Exam S: Reviewing Past Sittings and Expectations of the Future

By Kristen Leigh Schuck, ACAS, Candidate Liaison Committee

Over the past few years, the coverage of life contingencies and statistical models topics has shifted from Exam 3L to separate Exams LC and ST. Last year, these topics were combined again in Exam S. The learning objectives with each version have been similar, but the latest syllabus introduces candidates to generalized linear models and time series analyses. Each time that there is a significant alteration, there is a learning curve for candidates as they learn the new material and try to anticipate the types of questions that may be asked. Just as candidates study prior exams to improve their performance, it is also important for the CAS to learn from prior sittings in order to improve future offerings and deliver the best product it can to candidates.

Overall, candidate survey responses from the first two sittings indicate that Exam S was well received, with most candidates indicating that the questions were clear and the length was reasonable. Of course, there is always room for improvement. With time, the CAS and candidates are learning from each other and both parties refine expectations of what can be tested. One example of this is the questions tested thus far from Sections C and D of the learning objectives (generalized linear models (GLMs) and time series with constant variance) where questions have been narrowly focused. You may see problems in the future from a wider variety of topics as the exam writers better learn how to create questions from the syllabus material. You may also see tweaks to particular wording in the Learning Objectives and Knowledge Statements to fully describe the goals of the exam.

When evaluating the success of an exam, the Syllabus and Examination Committee consider the feedback in the exam survey in addition to other data points. "In general, we look at the survey results in conjunction with the pass mark panel review of the exam to see if there is consistency on the difficulty of the exam and overall length of the exam," said the leadership of the Syllabus and Examination Committee. "We find the candidate challenges to the exam to be an effective source of feedback too and we review these carefully to make sure the exam is graded fairly. When a candidate is challenging a solution, it is most effective to provide a detailed alternative solution. When challenging the validity of a question itself or suggesting that the wording is too vague, it is most useful to identify the specific phrase or sentence that makes the question invalid or describe in detail how the question can be interpreted in more than one way."

The main critique of new exams from the candidate's perspective is a lack of practice problems. With well-established exams, one can use past exams as a study resource. With Exam S, there are some topics that have not been previously tested and therefore do not have a large bank of problems. However, even with "seasoned" topics, candidates should be careful not to over-rely on prior questions, since questions are not created based on previous exams but rather based on the syllabus readings. In the near future, exam writers could create questions based on a broader range of the syllabus and increase the depth of questions, so it would not be wise to expect the same distribution of learning objectives or the same difficulty level as prior S exams. Even after there have been more sittings of S, you could still receive a question

iCAS Predictive Analytics Credential

By Rachel Hunter, FCAS, Candidate Liaison Committee

At the November 2015 Annual Meeting, CAS leadership announced the creation of The CAS Institute (iCAS). The CAS Institute has been created to fill the increasing demand for highly specialized quantitative skill sets in P&C insurance. The CAS specifically recognizes the increasing demand for data science and predictive analytics in solving actuarial and business problems across many aspects of insurance operations. While not all actuaries will need these skills, The CAS Institute addresses and recognizes the need for a community of skilled practitioners with both insurance and technical knowledge.

The first task of The CAS Institute has been to assemble a panel of subject matter experts and start work to develop an inaugural credential for data science and predictive analytics. The panel surveyed employers, actuaries and insurance data science practitioners in early 2016 to help guide the requirements. The credential targets both actuaries who wish to learn these quantitative techniques and experienced data science practitioners who wish to learn insurance fundamentals and demonstrate that they can apply their technical expertise in the context of insurance problems.

The high-level requirements for the credential were shared in the July/August issue of the *Actuarial Review*. The credential will require the completion of four components to demonstrate knowledge and competencies in data science and predictive analytics:

Topic	Assessment Method
1. P&C Insurance Principles	Online module and exam
2. Data Concepts, Tools, and Visualization	Computer-based exam
3. Predictive Modeling — Methods and Techniques	Computer-based exam
4. Predictive Modeling Application Project	Individual project

The P&C Insurance Principles online module and exam will be waived for those who have credit for both CAS Online courses 1 and 2 and CAS Exam 5. Likewise, an Experienced Practitioner Pathway is being designed to award the credential to those who are already well-versed in applying data science and predictive analytic techniques within the insurance area.

The requirement of a predictive modeling application project is a new assessment method being developed by The CAS Institute. This will allow candidates for the credential to demonstrate that they are able to synthesize and apply knowledge to solve a real business problem. Subject matter experts continue to work on detailed learning objectives for each topic. These learning objectives are expected to be released later this year.

