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Letters

(Continued from page 5)

obtained my C.A. (Chartered Accountant) designation prior to qualification as an FSA. Also, unlike Mr. Roeder, my undergraduate degree was in commerce, but I did include several actuarial science courses in my program, and as a result, I had passed the first four parts by graduation.

I have to agree with Mr. Roeder that the major difference in the exams is in the breadth of the material. This should be expected since the entire scope of the accounting syllabus (including auditing, taxation, professional ethics, financial reporting, etc.) is tested in four consecutive days, whereas the actuarial material is spread out in neater (and often more difficult) little chunks.

In Canada, the accounting exams are normally all essay type questions, as opposed to the blend of essay and multiple choice to which actuaries are accustomed. Furthermore, the accounting questions are often not as well directed as the actuarial counterparts. Indeed, marks are often allocated to the correct identification of the problem!

In terms of preparation time required, CA students usually begin their study schedule approximately one year in advance of the exams. For the actuarial exams at the Fellowship level, I generally found 3.5 to 4 months prior to the exam to be a suitable starting date.

Although I was probably too busy to notice, during the CA exams I failed to observe people "aimlessly walking around with a cup of coffee". Quite to the contrary of Mr. Roeder's experience, I usually felt much time pressure, especially in comparison to the multiple choice papers of the Fellowship exams where it is not uncommon to find people handing in their papers early (and still passing). I can only conjecture that in the U.S., where it is my understanding that partial credits may be obtained by passing, say, two out of the four papers, some candidates put all their emphasis in passing those two days, and wait until the next sitting to pass the remainder. In Canada, partial credits are not available, and so a somewhat more consistent performance is required on all four days.

As Mr. Roeder noted, the number of people attempting the accounting exams

(Continued on page 7)

Exam Memories

Sir:

For my solution to Henry Unruh's problem, I place the black balls on the line and make the following observations:

(1) Each of the $m-1$ spaces between the black balls will produce 2 contacts if occupied by one or more white balls; and the space at either end will similarly produce 1 contact, and

(2) The number of different ways of distributing n white balls in j of those spaces, none of the j spaces to be empty, is $C(n-1,j-1)$.

Let NC be a random variable equal to the number of contacts. Then it is not difficult to show, using (1) and (2), that

$$\Pr(NC=2j) = K[C(m-1,j)\cdot C(n-1,j-1) + C(m-1,j-1)\cdot C(n-1,j)]$$
$$\text{and } \Pr(NC=2j+1) = K[2C(m-1,j)\cdot C(n-1,j)]$$
where K is the reciprocal of $C(m+n,m)$

So much for the easy part of the problem. My solution to the rest of Henry's problem is very long, so I will give only the results.

Start by defining the quantities k and r as follows:

$k = [mm/(m+n)]$, where the brackets indicate "largest integer in"
$r = m + n - 2k$

It can be shown that at least one of 2k, 2k + 1, and 2k + 2 must be a modal value, and that 2k − 1 is the only other possibility.

Algebraic manipulation of the two probability expressions above will yield the following:

$$\Pr(NC = 2k) = A\cdot rk/((m-k)(n-k))$$
$$\Pr(NC = 2k+1) = A\cdot 2$$
$$\Pr(NC = 2k+2) = A\cdot(r-2)/(k+1)$$
$$\text{where } A = C(m-1,k-1)\cdot C(n-1,k-1)\,(m-k)\,(n-k)\,/\,k^2\cdot C(m+n,\,m)$$

Hence the modal value(s) among 2k, 2k + 1, 2k + 2, can be found by finding the largest values among the three quantities above. (In finding this largest value it is not necessary to determine A). 2k − 1 will be a modal value only if m = n and is even, in which case all of m − 1, m, and m + 1 are modes.

A more interesting question is what combinations of modal values are possible, and for what values of m and no do they occur? Here is a report on my progress so far (and the probability of further progress appears low).

(1) The distribution must be unimodal, bimodal, or trimodal (never more).

(2) It will be trimodal in only two circumstances, (a) if m = n and is even, as before noted, or (b) if m and n are integers of the form $2(2q-1)(q+1)$ and $2(2q+1)(q-1)$, where q is an integer greater than 1. Here the modal values will be 2k, 2k + 1, and 2k + 2. The first few values of such (m,n) are (18,10), (40,28), (70,54), etc.

(3) The distribution can be bimodal at 2k and 2k + 1, at 2k and 2k + 2, or at 2k + 1 and 2k + 2. These are the only possibilities.

(4) The distribution will be bimodal at 2k + 1 and 2k + 2 if and only if m + n = 4q, q is a positive integer, $m \neq n$, and $2q - \sqrt{2(q+1)} < n < 2q + \sqrt{2(q+1)}$. The first few examples here are (3,1), (5,3), (6,2), (7,5), (8,4), (9,7), and (10,6).

