Institute and Faculty of Actuaries

A Guide to CS1 and CS2 Examinations

for the 2020 examinations

January 2020

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Introduction to Actuarial Statistics (CS1 and CS2)

This guide should help answer your questions about CS1 and CS2, including:

- the format of the online examinations;
- guidance on how to take the examinations;
- administrative information; and
- information relating to the April and September examinations

If you have any further questions that are not covered in this guide, please contact the Education Services Team: education.services@actuaries.org.uk

Specimen and past papers for CS1 and CS2 examinations are available on the

IFoA website:

https://www.actuaries.org.uk/studying/curriculum-2019

https://www.actuaries.org.uk/studying/prepare-your-exams/past-exam-

papers-and-examiners-reports

What is covered in CS1 and CS2?

Subjects CS1 and CS2 are a fundamental part of the Core Principle subjects.

CS1 provides a grounding in mathematical and statistical methods that are of relevance to actuarial work. It will equip you with the knowledge of:

- statistical distributions,
- methods to summarise data,
- the principles of statistical inference, regression models (including generalized linear models) and
- the fundamental concepts of Bayesian statistics.

CS2 builds upon CS1. It develops knowledge of and the ability to apply:

- statistical methods for risk modelling,
- time series analysis methods,
- stochastic processes (especially Markov chains and Markov jump processes),
- survival analysis (including regression methods applied to duration data) and
- graduation methods.

It also includes a high level introduction to machine learning.

Subjects CS1 and CS2 include both theory and application of the ideas using the 'R' statistical package.

How have CS1 and CS2 been developed?

CS1 and CS2 have been influenced by external direction and guidance: the Actuarial Profession Standards (APSs), the International Standard of Actuarial Practice, the Actuaries' Code, the regulators, Sarbanes Oxley and Solvency II requirements. A summary of these are set out for reference below. While these subjects were taken into consideration when developing the syllabus for the Core Principles subjects, knowledge of these standards will not be directly tested in the CS1 and CS2 examinations.

- **Actuarial Profession Standards (APSs)**

  The latest standards can be found on the IFoA website: https://www.actuaries.org.uk/upholding-standards/standards-and-guidance/actuarial-profession-standards-apss

- **The Actuaries' Code**

  The Actuaries Code can be found on the IFoA website: https://www.actuaries.org.uk/upholding-standards/standards-and-guidance/actuaries-code

  The Code requires us to "perform professional duties competently and with care" and to "ensure that their communication, whether written or oral, is clear…"

- **International Standards of Actuarial Practice (ISAP)**

  The latest ISAPs can be found on the International Actuarial Association's website: https://www.actuaries.org/iaa/IAA/Publications/ISAPs/IAA/Publications/05ISAPs.aspx?hkey=3 34b21a7-a3ac-4e0e-8294-3cbc755ab14a

- **The regulators**

  In reviewing a firm's practices, the regulators expect to see acceptable standards of documentation, agreed by the firm, and documented.

- **Sarbanes Oxley (SOX or SarBox)**

  This is American legislation which governs the need for full documentation of internal processes and controls.

- **Solvency II**

  This framework for insurance companies includes emphasis on documentation and evidencing of the calculation work undertaken.

The timing and format of the CS1 and CS2 examinations

Examination dates for the coming year can be found at:
https://www.actuaries.org.uk/studying/exam-bookings/exam-dates-2020

Details of the syllabus for CS1 and CS2 can be found at:

https://www.actuaries.org.uk/studying/curriculum/actuarial-statistics

Questions for the CS1 examination and the CS2 examination will be drawn from across the syllabus.

Each of the CS1 and CS2 examination consists of two elements, referred to as Paper 'A' and Paper 'B':

- Paper A: a 3hrs and 15mins written examination paper. This is taken in an examination centre and sat in local time.
- Paper B: a 1hr and 45mins paper. This is a problem based assessment, using 'R' with questions requiring candidates to use data to answer questions. This is delivered online and can be taken at your workplace or at home, at UK times only.
- The two elements of each assessment will take place over two consecutive days where possible. Where this is not possible, there will be no more than a two day delay between sittings.
- When booking these two part examinations, your booking confirmation will show only the date and time of the A examination, there will be a separate email sent 4 weeks after the exam booking has closed with the exact time of your B exam. Your examination permit, when issued, will show dates for both parts of the assessment.