Current candidates working toward ACAS or FCAS should view the credential as an opportunity to develop and demonstrate additional skills after completing their exams and becoming CAS members. The credential provides a new pathway to demonstrate ability in predictive analytics if on-the-job learning opportunities do not exist. It may also become a desirable way to show readiness in what will surely become a more competitive predictive analytics job field.

In addition, The CAS Institute intends to develop an interactive community around data science and predictive analytics. Even those without the credential will be able to learn and share. The intention is that this will lead to the development of shared best practices and techniques for data science within the industry. The CAS Institute plans to provide continuing education opportunities for actuaries and other practitioners of data science within the P&C insurance industry along with research and other learning opportunities.

If you would like to learn more, please visit The CAS Institute website, TheCASInstitute.org. If you have additional questions about the new credential or The CAS Institute, contact the Candidate Liaison Committee or visit our blog to discuss more. Your questions or comments may inspire future *Future Fellows* content. **f**

Spotlight on Non-Trad: Actuarial Research and Development

By Isabel Ji, Candidate Representative to the Candidate Liaison Committee

In recent years, more and more actuaries are taking on roles outside of traditional spaces such as pricing and reserving -- perhaps as a consequence of growing external recognition of the versatility of actuarial professionals. An example of "non-traditional" work is actuarial research and development (R&D). *Future Fellows* conducted an interview with Claude Nadeau and Katie Kerckaert to learn more about their roles in the R&D sphere.

Claude Nadeau, ACAS, is an actuarial consultant at Intact Lab. He graduated from Laval University and has 12 years of P&C actuarial experience in commercial lines and R&D.

Katie Kerckaert is an actuarial analyst at Intact Lab, and a graduate of the University of Toronto. Prior to joining Intact Lab, she completed rotations in national personal lines costing and pricing.

Intact Lab is the Montréal-based centre for digital excellence of Intact Financial Corporation. It focuses on developing world-class digital solutions to provide Intact customers with an unrivaled service experience, and brokers with industry-leading business solutions.

Future Fellows: What does "research and development" mean in an actuarial/insurance context?

Katie: The actuaries that work on traditional actuarial teams have a lot of day-to-day tasks to deal with and problems that they have to quickly solve, which means that they don't usually have time to step back and think long term about topics like climate change or customer behaviour. They can't really let their minds go there because they have to think about implementing the next rate change, and doing things that are more pressing. In R&D, we don't have to deal with that, so we have the chance to sit back and really think about how we can innovate in the long run.

Claude: When you look at the normal operation of an insurance company, regular actuarial teams are often caught up in day-to-day production issues and answering questions from different people related to their business unit. These interruptions make research possibilities and time devoted to development rare. A research department is like a fast track for that because you have people who are dedicated to testing and trying new things, adapting ideas and concepts to different needs and making them available afterwards to the other business units.

FF: How did you get into this role?

K: To be honest, it was time for me to rotate teams – I had just moved to Montréal from Toronto, and they were moving my team to Toronto and I wasn't ready to move back! I applied for an R&D job posting, went through two interviews, and got the job. Employees have opportunities to rotate into other roles within the company, including in R&D.

C: For me, it was a bit different. Getting into R&D was a mix of luck and pursuing my interests. After working for a few years, I came to realize that I really enjoyed programming and statistical modeling. What's done in R&D is kind of a good fit for that sort of work and skill set, so I did a rotation in R&D and do not regret my choice.

FF: Standard actuarial work often involves following regulatory standards and guidelines, but R&D tries to develop new concepts that are not yet defined. What is your relationship with regulation?

C: I think it's better to look for a really great idea, and then go through negotiation phases to make it possible.

K: A lack of guidelines definitely helps! It's something that you have to eventually think about, but let's say you need to start a new project, and you're brainstorming. The best way to come up with new ideas is to not restrict yourself at all. Later, some ideas might turn out not to be possible, but the process still lets you come up with a lot of innovative ideas that are possible. Our team doesn't directly deal with regulators, but usually we talk to regional actuarial and underwriting teams, and they let us know if something is feasible or not.

FF: What roles do actuaries play in R&D?

K: On our team, we have a meteorologist, a geomatician, a software engineer, and a data scientist (and we're open to adding other professionals to our team). At the start, these people might not know very much about insurance concepts, like what frequency or severity are, so we bring our actuarial and insurance background and work with them on common projects.

