International Indian Statistical Association

IISA Newsletter
Fall 2014

Visit our website: *http://intindstat.org/*

Call for JSM 2015 Sessions:
Be a part of the program:
Online submission of topic-contributed session proposals deadline
January 15, 2015

Contribute to the News!
Please submit items of interest to the IISA Editorial Team.

Pune Skyline

Message from N. Rao Chaganty
President, IISA

Dear Colleagues,
It has been a great pleasure serving you all as President of IISA this year. Although my term is coming to an end, we have had an incredible year. This year we successfully organized the Conference on Research Innovations in Statistics for Health, Education, Technology, and Society, where we had more than 250 participants in attendance. We also were able to organize seven invited sessions at JSM 2014 in Boston. Currently, we signed a Memorandum of Understanding with Pune University to organize the next IISA international conference in Pune, India from December 20, 2015 to December 24, 2015.

I want to take this opportunity to especially thank the Executive committee, Mr. Cyrus Mehta, Ms. Sowmya Rao, Mr. Soumen Lahiri, and Mr. Subrata Kundu, for their tremendous dedication to IISA. They have been very instrumental in helping with IISA matters, reaching out to IISA members, and discussing other related issues to further the success of the association. Without them, we would not have had such an accomplished and outstanding year.

I would also like to thank Ms. Chaitra Nagaraja for putting together our wonderful newsletter. In the newsletter you can find an interesting article written by Mr. Srinivas Bhogle discussing the use of the Duckworth-Lewis statistical method in cricket matches and an insightful article written by Ms. Sowmya Rao on the cost of medical care in the United States versus India.

Soumendra Lahiri, 2015 IISA President

It is my pleasure to announce that Mr. Soumendra Lahiri will be taking over as President starting January 1, 2015. Additionally, I would like to congratulate the new President-elect, Ms. Amarjot Kaur.

I want to extend a warm welcome to all of the new members who have joined IISA over the last year. Thank you to all who have made IISA such a great success. I hope to see you at the IISA conference in Pune next December.

- ***N. Rao Chaganty***

2014 IISA Election Results

Amarjot Kaur, 2016 IISA President

We would like to welcome our 2016 President, Dr. Amarjot Kaur, and 2015-2017 Board of Trustees member, Prof. N. Balakrishnan.

Kaur is currently the Executive Director in the Biostatistics Department at Merck Research Laboratories. Her work in clinical trials has led to treatments for many illnesses such as arthritis and osteoporosis. Furthermore, she is an elected Fellow of the American Statistical Association (ASA) in addition to serving as the chair of the ASA Committee on Applied Statistics and as an Executive Committee Member of the ASA Biopharmaceutical Section.

Balakrishnan is Professor of Statistics at McMaster University. He will replace Hira Koul (Michigan State University) who is concluding his term. Balakrishnan has served IISA in a variety of roles including that of IISA President (2004-2005); he is also an elected Fellow of the ASA and on the editorial board of several statistics journals. As the author of numerous books and papers, Balakrishnan has made many contributions to the fields of mathematical and order statistics.

2014 IISA Conference Recognizes Young Researchers and PhD Students

by Subir Ghosh

The International Indian Statistical Association (IISA) Conference on Research Innovations in Statistics for Health, Education, Technology, and Society, July 11-13, 2014 was held at the Riverside Convention Center, Riverside, California, USA. Nicholas P. Jewell, University of California, Berkeley and Kathryn Roeder, Carnegie Mellon University were the plenary speakers. In addition, the special invited speakers were Sudipto Banerjee, University of Minnesota; Joyee Ghosh (Young Researcher), The University of Iowa; Ryan P. Hafen (Young Researcher: IISA President's Invited on BIG DATA), Pacific Northwest National Laboratory; William DuMouchel, Oracle Health Sciences; Marc A. Suchard, University of California, Los Angeles; Adityanand Guntuboyina (Young Researcher), University of California, Berkeley; Mark. J van der Laan, University of California, Berkeley; and Gourab Mukherjee (Young Researcher), University of Southern California.

Nick Jewell delivers a keynote address at 2014 IISA conference

Distinguished researchers representing many countries spoke at the conference. Furthermore, highly talented young

researchers and fresh PhDs took the center stage at the conference along with the mid-career prominent as well as senior distinguished researchers. Speakers were from academia, industry, research centers, and government organizations and presented on a range of topics from selective genotyping and spatial statistics to queueing theory.
Following the IISA tradition for the Young Researcher Awards, three young (under 45) researchers were honored. Bhramar Mukherjee from the University of Michigan, Ann Arbor won in the Methods and Applications category. Debashis Paul, University of California, Davis and Shalabh, Indian Institute of Technology, Kanpur, India both won in the Theory and Methods category.

