CAS Releases Syllabi for New Modern Actuarial Statistics Exams

By Mike Boa, CAS Chief Communications Officer

The CAS Syllabus and Examination Committee has released the syllabi for two new exams that will be offered as part of the CAS's revised credentialing requirements in 2018. The new exams, Modern Actuarial Statistics I and II (MAS-I and MAS-II), will address the emerging needs of future actuaries and their employers. The syllabi, which are now available on the CAS website, outline the learning objectives, knowledge statements, and readings that will be covered by the exams.
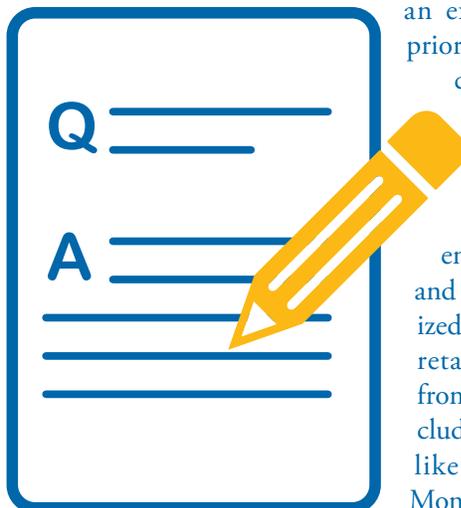
MAS-I is largely a modification of current CAS Exam S, which it will replace when it is first offered in the spring of 2018. MAS-II will replace the current CAS Exam 4 requirement that is typically fulfilled by most candidates through completion of SOA Exam C, which is being discontinued. MAS-II will first be offered in the fall of 2018.

The discontinuation of Exam C provided an opportunity for the CAS to create a replacement exam that focuses on the modern statistics that actuaries are increasingly using. This will enhance the relevance of the CAS exam syllabus with respect to emerging statistical and analytics skills, with minimal changes to the overall exam structure.

Both MAS-I and MAS-II will be four-hour exams, resulting in practically no net increase in exam hours required for CAS credentials. The exams will be offered every six months, initially as multiple-choice paper-and-pencil exams, in the same general windows in the spring and fall in which other CAS exams are offered.

The transition rules allow candidates with credit for Exam S achieved through an examination administered prior to January 1, 2018, to receive credit for MAS-I. Candidates with credit for SOA Exam C achieved through an examination administered prior to July 1, 2018, will receive credit for MAS-II.

As reflected in the syllabi, candidates should expect MAS-I to be similar to Exam S, but with more emphasis on applied modeling and a deeper coverage of generalized linear models. MAS-II will retain coverage of credibility from Exam C, and will also include advanced statistical topics like Bayesian Markov Chain Monte Carlo (MCMC) methods.

The syllabi are subject to further revisions until the changes for the 2018 CAS Syllabus of Basic Education are approved by the Executive Council and announced for MAS-I in July 2017 and for MAS-II in January 2018.

To learn more about the CAS's revised credentialing requirements, review the list of frequently asked questions and responses on the CAS website. Additional questions can be addressed to the Actuaries' Resource Center at the CAS Office at ARC@casact.org. ⨍⨍

VISIT THE FUTURE FELLOWS BLOG

Check out our new *Future Fellows* Blog, accessible through the new *Future Fellows* portal at casact.org/future-fellows. You can get the latest news, read interviews with actuaries on a variety of topics, and learn tips to succeed in the workplace. It's a great way to interact with other actuaries, including CAS leaders, by engaging in the online community.

What topics would you like the Future Fellows Blog to cover? Email your suggestions to slitrenta@casact.org.

10 Tips for Your First (or Second) CAS Meeting — *"What I should do the same and different while attending my second meeting."*

By Nicholas M. Schneider, ACAS

My first CAS meeting was the 100-year anniversary annual meeting in New York City. I was planning on attending my second meeting in Orlando last fall, but as fate and my later-identified inadequate knowledge of the exam 9 material would have it, I am currently dreaming about Austin, Texas for November 2017.

Here lies the best advice I collected before my first meeting, and what I will do differently while attending my second.

