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## PROFESSOR LEO MOSER -- REFLECTIONS OF A VISIT

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## PROFESSOR LEO MOSER — REFLECTIONS OF A VISIT

W. E. MIENKA, University of Nebraska–Lincoln

Professor Leo Moser<sup>1</sup> was known throughout the Mathematical Community as a significant researcher and excellent lecturer.

I first met Leo during the Summer Research Institute in the Theory of Numbers held at the University of Colorado in 1959. After talking with him and hearing his lectures during the Institute, I felt that arrangements would have to be made in the near future for a visit to Nebraska. During the academic year 1962–63 while Professor Moser was on a lecture tour for the MAA, I invited him to present two research lectures to the Nebraska Section on May 3 and 4, 1963. He responded: “Professor D. W. Western of Franklin and Marshall College is my booking agent and I will write him immediately and find out whether it would be possible to clear May 3rd and 4th for me and thus enable me to give the lectures in Nebraska.” His generosity was revealed in a subsequent letter in which he asserted: “According to a letter just received from Professor D. W. Western, I am to lecture in Cleveland, Ohio on May 1st and 2nd and in St. Petersburg, Florida on May 6th and 7th. Assuming connections are not too bad I should be able to get to Nebraska in time. If I find that the connections are not easy then I can move the Cleveland date back by one week I imagine. My talks at Nebraska will be on Number Theory and have the general title “Some New Applications of Generating Series.”

As usual his lectures were delivered with vigor, humor, and clarity. Following his last lecture I invited him to my office in order to discuss some of his results, and during our conversation the subject of mathematical limericks was mentioned and he asked if I would like to record some of his and other’s limericks. (I had previously received his permission to record his lectures.)

The main purpose of this paper is to present a transcription of these limericks and other verse, recorded on May 4, 1963.

### *Hiawatha Designs an Experiment*

|   |                                   |
|---|-----------------------------------|
| Hiawatha, mighty hunter,                    | This was commonly regarded        |
| He could shoot ten arrows upward,           | As a feat of skill and cunning.   |
| Shoot them with such strength and swiftness | Several sarcastic spirits         |
| That the last that left the bull-string     | Pointed out to him, however,      |
| Ere the first to earth descended.           | That it might be much more useful |

<sup>1</sup> Professor Moser died February 9, 1970 at the age of 48. The author wishes to express his appreciation to Mrs. Moser for her permission to publish this paper.

If he sometimes hit the target.  
 "Why not shoot a little straighter  
 And employ a smaller sample?"  
 Hiawatha, who at college  
 Majored in applied statistics,  
 Consequently felt entitled  
 To instruct his fellow man  
 In any subject whatsoever,  
 Waxed exceedingly indignant,  
 Talked about the law of errors,  
 Talked about truncated normals,  
 Talked of loss of information,  
 Talked about his lack of bias,  
 Pointed out that (in the long run)  
 Independent observations,  
 Even though they missed the target,  
 Had an average point of impact  
 Very near the spot he aimed at,  
 With a possible exception  
 of a set of measure zero.

"This," they said, "was rather  
 doubtful;

Anyway, it didn't matter  
 What resulted in the long run:  
 Either he must hit the target  
 Much more often than at present,  
 Or himself would have to pay for  
 All the arrows he had wasted."

Hiawatha, in a temper,  
 Quoted parts of R. A. Fisher,  
 Quoted Yates and quoted Finney,  
 Quoted reams of Oscar Kempthorne,  
 Quoted Anderson and Bancroft  
 (practically *in extenso*)  
 Trying to impress upon them  
 That what actually mattered  
 Was to estimate the error.

Several of them admitted:  
 "Such a thing might have its uses;  
 Still," they said, "he would do better  
 If he shot a little straighter."

Hiawatha, to convince them,

Organized a shooting contest.  
 Laid out in the proper manner  
 Of designs experimental  
 Recommended in the textbooks,  
 Mainly used for tasting tea  
 (but sometimes used in other cases)  
 Used factorial arrangements  
 And the theory of Galois,  
 Got a nicely balanced layout  
 And successfully confounded  
 Second order interactions.

All the other tribal marksmen,  
 Ignorant benighted creatures  
 Of experimental setups,  
 Used their time of preparation  
 Putting in a lot of practice  
 Merely shooting at the target.