Again, following the IISA tradition for the Best Student Paper Awards, four students were selected based on the quality of their work as well as their presentations. In the Theory and Methods category, the winners were Sumanta Basu and Pratima Bagchi, both from University of Michigan. In the Methods and Applications category, Subhabrata Sen (Stanford University) and Raymond Wong (University of California, Davis) won.

The complete conference program, photos, and award details can be viewed at the website: *http://2014iisa.intindstat.org*

A Tale of 2 Countries:
The Cost of My Mother's Cardiac Care in the United States and India

by Sowmya R Rao

It is well known that the U.S. healthcare system is one of the most expensive in the world. What is discussed less is the lack of transparency of healthcare costs in the U.S. Not knowing up-front the costs for procedures and tests makes it difficult for patients to make informed healthcare choices, especially, for international visitors.

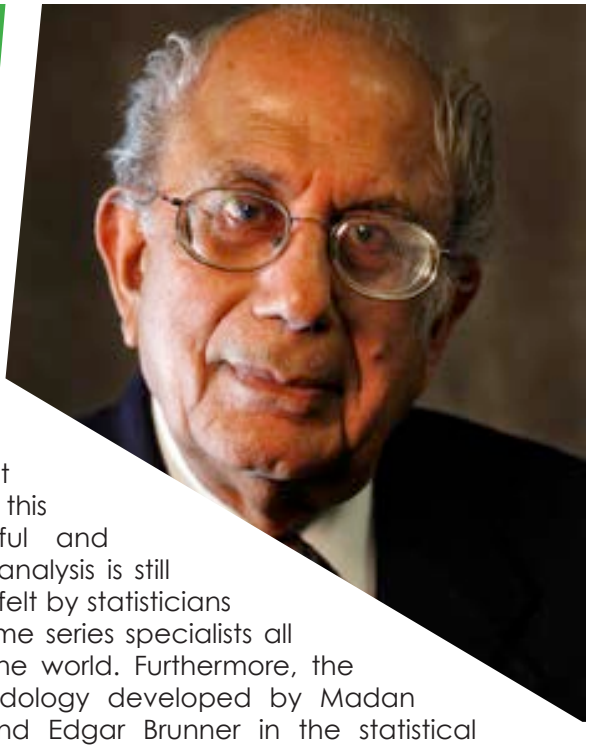
Another aspect for immigrants of living in the U.S. long-term is not being aware of the improvements in healthcare systems in India. Last year, I had the opportunity to deal with both systems (U.S. and India) in trying to obtain care for my 71-year old mother, who developed cardiac issues a few days after her arrival into Boston. It gave me the opportunity to compare costs of surgical cardiac care in the United States and India. I decided to take my mother back to India for care, since I could not get a good estimate of the costs involved or the flexibility afforded by the U.S. healthcare system. While in India, I was able to get a good estimate of costs, allowing us to make informed decisions.

My story is not unique. I am sure there are many others who have had similar experiences. I published my experience in the Annals of Family Medicine (*http://annfammed.org/content/12/5/470.full*). I hope many of you will find it interesting and illuminating. This article begs the question: "What do we do about this? Do we wait for the U.S. healthcare system to be revamped? Do we figure out a different insurance option for our parents when they visit? Do we lobby the U.S. government to do something about this?"

You may contact me at *sowmya.rao@gmail.com* if you need any further information.

Prof. Madan L. Puri Wins Prestigious Wilks Award

by George G. Roussas



Indiana University College of Arts and Sciences Distinguished Research Scholar and Professor Emeritus of Mathematics Madan L. Puri was this year's recipient of one of the American Statistical Association's most prestigious honor: the Samuel S. Wilks Award. With this recognition, he became the sixth person in the world to have received the association's two most distinguished awards, having been honored with the Gottfried E. Noether Senior Scholar Award in 2008.