C: I find that as actuaries, we have a great mix of business skills, knowledge of the regulatory environment, and technical skills that you need to have to quantify risk. When you do research, you need the business skills to sell your ideas and technical skills to make them implementable into the business. If we need specific skills to do stuff like geomatics or study the effects of climate change, we are well-equipped to work with the experts to get the information we need.

FF: How does an actuarial background contribute to your work?

C: Actuaries are really well-equipped to do cost benefit analysis. When you do research, there are so many paths to explore and so many things to try, but there are often some really great ideas that aren't worth any money in the end. As an actuary, you have a great skill set that helps you make wise decisions about which research paths to pursue.

K: We think logically and we have good problem solving skills, which helps enormously. Basic actuarial concepts like loss cost, loss ratio, and adverse selection tend to underlie many of our team's projects, so as actuaries we can bring that aspect to the team.

Spotlight on Non-Trad: Actuarial Research and Development

FF: How might your work be considered "actuarial" (or perhaps not)? Could you tell us about an R&D project that you really enjoyed working on?

K: I work almost 100 percent of the time on usage-based insurance (UBI). I am relating driving behaviour to loss cost, which is pretty similar to what a traditional pricing or costing actuary would do. The main difference is the size and structure of the data. A traditional actuary would be looking at variables like age, credit score, region, or gender, whereas for me, my database is second-by-second GPS data, so it's up to me and my colleagues to define our own new variables.

Something fun I enjoyed working on was an internal "Dragon's Den" (aka "Shark Tank" for the US crowd). We wanted to see how we could use external data to help with the company's objectives. Each of us had twenty minutes to make a pitch to use an external data source, like Facebook, YouTube, Waze, and more. We had to explain how we could use the data, how we could get the data, and how the data could be useful to the company. Then the "Dragons" (our managers) would ask us tough questions.

C: The things I've been doing in R&D are mostly related to the statistical modeling pipeline: extracting, preparing, and enhancing data. In UBI, you create variables that help you predict someone's potential loss cost. A lot of what we do is building models to segment around an objective, and evaluate the performance of the models afterwards. One project I liked was modeling the risk of hail using weather-related data because it really pushed my modeling skills. That was the point where R&D started really becoming a team with business impact. We started meeting with business units to figure out their needs. Being challenged by those people and their realities, and tweaking the model and products to suit their needs was really interesting.

FF: What's the hardest part about your job?

K: One of the most challenging things about this job (and also one of my favourite things) is the boundless opportunities. Sometimes it's so unstructured that you don't know how to actually go about it. For example, my second-by-second UBI database is amazing. I am so excited to play with this data, and there's so much that I could do with it, but at the same time, it's hard to know how to handle this absence of structure.

Another thing I find hard is that we work for all affiliated companies, all regions, and all lines of business so you never really get to be an expert on one, so that can make it a bit challenging. And every time you start a new project, you're working with a new database that someone else built, so there's that to deal with too! It's easier when it's a database that you built yourself and you know how everything works.

C: One thing I find tough from my end is keeping up with technology. Now with the incredible computational capabilities of computers, you see some really cool new implementations of models that have been around for years. If you look at what Google or Apple are doing in terms of voice recognition, you'll find that it relies on models that have been around for some time, but you needed that computational power to really make that work. Keeping up with those things is kind of challenging, but what's cool is that more and more you can find help in open-source communities that give you a glimpse of how it's done, so that kind of helps with our work.

I read a lot to try to keep pace and learn about new ideas, but there is a big disconnect between being aware of technologies in the market and implementing them. Knowing something exists is one thing, but building something useful with your knowledge…that's something else.

FF: Can you think of any drawbacks of an actuarial background?

C: There's a big discussion right now comparing actuarial science and data science. I find most data scientists have a strong programming background, and they are really skillful when it comes to implementing stuff. As an actuary, you're not really that well-equipped in terms of programming skills. It's another field that's evolving quickly that actuaries need to keep pace with.

K: In the past I have only worked with provinces that are heavily regulated in personal lines auto, so when working with less-regulated provinces on this team I have to get that regulator's voice out of the back of my mind and remind myself that I can be a little more creative than I'm used to.

C: With our background, actuaries are mainly focused on assessing risk, thinking about how things could be risky from various points of view, and sometimes that can hinder innovation. We were talking earlier about not having constraints when you try to develop things, but actuaries tend to think cautiously.

K: When we do brainstorming with the rest of *Intact Lab*, which includes marketing and IT and so on, they throw their ideas out there, but me, before I let myself finish thinking my idea, I think about all the constraints. I look at it in more of a conservative manner because that's what we're trained to do as actuaries.