Thus it happened in the contest  
 That their scores were most impressive  
 With but one solitary exception.  
 This, I hate to have to say it,  
 Was the score of Hiawatha,  
 Who as usual shot his arrows,  
 Shot them with great strength  
 and swiftness,  
 Managing to be unbiased,  
 Not however with a salvo  
 Managing to hit the target.

"There!" they said to Hiawatha,  
 "That is what we all expected."  
 Hiawatha, nothing daunted,  
 Called for pen and called for paper.  
 But analysis of variance  
 Finally produced the figures  
 Showing beyond all peradventure,  
 Everybody else was biased.  
 And the variance components  
 Did not differ from each other's,  
 Or from Hiawatha's.  
 (This last point it might be mentioned,  
 Would have been much more convincing  
 If he hadn't been compelled to

Estimate his own components  
From experimental plots on  
Which the values all were missing.)

Still they couldn't understand it,  
So they couldn't raise objections.  
(Which is what so often happens  
with analysis of variance.)  
All the same his fellow tribesmen,  
Ignorant benighted heathens,  
Took away his bow and arrows,  
Said that though my Hiawatha  
Was a brilliant statistician,  
He was useless as a bowman.  
As for variance components

Several of the more outspoken  
Made primeval observations  
Hurtful of the finer feelings  
Even of the statistician.

In a corner of the forest  
Sits alone my Hiawatha  
Permanently cogitating  
On the normal law of errors.  
Wondering in idle moments  
If perhaps increased precision  
Might perhaps be sometimes better  
Even at the cost of bias,  
If one could thereby now and then  
Register upon a target.

\* \* \*

Chicago's mathematical forces  
Despite their numerous resources  
Always adorn  
With the Lemma of Zorn  
At least ninety percent of their courses.

\* \* \*

Professor Adrian Albert said who  
Can tell me a theorem that's true  
The ones that I know  
Are simply not so  
When the characteristic is two.

\* \* \*

Eduard Čech by God's grace  
Was the first man on Earth to trace  
That sordid and dreary  
Cohomology theory  
Of a subnormal bicomact space.

\* \* \*

A mathematician confided  
That a Möbius strip is one sided  
And you get quite a laugh  
When you cut it in half  
Because it stays in one piece when  
divided.

\* \* \*

Mathematicians try hard to floor us  
With a non-orientable torus  
The bottle of Klein  
They say is divine  
But it is so exceedingly porous.

\* \* \*

Once a man whose name wouldn't rhyme  
Found an unbelievably large prime  
But with no place to store it  
He had no use for it  
So Dick Lehmer got it for a dime.

\* \* \*

A mathematician named Moser  
Well-known as a problem proposer  
Sent some that were silly  
To his brother named Willy  
Could he stump him? The answer is  
no, sir.

\* \* \*

There was a young man from Racine  
Who invented a brain-like machine  
It knew digits in  $\pi$   
And found cube roots of  $i$   
And sang a few hymns in between.

\* \* \*

Where are the zeroes of zeta of  $s$ ?  
 Bernhard Riemann made a pretty good guess:  
 "They're all on the critical line," said he  
 "And their density is  $t$  over  $2\pi \log t$ ."

Now the statement of Riemann has set off a trigger,  
 And many a good man with vim and with vigor  
 Tried to prove with mathematical rigor  
 What happens to zeta as mod  $t$  gets bigger.

The names of Hardy, Landau, and Cramér  
 And Littlewood and Titchmarsh are there.  
 But in spite of their skill and in spite of finesse  
 In locating the zeros, no-one's had success.

In 1914, G. H. Hardy did find  
 An infinite number that lay on the line.  
 But unfortunately his theorem won't rule out the case  
 That there may be some zeros in some other place.

Oh where are the zeros of zeta of  $s$ ?  
 We must know exactly, we cannot just guess.  
 For in order to refine the prime number theorem,  
 The path of integration must not get too near 'em.  
 (by Tom Apostol\*)

\* \* \*

There was a young fellow named Ben  
 Who could only count modulo ten  
 He said when I go  
 Past my last little toe  
 I shall have to start over again.

\* \* \*

The binary system is fun  
 For with it strange things can be done  
 And two as you know  
 Is a one and an oh  
 And five is one hundred and one.

\* \* \*

The marvelous things a computer can do  
 Makes an idiot out of the highest IQ  
 But there's one consolation  
 In this observation  
 It can't even add up to two.

\* \* \*

Here's to uncle Albert E.  
 Pundit of relativity  
 You'll know him by his fiddler's locks  
 and by his utter lack of socks.