Puri is considered one of the world's most versatile and prolific researchers, and an extremely influential contributor to theoretical statistics for more than four decades. His research areas include nonparametric statistics, limit theory under mixing, time series, tests of normality, generalized inverses of matrices, stochastic processes, statistics of directional data and fuzzy sets and fuzzy measures. His work on rank-based methods in particular has advanced the frontier of the subject. His fundamental contributions in developing rank-based methods and precise evaluation of the standard procedures, asymptotic expansions of distributions of rank statistics, as well as large deviation results concerning them, span various areas, such as analysis of variance, analysis of covariance, multivariate analysis, and time series. His work has resulted in pioneering research contributions which have had substantial impact on current research. The methods that Puri and his co-authors have introduced for implementing rank-based methods with dependent data, and for theoretically analyzing the properties of those techniques, fundamentally changed the direction in which the subject evolved for a decade from the mid-1980s. His 1964 paper on rank-based methods in one-way layout models laid the foundation for the development of nonparametric methods in analysis of variance. Puri's two advanced research monographs, co-authored with P.K. Sen (1971, 1987), on nonparametric methods in multivariate analysis and general linear models—the fields that he created—laid out these remarkable theories; they are still standard texts for researchers in the field.

Beginning in the mid-1980s, in a series of path-breaking papers with Marc Hallin, he tackled the most difficult problem of applying nonparametric methods to time series analysis. Even today, the far-reaching impact of this beautiful and deep analysis is still being felt by statisticians and time series specialists all over the world. Furthermore, the methodology developed by Madan Puri and Edgar Brunner in the statistical design and analysis of experiments has paved the way for the development of clinical designs, epidemiological investigations, and environmental studies. In the context of dependent data, his highly technical papers on the weak convergence of U-and V-statistics, the crucial underlying empirical process, and applications to curve estimation are essentially the "last word" on the topic. Stephen Stigler, the Earnest Burton Distinguished Service Professor at the University of Chicago, says: "[Madan Puri] has been responsible for the creation of several subfields and has done more for the field of rank statistics than anyone since Hajek's work in the late 1960s".

In 1997, he was ranked fourth most prolific author in a report titled *Statistics on Statistics: Worldwide Performance Based on Journal Publications in the Period 1985-1995*. Puri has received Germany's Alexander von Humboldt Foundation's Senior U.S. Scientist Award twice. He has also been honored by the Government of the Federal Republic of Germany, "In recognition of past achievements in research and teaching." Puri has had several volumes published in his honor: *Research Developments in Probability and Statistics*, edited by Edgar Brunner and Manfred Denker (University of Göttingen, Germany); *Asymptotics, Nonparametrics and Time Series Analysis: A Tribute to Madan Puri*, edited by Subir Ghosh (University of California, Riverside); and Journal of Statistical Planning and Inference (Vol. 137, No. 3), edited by George Haiman (Université de Lille, France), Stefan Ralescu (City University of New York, New York) and Frits Ruymgaart (Texas Tech University). Furthermore, in 2003, *Selected Collected Works of Madan L. Puri*, edited by Peter Hall (Australian National University), Marc Hallin (Université Libre de Bruxelles, Belgium), and George G. Roussas

(University of California, Davis) were published in a three volume set by International Science Publishers. In 2004, his short biography appeared in the book *Oxford Dictionary of Statistics*, authored by G.J.G. Upton (University of Essex, England).

Not to rest on his accolades, Puri is still an active researcher and is currently a Visiting Professor at Columbia University.

Conference held in honor of Professor Malay Ghosh's Seventieth Birthday by Bhramar Mukherjee, Yan Li, and Rebecca Steorts

A conference in honor of Malay Ghosh ("Frontiers of Hierarchical Modeling in Observational Studies, Complex Surveys and Big Data"), hosted by the Joint Program in Survey Methodology (JPSM), University of Maryland at College Park, was held on May 29-31, 2014 at College Park Marriott Hotel & Conference Center, Maryland. About 225 were in attendance to celebrate Ghosh's outstanding contributions to statistics and his dedicated role as a teacher and mentor.