C: But at the end of every brainstorming session, there's a need for a cost-benefit analysis. Actuaries may be conservative in the ideas that they throw around, but I think they're great at making ideas realistic, weighing the benefits and even finding good alternate solutions.

FF: Any final comments?

C: People often think they need awesome technical skills, a master's or a PhD to work in R&D. That's not necessarily true. With business skills and knowledge of the insurance environment, actuaries are quite useful in providing guidance for research in an insurance context. They definitely have their place with other professionals in a well-rounded R&D team.

K: The way that an R&D team can be as successful as possible is to have a variety of skills and perspectives!

Survey Results on the Methods and Deliveries for Basic Education

By Elizabeth End, FCAS, Candidate Liaison Committee

The CAS reached out to candidates in late February to get their input on alternate learning methods and validation options from what is currently being used in the CAS credentialing process. Over 600 candidates contributed their opinions on textbooks, online courses, online forums, open-ended questions, multiple-choice questions, and capstone projects. CAS leadership have been presented with the survey results and are discussing what changes to implement in consideration of the feedback. In the meantime, *Future Fellows* would like to share the general conclusions with its readers.

Using a textbook as the main source material for upper-level exams has some benefits but also some drawbacks. A single textbook uses consistent terminology and notations, and it can make it easier for a candidate to focus on and understand a topic. On the other hand, actuarial learning beyond the exams does not usually come from a textbook. Actuaries often reference different papers that have different notations, and they must infer the relationships between the separate sources. Moving towards textbooks and away from individual papers as the source materials on the exams might be a disservice to the candidates by not forcing them to develop and practice the skill of utilizing different sources. When asked directly if they thought the CAS would benefit from more textbooks covering topics on upper-level exams, more than 50 percent of respondents agreed or strongly agreed, weighing in that they think the benefits of a textbook outweigh the drawbacks.

Online courses are increasingly prevalent in today's educational sector, and the majority of survey respondents indicated that they thought online courses would be an effective way to deliver actuarial materials. Nearly 70 percent of the respondents felt that online courses should be considered for content currently covered in the VEEs and the pre-associate level exams. Although the support for online courses dropped when considering if they should be used for associate and fellowship level exams, 52 percent of respondents still thought they would be effective. Multiple respondents commented that online courses are helpful in breaking down the material into more absorbable sections and can really benefit candidates who might have a learning style that differs from the traditional "read and write" method. Some commenters were critical of the functionality of the current CAS Course 1 and Course 2, which reiterated the results from a separate CAS survey regarding those courses. (See the June 2016 *Future Fellows* article, "Online Courses – Your Feedback.") When asked if the online courses should replace exams as validation of a student's knowledge of the subject material, the feedback was split based on the content.

For foundational materials, such as the VEEs, the majority of respondents thought the online courses would be sufficient in providing validation of the student's knowledge. For Associate- and Fellow-level materials, more respondents said the online courses would not be an appropriate means to validate a student's knowledge. Those who did not feel that online courses would be an effective means of delivering content and validating a student's knowledge cited many concerns such as cheating and the appearance of material mastery being much easier with online courses than in-person courses and/or exams. Additionally, there is the perception that online courses are easier than the CAS's current educational methods, and that the implementation could diminish the value of CAS credentials. The general feeling from the survey results and comments both for and against the online courses was that online courses would be a great addition to the exam preparation materials, but they should not be a substitute for Associate- or Fellow-level exams.

The possibility of moderated online forums was also discussed in the survey. The CAS asked about whether mandatory or voluntary moderated online forums would be an effective method to deliver and drill down on actuarial concepts. Over 50 percent of respondents were against or strongly against mandatory participation in a moderated online forum. Some arguments against the mandatory online forum were time constraints, time zone conflicts, and incompatibility with one's learning style or personality type. The voluntary online forum idea was much better received, with only 21 percent against it. Comments on this topic suggested that the voluntary online forum would be very helpful to actuarial students at smaller organizations, who likely have less access to credentialed actuaries for questions and advice.