1) Still on an early exam? Look out on the CAS calendar and see future meeting destinations and start getting excited now. ("If I pass this spring, fall, and then next spring, I will get to go to a meeting in Cleveland! I've always wanted to go to Cleveland.") They pick some cool spots. The CAS took me to NYC for the first time in my life; I'm a small-town kid who had relocated to a city with a population around 100,000. NYC was a whole different experience.

2) Make a trip out of it. As my first calculus professor used to say, "Let's start a little early, so we can end a little late." A lot of employers will allow you to go early/stay after as long as the extra days are on your own dime — so make use of the drive/airfare and add some sites and days to the trip.

3) Too many conflicts? Consider holding off for a later meeting. We all know the effects that getting our letters have on our lives — buying your first house, getting married, getting divorced, adopting kids, getting a dog, changing jobs, and/or a big promotion. If you cannot attend the immediately following meeting, still make an effort to get to one of the next ones.

4) Attend a roundtable. Have a discussion, listen to others in different roles/different companies, and learn about how you can start volunteering for the CAS.

5) Seek out some old friends and make some new ones. We actuaries, per the stereotype, can be a bit socially awkward; but, more importantly, we are friendly and open to being approached and meeting people while networking. Everyone is wearing name tags to facilitate this. Take the initiative: Reconnect with the person you sat behind at your Exam 3 seminar years ago or go for a pre-meeting run with the retired chief actuary from your first employer, or even better, seek out your favorite contributor from *Future Fellows*; they know where the fun is.

6) Skip a session. Know the required sessions, and what your employer expects you to return with, knowledge and note-wise, but you are there to celebrate as well. This is a particularly good idea if you have brought a companion.

7) Print the slides for the sessions you expect to attend in advance. Having these and taking notes on them is substantially easier than writing down everything from scratch.

8) Hit up the vendor booths, but don't get more swag than will fit in your suitcase. You do not actually want the mini business supplies kit; those staplers only ever work twice. You will also want to bring your business cards — a few on hand and reserves in your room. No actuarial pun intended. (The Annual Meeting features an exhibit hall; the Spring Meeting does not.)

9) When it is photo time (Sunday night ACAS, Monday night FCAS) get in line with some coworkers or friends and try to get in the same photo. Smile. Then print the photo for the chief actuary's desk.

10) Divvy up the presentations. If there are a few of you attending from the same employer, coordinate so that you do not all attend the same sessions. Plan this in advance of the meeting.

Bonus tip — be aware of the dress code requirements for the ACAS/FCAS meetings. Youtube has you covered on how to pack a suit and avoid wrinkles (for those of us who do not travel often requiring dress up). That being said, your room will likely have an iron; but it will probably leak a little, so iron early in your stay and get that outfit on a hanger.

For more tips on attending your first meeting, visit casact.org/membership/NewMembers/index.cfm?fa=video.

After the Exam: A Behind-the-Scenes Glimpse of the CAS Grading Process

By John Klodnicki, Candidate Representative to the Candidate Liaison Committee

Exam day is over and for CAS candidates, eight weeks of waiting begins (actually seven weeks for the last exam sitting). Some candidates breathe a sigh of relief, knowing that their hours of studying probably paid off. Others feel a sense of dread towards results day and do their best to put it out of their minds. But what actually happens behind the scenes between the day of the exam and the day that the list of passing candidate numbers is released? And once the Examiner's Report is posted, what happens if a candidate disagrees with the model answer or thinks they had a valid alternative?

0-2 Weeks After the Exam — Collection and Defective Questions

After the exam, CAS candidates' long journey of studying and sitting for the exam is complete, but for the exams themselves the voyage is just beginning. All around the world, from Philadelphia to Hong Kong, the answer sheets are collected and make their way to the CAS office in Arlington, Virginia. Once all of the envelopes arrive, staff must verify that the candidate numbers on the envelopes match the numbers on the answer sheets within, and they also must confirm that the numbers match the records of the exam proctor from each examination center. The answer sheets are now ready to be sorted by question and scanned in preparation of being sent to the graders.