(5) It is surprising that the distribution can be bimodal at 2k and 2k + 2. A computer run indicated that, for m and n each less than 1000, there were only 6 such cases, namely, (144,45), (385,145), (399,252), (455,203), (741,416), (868,412). At (144,45), k = 34, the modes are at 68 and 70, and the probability of 68 or 70 contacts is 70% greater than the probability of 69!

(6) A few examples where the distribution is bimodal at 2k and 2k + 1 are (9,5), (10,7), (20,14), (27,22), and (30,21).

(7) The distribution will be unimodal at 2k + 1 if m = n and is odd. In that one case, $k = (m-1)/2$, and the unique mode is at m.

(Continued on page 7)

Comparing Actuarial Exams

(Continued from page 6)

is significantly greater than those sitting for actuarial exams. I made it a point of visiting the CA exam site a couple of weeks prior to the first exam day in an attempt to reduce the sensation of being overwhelmed by the size of the arena.

Both the accounting and actuarial professions are rightfully demanding in their exams for admission, and in the final analysis, the feeling of isolation is about the same when you're locked up in a room studying and missing out on the World Series or Stanley Cup playoffs. Neither profession has an easy path for admission, and of course, the responsibility for professional development continues long after the diplomas are framed and hung proudly on office walls.

Ben Mackler

Exam Memories

(Continued from page 6)

As you can see, I left a few holes for others to fill. As a final comment, let me express the hope that Henry Unruh has forgotten all the other problems from the old exams.

Walter Shur

Editor's Note: Mr. Shur tells us that he agrees with most, but not all, of the Arvanitis analysis (April). Although the even-number-of-contacts equations are correct, it is not possible to determine the even-distribution mode by comparing P(2k) with P(2k − 1). For example, if m = 4, n = 3, M(k) = (7 − 2k)/2k, making the critical largest k = 1, and suggesting that 2 is the mode of the even distribution. While 2 is the last even contact more probable than the next preceding odd, 4 is the last even contact more probable than the next preceding even — and hence the mode of the even distribution.

Exam Memories

Sir:

I wonder how readers' solutions to the "m-black and n-white ball problems" would compare with the "official" solution in the 1938 "Problems and Solutions" published by the Society's predecessor organizations. As I remember the solution was lengthy, with characteristics of the Arvanitis and Shur analyses. Surely solving this problem in roughly 18 minutes under examination conditions was a pretty tall order.

Henry Unruh

Editor's Note: With the publication of Mr. Shur's lengthy analysis, and Mr. Unruh's short comment, *The Actuary* now takes a breather as to this exasperating probability problem. Before we do so, however, we wish to acknowledge recently received letters from Michael Gastineau and Jack Elkin; and a further analysis from Ernest Arvanitis.

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Sir:

I really enjoyed the March article. I, a recent ASA and a new employee of a "Big 8" accounting firm, have often been asked to compare the CPA exam to the actuarial exams and have found it difficult to respond. I feel I will be more able to compare the Fellowship exams with the CPA exam, as they both consist of multiple choice and essay questions. However, after completing the first five exams, I am a little disappointed with Mr. Roeder's analogy.

Are we actuarial students, or former students, actually "Actuarial Gods" — able to withstand the toughest questions on the "Ten Toughest Tests" in the universe? I hardly believe this to be true and in defense of my "CPA brethren", I'd like to make a few points for the CPA exam.

(1) Are calculators allowed to be used on the CPA exam? No. Lord knows how we actuaries could pass an exam without our "Official Society Calculator".

(2) The actuarial exams are for one day and the longest are in total 5 hours. This is a far cry from 2½ days of testing with the "Accounting Practice" sections alone consisting of 5 straight hours.

(3) If the CPA examination room is really the atmosphere of a Van Halen concert, wouldn't it be easier to concentrate taking an actuarial exam — whose acoustics could be compared to the Mormon Tabernacle — than taking the CPA exam?

One further comment, my hat is off to Mr. Roeder who passed the exam by occasionally studying between innings of the Tiger-Padre series. I went to a well known accounting university which has a CPA review course and a fine record of passing, on average, 60% of its students on the first try. I studied just as hard for the CPA exam as for any of the first 5 actuarial exams and found myself passing with only a few points more than the magic 300.

My point is that the actuarial exams may be tougher than the CPA exam in a lot of ways, but the CPA exam is by no means like a "10-point quiz". The accounting profession and CPA's are highly regarded in the business world and they've earned it. The actuarial profession is also regarded very highly, but is no better or worse than the former. And as the old joke goes — "An actuary is just an accountant who found accounting work *too* exciting".

John Christensen

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Sir:

I was fascinated to read Rick Roeder's comparing of actuarial and CPA exams.

I was, sadly, fairly "senior" when I took both the C.P.A. and the actuarial exams. However, I had no formal training in either (beyond my mathematics background): i.e., no actuarial or accounting courses. I would like to add these observations:

1. There is no doubt the actuarial exams are tougher (for one thing, there are ten of them; it is possible to pass the CPA all at a swoop as I, and presumably Rick, did).

2. Starting from scratch, it took me two years to prepare for the CPA exam. It took two and a half years to get my A.S.A.

(Continued on page 8)