from Table formulas for certain parametric families of loss models.