While the CAS staff is busy sorting through thousands of exams, candidates have a chance to voice their concern about specific questions from the exam they just took. The CAS Syllabus and Examination Committee makes every effort to provide a perfect exam, but in rare cases a typo, ambiguity, or other flaw may be present in a question. If a candidate feels that a question was defective, they are invited to write to the Syllabus and Examination Committee within two weeks after the examination. Members of the committee will review the model solution(s) that was provided to them and determine if there are any modifications that are needed. They will also carefully review every comment and decide if they need to take action. In some cases, the model solution(s) may be altered in order to accept an additional answer, or the question may be considered defective and not counted at all. Sometimes, the syllabus may even be changed for future exams in order to eliminate confusing or contradictory information in the source material.

2-5 Weeks After the Exam — Initial Scoring

In order to maximize the consistency in grading for CAS exams, the scanned answer sheets are sorted by question and every answer sheet for a given question is sent to a team of graders. First, each of the graders independently scores around 20 of the responses, using the model solution and their own knowledge. Then, they compare these initial scores between themselves in order to establish a consistent grading scale for the question. Once they agree on the scale and how to interpret the model solution, the graders independently assign scores to each of the responses. The graders compare their scores for each response and must ensure that the scores are within a certain margin of consistency. If not, they will have to discuss the grading of that response further in order to come to a consensus. Finally, the graders record all of the scores for their question in a spreadsheet and send them to the Syllabus and Examination Committee.

5-6 Weeks After the Exam — Grading Session and Final Pass Mark

During this time, the Syllabus and Examination Committee, along with all of the graders for every CAS exam, meet in person for the grading session. The graders make modifications to the proposed solutions and provide sample responses as well as common mistakes, which will eventually be published in the Examiner's Report. Once again, the graders review their assigned questions in order to determine what score a minimally qualified candidate (MQC) would achieve on that question. While a MQC score for each question is established during the construction of the exam, the graders may feel that it should be adjusted based on the hundreds of responses and solutions that they have studied (See December 2013 *Future Fellows* article for more detail on establishing a MQC score). Similarly, the pass mark for the exam was established months before, but the Examination Committee now has a chance to potentially revise it based on adjustments to the MQC score from the graders, any unforeseen solutions or defective questions, and modifications to the grading rubric. At this point, the candidates' scores are compared to the pass mark, and any exam whose score is within a certain range from the pass mark automatically triggers further review. For these close candidates, each question is reviewed one final time by the graders, who must reach an exact agreement on what score the candidate deserves. Once all of the scores are compiled and the grading session is complete, the chair of the Syllabus and Examination Committee will give a detailed explanation of the exam and results to the CAS vice president of admissions as well as the Canadian Institute of Actuaries representative, who will give the final approval of the pass mark.

6-9 Weeks After the Exam —t Results Release and Appeals Process

Approximately seven to eight weeks after the exam, CAS candidates will receive an email with a randomly generated URL to a webpage containing the candidate numbers of those who passed the exam. About a week later, all candidates, including those who passed, will be sent their numeric score (0-5 is failing and 6-10 is passing), and the examiner's reports will be released on the CAS website. CAS candidates can now access their official grade report by logging into

their CAS profile. The release of the examiner's reports triggers the final phase of the exam results process: appeals. Candidates have two weeks from the release of the Examiner's Report to appeal questions on the exam. Appeals must pertain to a specific question from the exam, and can either explain why the model answer from the examiner's report is incorrect or why the candidate believes that their alternative solution is also correct. Candidates must give a detailed explanation in either scenario. Once the appeal is received, the graders for that question along with the Syllabus and Examination Committee will review the explanation, and the decision they reach on a score will now be now final. The grading process for this round of exams is complete, but it will start over again in about four short months! **ff**

Location, Location, Location

By Elizabeth End, FCAS

An often overlooked aspect of the actuarial exams is the exam site. It is given consideration when you are registering for the exam, and then it becomes completely secondary to learning your exam materials and working problems until a couple of days before the exam. At that point it enters the picture again; you start to plan out your route to the location and go shopping for some new ear plugs. You might torture yourself by recalling stories of exam site mishaps (like the fire alarm going off in the middle of the exam), but really, all you can do is keep your fingers crossed and hope for the best — an unobtrusive proctor, a quiet room, a steady table and a clock that you can see. To shed a little light into the world of CAS exam sites, *Future Fellows* reached out to CAS Examinations Coordinator Bob Craver.