Here's to uncle Oswald V.  
 Lover of England and her tea  
 He is that mathematician of note  
 Who needs four buttons to button his coat.

\* \* \*

Condemned for defending the masses  
 Scourged for defaming the lasses  
 Not moved by disgrace  
 He has come to this place  
 To teach the class of all classes.  
 (Student – University of Minnesota,  
 written on the occasion of B. Russell's  
 visit in 1942–1943)

\* \* \*

A function from feeling inferior  
 Felt life monotonically drearier  
 With a hell of a yell  
 That jumped into  $L$   
 And converged to the limit superior.

There once was a hairy baboon  
 Who always breathed down a bassoon  
 For he said it appears  
 That in millions of years  
 I will certainly hit on a tune.

\* \* \*

Let  $x$  stand for beauty,  $y$  manners well-bred,  
 Zed fortune (this last is essential).  
 Let  $L$  stand for love, our philosophers said,  
 Then  $L$  is a function of  $x$ ,  $y$ , and zed  
 Of the kind that is known as potential.  
 Now integrate  $L$  with respect to  $dt$   
 ( $t$  standing for time and persuasion).  
 Then between proper limits it's easy to see  
 The definite integral marriage must be.

(A. S. Eddington — A very concise demonstration. L.M.)

\* \* \*

Said a monkey as he swung by his tail  
 To his children both female and male  
 From your offsprings my dears  
 In some millions of years  
 May emerge a professor at Yale.

A mathematician O'Flaherty  
 Invented a new singularity  
 Where the  $Z$  plane corrodes  
 And the function explodes  
 Well you'll have to admit it's a rarity.

But who could dream in those  
 times immemorial

\* \* \*

That from those creatures arboreal  
 Professor Uhler would evolve  
 Who had the courage and resolve  
 To calculate one thousand factorial.

The subject of today's instruction  
 Is to perform mathematical induction.  
 The steps are easy as one two three  
 If you want to get clued just listen to me.

\* \* \*

Nature and nature's law lay hid by night  
 Then God said "Let Newton be,"  
 and all was light,  
 This could not last, the Devil shouting "Ho  
 Let Einstein be," restored the status quo.

You want to prove a theorem then  
 To prove it for every integer  $n$   
 You prove it first for  $n$  equal one  
 And then the induction is begun.

\* \* \*

A mathematician named Moser  
 Was able to regain his composure  
 When a pair of young men  
 Claimed their distance was ten  
 But were unable to prove this disclosure.

The proof goes on in the following way  
 You assume it next for  $n$  equal  $k$ .  
 If you can show it then for  $k + 1$   
 Then the induction is truly done.  
 (To be sung to the tune of  
 "Three Little Fishes")

\* \* \*

\* \* \*

\* Prof. Apostol points out that the oral tradition has produced some changes in his verses. He offers the original, guaranteed correct, version of what turns out to be a *song*, sung to the tune of "Sweet Betsy from Pike". Our efforts to locate the melody have failed. *Editor*.

*Where are the zeros of zeta of  $s$ ?*

Where are the zeros of zeta of  $s$ ?  
 G. F. B. Riemann has made a good guess,  
 They're all on the critical line, said he,  
 And their density's one over  $2\pi \log t$ .

This statement of Riemann's has been like a trigger,  
 And many good men, with vim and with vigor,  
 Have attempted to find, with mathematical rigor,  
 What happens to zeta as mod  $t$  gets bigger.

The names of Landau and Bohr and Cramér,  
 And Hardy and Littlewood and Titchmarsh are there,  
 In spite of their efforts and skill and finesse,  
 In locating the zeros no one's had success.

In 1914 G. H. Hardy did find,  
 An infinite number that lay on the line,  
 His theorem, however, won't rule out the case,  
 That there might be a zero at some other place.

Let  $P$  be the function  $\pi$  minus  $li$ ,  
 The order of  $P$  is not known for  $x$  high,  
 If square root of  $x$  times  $\log x$  we could show,  
 Then Riemann's conjecture would surely be so.

Related to this is another enigma,  
 Concerning the Lindelöf function  $\mu(\sigma)$   
 Which measures the growth in the critical strip,  
 And on the number of zeros it gives us a grip.

But nobody knows how this function behaves,  
 Convexity tells us it can have no waves,  
 Lindelöf said that the shape of its graph,  
 Is constant when sigma is more than one-half.

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 We must know exactly, we cannot just guess,  
 In order to strengthen the prime-number theorem,  
 The path of integration must not get too near 'em.