The survey asked candidates if they felt that having more open-ended questions on exams would improve the validation of whether a candidate has adequate understanding and can appropriately apply the material in practice, as well as how open-ended questions could be fairly implemented. More than half of the respondents agreed that more open-ended questions would improve validation efforts. Twenty-five percent thought that they would not improve validation, and the remainder were neutral or had no opinion. Many survey respondents commented that having more open-ended questions would require more time to answer. They also felt that the CAS would need to provide many example questions with sample solutions to fairly implement them. Some people suggested that online courses or online forums might be a good arena to

Survey Results

have a Fellow walk candidates through sample questions and the Fellow's thought process on how to answer them. Many respondents commented that the open-ended questions would need to be very clear on the graders' expectations (e.g., do they expect three arguments in support of the answer or five?, etc.). A few respondents felt that the open-ended questions rightfully put more responsibility on the student and could be a very good means to differentiate between those who have mastered the material and those who have not. Multiple respondents suggested that open-ended questions should be reviewed and graded by more people than a standard exam question, to provide more varied points of view on the responses.

The foundational exams currently include multiple-choice questions, and the CAS was interested in hearing if candidates thought they would be a worthwhile addition to the higher-level exams. The survey responses show that three out of ten respondents are neutral on this topic, and of those who do have an opinion, the majority think multiple-choice questions are good for validating knowledge but are not useful in validating whether a candidate has adequate understanding and can apply the material in practice. Some of the comments in favor of multiple-choice questions centered around the possibility of potentially saving time on the exam, alleviating the stress for those who have bad handwriting, and making the grading of the exams faster and easier. On the other hand, many respondents were against the implementation of multiple-choice questions due to lack of partial credit. These candidates felt that the dif-

ficult topics and the complexity of calculations on higher level exams are better addressed by essay questions where work needs to be shown and a small error doesn't prevent a candidate from receiving credit where due.

Lastly, the CAS collected feedback on including a capstone project as part of the CAS basic education requirements. The majority (roughly 65 percent) of survey takers indicated that they thought a capstone project would both improve candidates' understanding of the material as well as improve the CAS's validation of candidates' knowledge and application of the material. In response to survey questions about whether employers and/or other candidates should be considered as potential graders/reviewers for the projects, the majority of responders discouraged both options. Through their comments, several voiced that they think the reviewers should be volunteer CAS members. Utilizing employers or other candidates could potentially introduce bias into the grading. Additionally, this could be burdensome to smaller organizations and somewhat difficult for candidates working outside the U.S.

The CAS has given its candidates the chance to express their feelings about possible changes to the current educational process with this survey, and they are very appreciative of everyone who took the time to complete it. Any outcomes or changes that the CAS leadership may make to the methods and deliveries of basic education as a result of this survey will be reported here in *Future Fellows*. Stay tuned for details! **f**f

Exam S

that is not exactly like any others previously tested, so you can never fully prepare for the exam solely using old practice problems. This is the same reason why you should never study using third-party resources as your only resources. Please keep in mind that there are problems and solutions in the textbooks you can utilize to build your knowledge that should not be ignored. However, as a candidate, you want to fully grasp the material as much as possible and having difficult problems to increase your knowledge of topics only helps you.

With each new exam, especially those with Learning Objectives not previously tested, there are learning curves, and

Exam S is no exception. The biggest take-away while you are studying is to be prepared for questions based on the syllabus readings themselves and not solely from practice problems or third party sources. After the exam, you should complete the survey to ensure the validity of each question and the general quality of the test. This will not only serve you for the current sitting, but for all future sittings of Exam S. If you have any questions or concerns about the exam process, feel free to reach out to the Candidate Liaison Committee at http://www.casact.org/newsletter/index.cfm?fa=feedback. **f**f

Resources & Reminders

Candidate Liaison Committee Mission

The Candidate Liaison Committee communicates with CAS candidates, collectively and individually, who are taking CAS examinations. The committee informs candidates as to appropriate courses of action available to them. Through periodic communication, this committee informs candidates of results of examination administrations, actions taken on complaints received regarding examination questions and reasons for syllabus and examination changes being implemented. Communication encompasses existing policies and procedures as well as changes being considered. The committee should advise the CAS and its committees of the interests of the candidates regarding matters that come before the CAS and its committees. Candidates may contact the Candidate Liaison Committee at the CAS office address. The Casualty Actuarial Society is not responsible for statements or opinions expressed in the articles, discussions or letters printed in *Future Fellows*.

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June 2016 Examination Results

Exam	Number of Candidates	Number of Passing Candidates	Number Below 50% of Pass Mark (Ineffective)	Effective Pass Ratio
LC	31	13	2	44.8%
ST	118	88	5	77.9%
S	322	133	35	46.3%
5	838	392	35	48.8%
6 Canada	95	37	5	41.1%
6 United States	504	199	41	43.0%
7	603	226	23	39.0%
9	521	254	17	50.4%