Several areas to which Ghosh made substantial contributions were represented, including small area estimation, objective Bayesian inference, hierarchical Bayesian modeling, and statistical inference for case-control studies. There were nine plenary, seven invited, two contributed, and one poster session in the three-day conference. The conference began on Wednesday afternoon with a reception. The scientific program started on Thursday morning with welcome remarks by the director of JPSM, Fred Conrad, followed by the two head organizers Partha Lahiri and Gauri S. Datta, both former Ph.D students of Ghosh. The day followed with presentations by several of Ghosh's doctoral students and by many other eminent scholars such as Ghosh's dissertation advisor Pranab K. Sen. Later that morning JNK Rao presented on current trends in small area estimation followed by discussions by Graham Kalton and Danny Pfeffermann. Friday opened with a panel discussion on Bayesian Model Uncertainty by James Berger, Mike Daniels, Edward George, Jayanta K. Ghosh and Brunero Liseo. A plenary session followed on the Future of Bayesian Methods in Sample Surveys by Roderick J.A. Little and Joseph Sedransk with a discussion by Alan Dorfman. Saturday featured a rich discussion on integrated likelihood, profile likelihood and various associated variants and their subtle properties by Thomas Severini, Nancy Reid, Donald Fraser and Judith Rousseau. The quality of the scientific program was strong and featured both Bayesian and frequentist work.

The banquet on Friday featured tributes from many of Ghosh's colleagues, students, and mentees with opening remarks by his son Debashis Ghosh, a distinguished statistician himself. The evening ended with a touching speech by Ghosh, sharing his broad view on the changing landscape of statistics over time and thanking his professors in India and abroad as well as his students, collaborators and his family. He has supervised forty-nine doctoral students during his career and sixteen of them were present at the conference.

Many colleagues from the University of Florida attended the conference. Ghosh's wife Dola and his younger son Debadyuti were also present. The conference received significant financial and administrative support from JPSM. A special thanks goes out to JPSM staff: Stacey Hall, Gina Hsu, Jarrett Klein, Kendra Nguyen, and Mark Van Pelt, and other generous sponsorships, including the U.S. Census Bureau, National Agricultural Statistics Service, National Science Foundation, Novartis, Survey Research Method, Section of the ASA, Washington Statistical Society, and Westat.

The conference was a fitting tribute to Malay Ghosh's numerous contributions to the profession of statistics and, in particular, celebrating the legacy he has created in terms of his research and mentoring of the next generation of statistical scientists.

WELCOME
Chaitra H. Nagaraja,
Fordham University,
Our Newest Editor

Member News

Jayant Deshpande, formerly Professor of Statistics at the University of Pune, will be spending the 2014-2015 academic year at the Department of Probability and Statistics, Michigan State University.

Dipak Dey, Associate Dean of the College of Liberal Arts and Science at the University of Connecticut, Storrs, was elected a Fellow of the International Society of Bayesian Analysis this year. He was selected for his exceptional research, teaching and service contributions, especially in Bayesian methods.

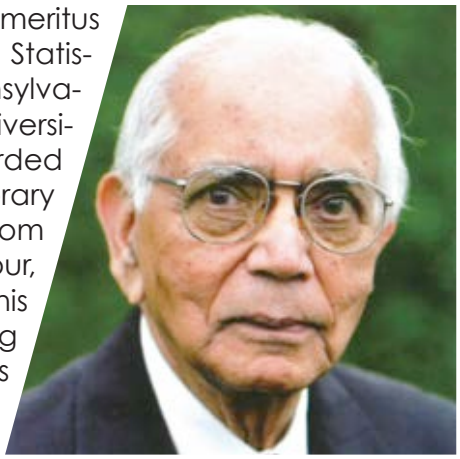
Dipak Dey

Abhishek Koul, doctoral student of Hira Koul at Michigan State University, has one of the most downloaded articles within the past three months from ScienceDirect: "Lasso with long memory regression errors," Journal of Statistical Planning and Inference. Vol. 153, 2014, pp 11-26.

Sastry Pantula, Dean of the College of Science at Oregon State University, received the American Statistical Association 2014 Founders Award. This honor recognizes exemplary leadership and service to ASA and the statistics profession. As former ASA president in 2010, chair of the Department of Statistics at North Carolina State University, and director of the Division of Mathematical Sciences at the National Science Foundation, Pantula has shown his continued commitment to strengthening statistics programs and expanding the visibility and importance of statistics in the wider academic community.

Sastry Pantula with ASA President Nathaniel Schenker (left) and ASA Executive Director Ron Wasserstein (right)

C.R. Rao, Emeritus Professor of Statistics at Pennsylvania State University, was awarded an honorary doctorate from IIT Kharagpur, India for his outstanding contributions to the field of statistics.