Simply enough, "Exam sites are generally chosen by need," said Craver. The locations used are those that have actuarial students needing a place to take their exams and volunteer CAS members who are willing to proctor. Many times a company will volunteer to host the exams, thereby providing the space and the staff. Otherwise, the CAS will arrange a location and will reach out to local CAS members to administer the exams. In the continental United States, the CAS tries to have an exam site within an hour and a half drive for each candidate. According to Craver, outside of the U.S., the sites are set-up where "candidates tend to cluster. However, there may only be one site in a given country." The designated exam space needs to accommodate the number of exam takers in the area, which can vary quite a bit. The largest sites are in New York City and Toronto, which may see up to 70 candidates for a single exam. Chicago is another large location, which could have 40 exam-takers sitting at one time. Some sites may have just a handful of students who are taking exams.

Despite the differing numbers of exam-takers, the exam sites are all given the same instructions in terms of administering the exams. Additionally, Craver said he "always tell[s] the proctors, as they've taken the exams before, to try to make their site the way they would have wanted it when they were candidates." Craver also encourages sites to follow the philosophy of "the more space the better," for the candidates, but quarters can still feel cramped at times due to different circumstances. Exam locations change often, and some preferred spaces aren't always available on a consistent basis.

Bob Craver

If you have feedback on your exam location, you are strongly encouraged to share it via the post-exam survey. The survey gives candidates the means to confirm excellent sites and to provide feedback on site improvements. As the examinations coordinator, part of Craver's responsibilities are to "look at the data from the exam surveys and determine if there is a consistent problem happening at the site either on a continuous basis or for a given sitting." Since the surveys are anonymous, though, the students need to identify the exam site they are commenting on in the free form survey response. Without including the exam location, little can be done. However, when candidates include the site name and there has been a problem at the site, "it usually becomes very clear as the same story keeps appearing repeatedly. If it is determined that there is a procedural issue at the site, then they are contacted with the data from the surveys and given a chance to make necessary adjustments." Although students can provide feedback on any issues at their exam location, some recurring problems such as "outside construction noise, fire alarms, traffic, parking or weather" are beyond the CAS's control.

If your company is interested in becoming a CAS exam site, please have a company representative reach email Bob Craver at bcraver@casact.org. **ff**

Underwriting Applications of Predictive Analytics

By Rachel Hunter, FCAS, and Ling Tan, FCAS

As predictive analytics has become more common within the insurance industry, actuaries and data scientists are often getting involved in predictive modeling projects outside of traditional pricing and reserving applications. Involvement in these projects can expand an actuary's knowledge of the business and challenge them to address new problems. One area where actuaries have historically been consulted is in underwriting. The underwriting process typically includes the correct classification and pricing of risks as well as evaluating the acceptability of risks within an insurer's appetite guidelines. In this article we look at a few areas where predictive analytics could potentially help insurers make better decisions in underwriting beyond pricing.

During the submission and risk selection process, insurers would like to identify customers with high profitability potential from its list of new customers, and then prioritize the quoting process to actively target those profitable customers. To achieve this goal, insurers can use historical exposure information and insurance performance as inputs from their current customers, choose a metric to be optimized such as loss ratio or combined ratio, and build a supervised model to predict this metric. In this application, robust machine-learning techniques such as gradient boosting, random forests or neutral-network can be used as a powerful tool for the prediction model given the flexibility of the techniques to account for non-linear relationship and interactions. Because prediction accuracy has the highest priority in this application, these more sophisticated modeling techniques are expected to yield the best outcome, as opposed to techniques that are easy to interpret an underperforming in prediction accuracy, such as linear regression. Insurers can then optimize its selection of customers based on the predicted metric, e.g., top 20 percent customers with lowest predicted loss ratio or combined ratio.

