Augarithms

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The new fall schedule is revealed...

Mathematics Colloquium Series

Unless otherwise indicated, colloquia are held Wednesdays from 3:40 - 4:40. Refreshments are provided.

Sept.	14	Kenneth Kaminsky, Augsburg College
	28	Stephen Willson, Iowa State University
Oct.	12	Juan Pablo Trelles, Univesity of Minnesota
	26	Blake Boursaw, Augsburg College
Nov.	**→ 9**	**Jennifer Geis, Augsburg College**
	30	Mary Laurel True, Augsburg College

This week's speaker

Option Pricing Made Cents
By Jennifer Geis

Jennifer Geis

Jennifer Geis is a senior mathematics and actuarial science major at Augsburg College. Over the past summer, she had the opportunity to go to North Carolina State University for a Research Experience for Undergraduates (REU). There she learned about financial mathematics and about correctly pricing stock options. Options are the right, but not the obligation, to buy or sell a stock for a certain price at a certain time in the future. Her research consisted of improving upon a least-squares Monte Carlo simulation technique for pricing American put options by implementing and testing different control variates.

Problem of the week...

We have not received any solutions to the problem of vol. 19.4 (circles). Here is this week's problem of the week:*

A gambler has in his pocket a fair coin and a two-headed coin. He pulls one of the coins at random from his pocket and, when he flips it, it shows heads.

(a) What is the probability that it's the fair coin?

Suppose he flips the same coin a second time and again it shows heads.

(b) Now what is the probability that it's the fair coin?

Suppose that he flips the same coin a third time and it shows tails.

(c) And now what is the probability that it's the fair coin?

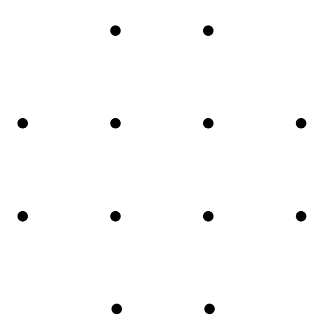
Send solutions to the editor at kaminsky@augsburg.edu, or slip them under his door at Science Hall 137E.

*reproduced with permission from Bradley University's 'potw' page <bradley.bradlye.edu/~delgado/>

Puzzle of the week...

Diane Glorvigen and **Carol Knicker** submitted solutions to the puzzle of vol. 19.3. **Regina Hopingardner** and Tracy's Math 138 class noticed that *E* could not be folded into a cube. Actually, it was an unintentional error to have only 5 squares in *C*. The following readers submitted solutions to the puzzle of vol. 19.4: **Regina Hopingardner**, **Wayne Kallestad**, **Richard Garnett**. Here is the new puzzle:

How many squares can you create in the figure below by connecting any four dots? The corners of the squares must lie upon a grid dot.



Send solutions to the editor at kaminsky@ augsburg.edu, or slip them under his door at Science Hall 137E. Source: Giant Book of Challenging Thinking Puzzles by Michael A. DiSpezio

Augarithms

The bi-weekly newsletter of the
Department of Mathematics at Augsburg College.

Editor.....................Ken Kaminsky <kaminsky@augsburg.edu>

Mean Value Theorem

Attributed to the Italian-born French mathematician and physicist Joseph Louis Lagrange (1736-1813).

(1) The theorem that the average value of a continuous function on an interval must be attained by that function; specifically, if a real function is continuous of a closed interval $[a, b]$ and differentiable on the open interval (a, b), then there is at least one point strictly between a and b where the first derivative equals

$$\frac{f(b) - f(a)}{b - a}.$$

Geometrically, this means that on a curve f there must be a place where the tangent line to the curve is parallel to the secant line joining a and b. The generalized mean value theorem states that if the functions f and g are differentiable on (a, b) and continuous on $[a, b]$ and the derivative of g is non-zero in the open interval (a, b), then there is at least one point c in (a, b) where

$$f'(c)[g(b) - g(a)] = g'(c)[f(b) - f(a)].$$

(2) The first mean value theorem extends this result to show that if, in addition, g is non-negative and integrable, then there is some c in (a, b) such that

$$\int_a^b f(t)g(t)dt = f(c)\int_a^b g(t)dt.$$

The second mean value theorem for integrals states that if f is monotone and g is integrable, then there is a value c in $[a, b]$ such that

$$\int_a^b f(t)g(t)dt =$$

$$f(a)\int_a^c g(t)dt + f(b)\int_c^b g(t)dt.$$

H. Anton, *Calculus with Analytic Geometry* (New York, 1980).

Article by Martha Limber. Reprinted with permission from *Dictionary of Theories*, by Jennifer Bothamley

Born on this Day: Carlo Alberto Castigliano

Alberto Castigliano

Born November 9, 1847 in Asti, Piemonte, Italy, Alberto Castigliano moved from the region of his birth, Piedmont in northwestern Italy, to the Technical Institute of Terni in 1866. After four years in Terni, in Umbria, Castigliano moved north again, this time to become a student at the Polytechnic of Turin. After three years of study in Turin he wrote a dissertation in 1873 *Intorno ai sistemi elastici* for which he is famous.

After graduating from the Polytechnic of Turin, Castigliano was employed by the Northern Italian Railways. He headed the office responsible for artwork, maintenance and service and worked there until his death at an early age.

In his dissertation there appears a theorem which is now named after Castigliano. This is stated as:

... the partial derivative of the strain energy, considered as a function of the applied forces acting on a linearly elastic structure, with respect to one of these forces, is equal to the displacement in the direction of the force of its point of application.

Castigliano's results contain the principle of least work as a special case and this was to lead to a dispute with Menabrea in which Castigliano came off less well than he had hoped. As B. A. Boley writes:

It is clear that Menabrea*'s principle may be considered to be included in Castigliano's theorems; furthermore, Menabrea's proofs were not satisfactory and were in fact repeatedly modified by him.*

Certainly when Menabrea attempted another proof of his principle in 1875 he used Castigliano's results but his only reference to Castigliano was in a footnote. Castigliano did not find this satisfactory and objected to the lack of recognition given to him by Menabrea. Cremona chaired a special meeting of the Accademia dei Lincei which was asked to judge whether Menabrea had indeed acted unfairly towards Castigliano. Cremona did not find in favor of Castigliano, stating the decision of the committee:

Mr Castigliano can have the honor of having done a good piece of work: no one will be able to take away from Member Menabrea *the merit of having made popular and of common use a general principle, which is certainly destined to receive ever more extensive application.*

Although Cremona may well have been right in saying that the credit for the principle should go to Menabrea, his claims that Menabrea has the merit of making them popular is less certain. As B. A. Boley says in when he summarizes Castigliano's contribution:

To assess the importance of his contribution, however, it is important to note that, although there is some validity in Cremona's attribution of the popularization of energy methods to Menabrea, it is precisely in this respect that Castigliano excels. He solved an amazing number of structural problems by his methods.

Casigliano died October 25, 1884 in Milan, Italy

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