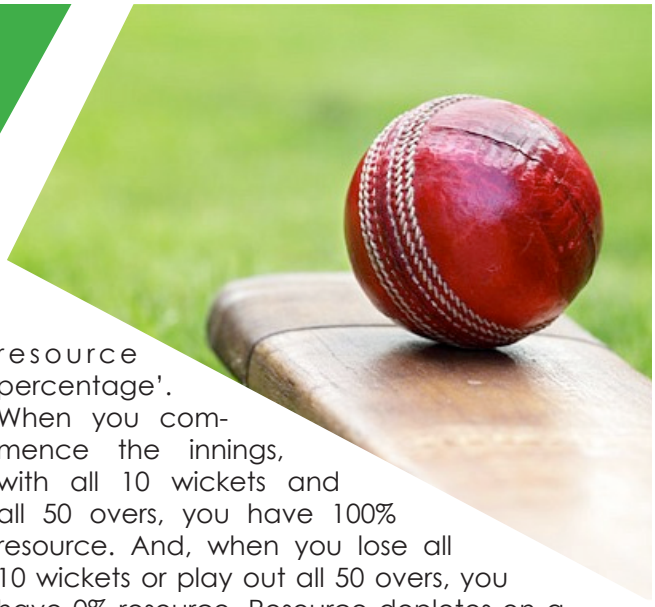
C.R. Rao

New IISA Lifetime Members

Firdous Ansari, *Jainarayan Vyas University*
Bhagwati Bagsmrita, *B.H. College*
S. N. Balakrishna, *Tata Consultancy Services*
Narasimhan Balasubramanian, *Stanford University*
Navin Chandra, *Pondicherry University*
Bertrand Clarke, *University of Nebraska-Lincoln*
Shobha Dhadda, *Eisai Pharmaceuticals*
Samrat Hore, *Tripura University*
Arun Kaushik, *Banaras Hindu University*
Rabindra Kayastha, *Katmandu University*
K.B. Kulasekera, *University of Louisville*
Raghavendra Rao Kurada, *SAS Institute*
John P. Morgan, *Virginia Tech*
Sirisha L. Mushti, *U.S. Food and Drug Administration*
Budhinath Padhy, *Black Hills State University*
Mohsen Pourahmadi, *Texas A&M University*
Radha A. Railkar, *Merck & Co.*
Shantha Rao, *Novartis Pharmaceuticals*
Manoj K. Rastogi, *IIT Patna*
V.H.D. Reddy, *TIME Business School & VCRIMS*
Sourav Santra, *Piramal Enterprises, Ltd.*
Saunak Sen, *University of California San Francisco*
Venkatraman E. Seshan, *Mem, Sloan Kettering Cancer Ctr*
Smitha Sharma, *DAV College*
Manasi Sheth-Chandra, *Old Dominion University*
Vaidyanathan Subramanian, *Pondicherry University*
Akhil K. Vaish, *RTI International*

Elucidating the Duckworth-Lewis Statistical Calculations

by Srinivas Bhogle



Q: I have a confession to make. I love cricket, I watch cricket, I understand cricket, but I still can't fathom this D/L method.

SB: That's not particularly surprising. Many cricket fans don't understand D/L, but most pretend that they do.

Q: I of course know that we need D/L when an ODI match is curtailed by bad weather, and we need to reset the winning target.

SB: If both teams get to complete their 50-over innings there's no problem. The team that scores more runs wins. But suppose the team batting first scores 255 in their 50 overs, and the team that is chasing is at 125/2 or 125/5 after 25 overs when rain stops play. Which team do you think should win?

Q: I remember this example! The team chasing had to maintain a run rate of 255/50 = 5.1 per over. So after 25 overs it should have scored 25*5.1 = 127.5 (rounded up to 128) to win. Since it had scored only 125, it lost.

SB: Do you consider that to be a fair verdict? Take the extreme case when the team chasing is 128/9 when rain ends play. They were probably just one ball away from a horrible defeat – and yet they are declared winners!

Q: I agree that makes no sense, but what else can one do?

SB: Think about it. What's different between 125/2 and 125/5? Of course, the number of wickets! Wickets matter too. A team's ability to win depends not just on the number of overs (or balls) remaining, but also on the number of wickets left.

Q: I agree. But how do you combine the two?

SB: That's exactly the problem that Frank Duckworth and Tony Lewis solved in the mid-1990s. And very elegantly too!

Q: How?