As an enhancement to the above application, insurers can introduce survival analysis (retention analysis) for each customer in the list, and vary the expense assumption over the analysis period (acquisition cost vs. retention cost), so that insurers can have a long-term expectance of profitability for each customer based on the likelihood of the customer staying with the insurer over time and the customer's expected combined ratios with varying expense assumptions over time. Not only can insurers apply this model at the time of customer prospecting to target selected customers with highest profitability expectancy, they can also apply this model when quoting a customer (new or renewal) to have an indication of future profitability, which may lead to other pricing decisions, such as rate decrease for a high-value customer or nonrenewal for a low-value customer without breaching compliance requirements.

We mentioned the need to appropriately classify risks when underwriting. This can be very difficult to do for many commercial lines coverages such as general liability where the nature of different business type classifications can be somewhat nuanced but result in dramatically different risk exposure. A model to help identify accounts that are more likely to be misclassified can help the insurer focus manual review efforts on the accounts that would add the most value. This model would normally result in a binary classification of "needs review" or "does not need review" but the model output is often in the form of a score. To result in a classification of what to review, the insurer needs to choose a cutoff score to distinguish which risks to review. A useful tool to help select the cutoff where the model will deliver benefits is the confusion matrix. The costs/benefits of each of the four possible outcomes of correct versus incorrect classification can be combined to measure net benefit, with knowledge of the model accuracy at different thresholds, in order to choose a cost-effective cutoff. Even a very good model requires careful review of the threshold when the aim is to classify.

		Model Identifies Misclassification	
		Yes	**No**
Actual Misclassification	**Yes**	True Positive	False Negative
	No	False Positive	True Negative

In addition to identifying the most profitable customers, an insurer needs to clearly identify those customers who potentially have exposures that are beyond what is contemplated for typical risks in the classifications an insurer is offering.

Another concern for commercial lines carriers relates to the heterogeneity of businesses even within well-defined classifications. An insurer may have a very sophisticated pricing model capturing many variables correlated with expected costs but still not have enough granularity in the models to accurately price for the specific characteristics of all applicants. In this case it is typically the role of the underwriter to review the risks for acceptability, but reviewing all policies in detail is not cost-effective. The target variable of such a model would need to be some measure of extreme loss ratio probability determined by the company's appetite. Because there is so much heterogeneity

Candidate Experience: Consulting Firm vs. Insurance Carrier

By Agatha Caleo, Candidate Representative to the Candidate Liaison Committee

Acommon question asked by candidates searching for their first actuarial job is, "Should I work for a consulting firm or a traditional insurance carrier?" In *Future Fellows* December 2008 & March 2009, we addressed several myths about the similarities and differences of consulting firms vs. insurance carriers from the points of view of long-term actuaries. For this article, we decided to interview people at an earlier point in their careers: candidates.

Dan DiMugno, ACAS, has worked for insurance carrier Travelers for five years in a variety of roles. Ken Steinhauser has been a consultant in life and annuities for Oliver Wyman for two years. In his five-year actuarial career, Manpreet Mann has worked at both a carrier and a consulting firm, first at The Hanover and now at Aon. All have reached or are very close to achieving Associateship in their respective actuarial societies and are active in their companies' student programs. All three of our candidates sat down together to talk about their personal experiences.

Which has the best environment for passing exams?

Our candidates felt that while there were differences in the study culture between a consulting firm and an insurance carrier, one was not necessarily "better" than the other. While number of study hours was similar, how each candidate scheduled his study time varied. Steinhauser said of studying at a consulting firm that "people who are most successful at it around here build a lot of buffer into their study schedules." Mann agreed that a buffer is necessary to allow for flexibility when client needs arise, stating, "There are situations where if you're studying and a client calls you up or a broker calls you up, you'll have to take the call and put your study time on pause, but you can always get back to it at a later time…In general, we're able to use our study time as we need to." In contrast, at a carrier, DiMugno's study time was a little more structured, generally two hours each day during exam season. He said that if an important meeting comes up months before the exam, he generally adjusts his study schedule and attends the meeting, but as the date of the exam approaches, focus shifts and "study time takes priority over certain work items."