Note: With effect from the April 2019 reading time is included in the overall examination time. It is therefore up to candidates to manage their time between reading through the paper and starting to answer the questions. There is guidance on this at *Hints and Tips* at:
https://www.actuaries.org.uk/studying/prepare-your-examinationinations/revision-programme

For the problem based assessments all candidates will need to be confident in the use of the statistical package 'R'. There is a handy guide on "Getting started with 'R'" at:

https://www.actuaries.org.uk/studying/curriculum-2019/actuarial-statistics

For the 2020 problem based assessments (April and September) you will need the following:

Examination	Version of R required	Version of R Studio required	Packages required	External Data Sets
CS1B	3.6.1	Any release of version 1.1 (32-bit operating systems) Any release of version 1.2 (64-bit operating systems)	base*, graphics, stats, utils	External data set required for April and September examination
CS2B			base*, graphics, markovchain, stats, utils	

*this package is loaded by default during the R installation – you are not required in install this package.

It is strongly suggested that you verify your R Console or R Studio set up prior to the examinations. The IFoA can support with technical aspects of the online examination platform only and cannot offer technical support with the installation or configuration of R Console/R Studio and any associated packages.

For an overview on how to install R Console or R Studio, and how to load packages, please refer to the Getting started with 'R' guide which can be found here:

https://www.actuaries.org.uk/studying/curriculum/actuarial-statistics

If external data sets are required for the problem based assessments these will be provided by the IFoA approximately two weeks prior to the assessment date. Data files will have one of the following extensions: ".txt", ".csv" or ".Rdata.

The data set(s) will need to be loaded into R prior to the examination. For instruction on how to load data to R Console or R Studio please refer to the "Getting started with 'R' Guide referenced above.

R is continually being updated and version releases can change quickly, sometimes this will happen quite shortly before the examination. Whilst the version of R stated above is required for sitting CS1 and CS2, later versions may be offered at the point of download. Students may opt to download a later version however it should be noted that some functionality may differ, and output could vary from the defined marking solutions. Whilst the Examination team endeavour to mark all alternative output, it cannot be guaranteed that every variance will be recognised.

What examinations should I have passed before sitting CS1 and CS2?

Students do not have pass any other examination prior to attempting CS1 or CS2. However the syllabus for CS1 lists a number of foundation topics such as summarizing data sets, basic probability theory and random variables. These topics are assumed knowledge for CS1 and you may wish to ensure you are familiar with them before studying for CS1. Furthermore because CS2 builds on many of the principles covered in CS1, you may wish to ensure you are familiar with the topics covered in CS1 before studying CS2.

Candidates are advised that Formulae and Tables books may be required for these assessments. Whilst copies of these will be made available in examination centres for the A papers Candidates may use their personal copies for the online B examinations. You can purchase your copy through the e-shop at:

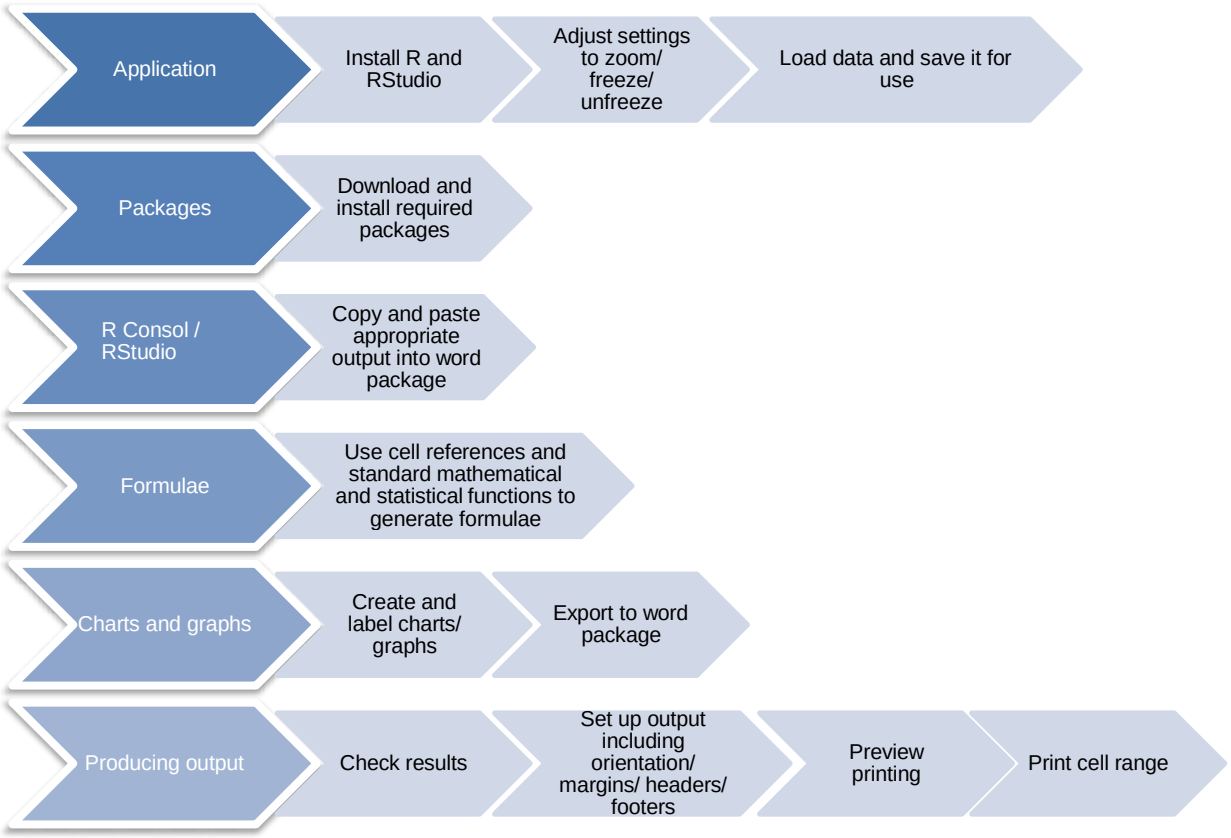
https://www.actuaries.org.uk/shop

I want to sit the examination. What do I need to do?

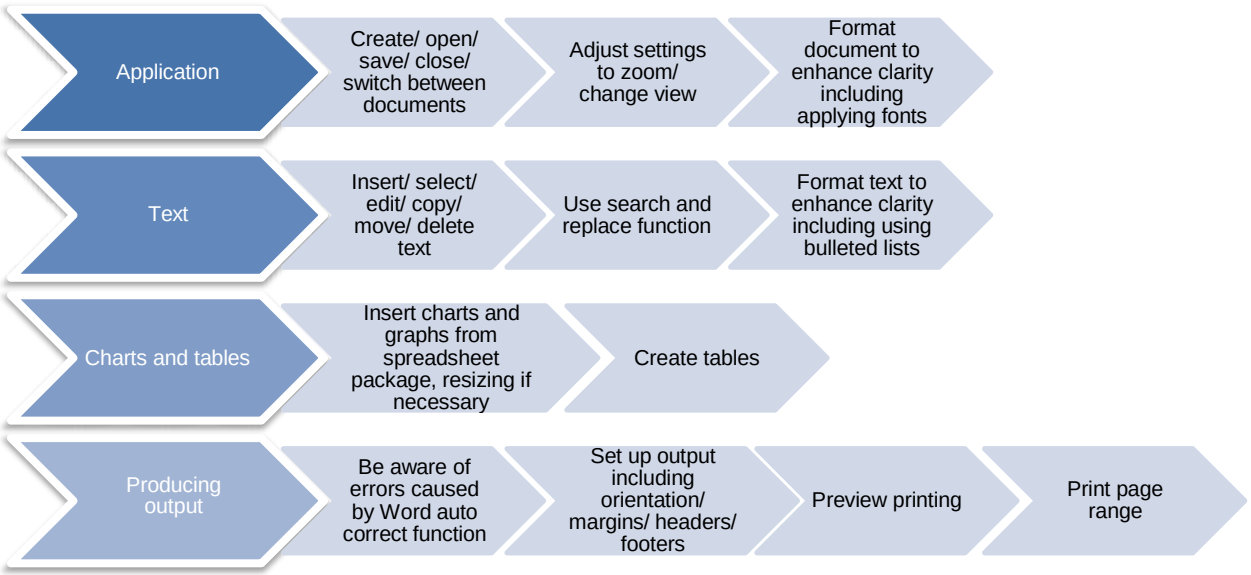
Information can be found on the IFoA website:
https://www.actuaries.org.uk/studying/exam-bookings

What should I know before sitting CS1 and CS2?

R and RStudio



Word Processing



- You must include the R code that you have used to obtain your answers, together with the main R output produced, in a Microsoft Word file.
- When a question requires data to be simulated or generated in R, you do not need to paste the individual values of the generated data into the Word file, unless specifically instructed to do so in the question.
- When a question requires a particular numerical answer or conclusion, this should be explicitly and clearly stated, separately from, and in addition to the R output that may contain the relevant numerical information.
- All graphical output generated in R should include appropriate titles, axes labels, and where relevant, legends.
- Relevant comments should be provided when instructed to do so in the question.
- You should start the answer to each question on a new page.

Final grading

The CS examinations will assess a candidate's overall performance over both papers. A Candidate, therefore, does not have to produce a pass standard for each separate paper, but does need to demonstrate a pass standard overall. Marks for the two elements of assessment for CS1 and CS2 will be combined and a single mark awarded for each subject.