Everyone agreed that their study time was respected by colleagues and supported by management. Most of their co-workers are taking or have taken actuarial exams and are very understanding of the process. Steinhauser took it a step further, explaining that "a consultant spending hours studying is a tangible investment for a consulting firm and so I think from that

Left to right: Dan DiMugno, Ken Steinhauser and Manpreet Mann.

standpoint the good managers … realize that getting people all their study time and making sure that everyone's passing exams on the first try is the most efficient way to run the business." "It's not just management that wants you to pass but each other as well," added DiMugno. "There's no cut-throat type of feeling."

Which has the best training program?

Our candidates agreed that training at an insurance carrier is more formal. Carriers can often provide targeted training because their candidates are working on more focused tasks. They then use formal rotation programs to expand the breadth of a candidate's knowledge. Steinhauser said candidates in consulting tend to get "thrown onto live work and pick it up as you go." Neither he nor Mann had formal rotational programs at their companies. "However," Mann explained, "we do work with a lot of different products and get to work with different people as well, so we are able to see different areas of the profession." If candidates' learning styles do not match the company's training philosophy, they can still be successful; they might just have to work a little harder.

Which has a better work-life balance?

DiMugno says work-life balance is part of the culture at his carrier, but it may be a function of the large pool of actuaries; greater ability to spread the work around makes this "possibly more of a large carrier thing than a carrier thing," he said. "Work-life balance is sort of an individual concept," stated Steinhauser. While he agrees that the "hours tend to be a little bit longer or a little bit less predictable," it appears the stereotype of the overworked consultant is false, at least in this case. Mann said when he moved from carrier to consulting firm, he traded a more structured schedule with fewer hours for a more flexible schedule with occasionally longer hours. Client needs must be met, but he can always ask for help from other analysts if the

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work starts to overflow.

How is the work different?

The work can vary drastically. It is less about consulting vs. carrier and more about the exact position you are assigned. DiMugno has been in a rotational program at Travelers, with jobs ranging from auto reserving to profitability analysis for international markets. Steinhauser builds models for life- and annuities-related products for Oliver Wyman's clients. At The Hanover, Mann worked in workers' compensation ratemaking, including state filings; while at Aon, he spends most of his time in reserving for various casualty lines. As you can see, Mann's consulting position at Aon is more similar to DiMugno's reserving position at carrier Travelers than what Steinhauser does at consulting firm Oliver Wyman.

On the other hand, there are some common themes to the consulting vs. carrier work environment. Two examples are personal interaction and travel. As a consultant, Steinhauser spends about half his week away from his office working on-site at client offices. Mann, also in consulting, travels only occasionally but spends much of his time interacting with clients, both external and internal (such as brokers). As an analyst for a carrier, DiMugno spends a similar amount of time interacting with people, but they are all on internal company teams (claims, advanced analytics, etc.).

There are some general differences between working for a consulting firm or an insurance carrier, but it seems that where it matters most, conditions are comparable. Much more important is job description. Therefore, it is a good idea to keep options open and refrain from narrowing the job search too early by eliminating either consulting firms or insurance carriers from the pool of potential employers. Instead, a candidate needs to carefully evaluate each job on its individual merits.

Resources & Reminders

Use the CAS website for the following resource tools:
- CAS *Syllabus of Basic Education* and updates
- "Verify Candidate Exam Status" to confirm that joint exams and VEE credits are properly recorded
- "Looking at the Exam Process" series
- Feedback button to the Candidate Liaison Committee
- Feedback button to the Examination Committee
- CAS Regional Affiliates news

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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Underwriting Applications of Predictive Analytics

and potentially different indicators of potential risk for each of the company's rating classification, a typical GLM structure as used in pricing may not be appropriate. A common technique that is already well-proven in other industries and applications is to apply random forest modeling to the data. This technique combines a large number of decision tree models to avoid the typical over-fitting problem found with traditional decision trees, whereas it takes advantage of tree models to capture complex data relationship.

As with many data science problems, an important role for the actuary in the underwriting process is to help define the business objectives and costs to be considered in the models. This can include giving feedback on model effectiveness measures and target variables but may also extend to the actuary applying the modeling techniques and providing final recommendations for model implementation. ff