SB: They came up with the idea of a 'combined resource percentage'. When you commence the innings, with all 10 wickets and all 50 overs, you have 100% resource. And, when you lose all 10 wickets or play out all 50 overs, you have 0% resource. Resource depletes on a ball-by-ball basis as the match progresses. When a wicket falls, the resource percentage drops rather more steeply. When you are at 125/2 after 25 overs, you've probably used up 40% of your available resource, but if you are at 125/5 after 25 – and have lost 3 more tickets – your resource depletion may be as high as 60%.

D/L was also the first to talk of a 'par score', i.e., what you need to score to just edge past the winning line. At 125/2, you are well past the winning line; at 125/5 you are well behind.

Q: Yes, I understand all that. But how do you calculate the actual resource percentage?

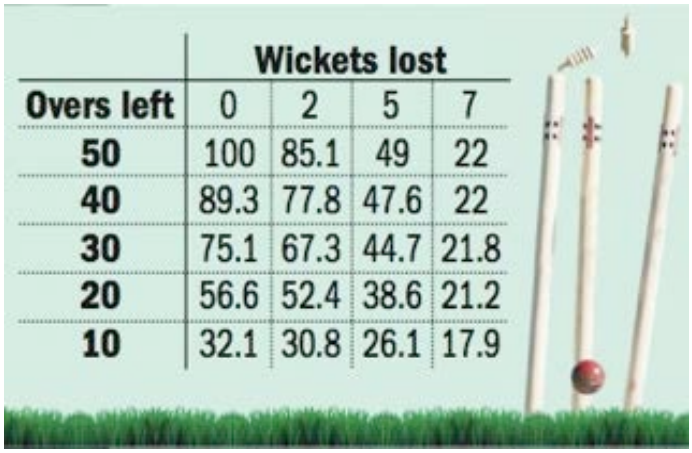
SB: Well, that was essentially the genius of D/L. They asked the following key question (and don't let the notation upset you): how many more runs is a team likely to score if it has u overs remaining (u can be 50, 49, 48 … 3, 2, 1 or 0) and has so far lost w wickets (w can be 0, 1, 2 … or 9). They denoted this number Z(u,w) and used archival one-day cricket data to model Z(u,w). Not surprisingly, they modeled it using an exponential decay function which had a smooth, orderly and 'controllable' descent. They needed a curve with that sort of behavior because, as the innings progresses, Z(u,w) must decrease continually and consistently. The combined resource percentage was then calculated using the ratio $Z(u,w)/Z(50,0)$; note that this percentage drops from 100 at the beginning of the innings to 0 at the end.

Q: Ah, so these were the strange percentages in the D/L resource table!

SB: I remember being myself daunted by those tables (see adjoining condensed table view). But today it all seems quite simple; this is just an array

with 300 rows (one row for every valid ball; there are 50*6 = 300 valid balls) and 10 columns (corresponding to 0,1,2 .. 9 wickets lost).

Q: Ok, you now have the resource percentage table. But how do you actually reset the winning target after an interruption.



Overs left	Wickets lost			
	0	2	5	7
50	100	85.1	49	22
40	89.3	77.8	47.6	22
30	75.1	67.3	44.7	21.8
20	56.6	52.4	38.6	21.2
10	32.1	30.8	26.1	17.9

SB: To explain the way D/L calculates the winning target, we'll need some simple notation. Let *S* be the first team's score, and let *R1* be the resource that was used up by the first team (if all 50 overs are bowled, or all 10 wickets fall then *R1*=100; but if the first innings was interrupted with a score of 188/5 after 42 overs, then clearly *R1* < 100). Let us suppose that the second team had an available resource of *R2* (*R2* < 100) when the innings is interrupted. Then, if *R1* > *R2*, the reset target *T* = *S** (*R2*/*R1*). If, however, *R2* > *R1* then *T* = *S* + (*R2* - *R1*)* *G*50, where G50 is the average number of runs scored in a 50-over innings, and now assumed to be 245. This rule works for multiple interruptions, and for interruptions at different times in the innings: between innings, during the second innings, or during the first innings itself.

Q: Is the timing of the interruption so important?

SB: Oh, very much so. That's a feature of the D/L method that hasn't been appreciated enough. Creators of earlier rain rules didn't really understand this. Think of the most productive overs (MPO) rule used in the 1992 WC that led to the horrific situation where a target of 22 runs in 13 balls suddenly became 21 runs in 1 ball. The MPO rule could work sensibly only if the interruption happened between the innings. If there were interruptions in the second innings it made the task of winning progressively harder for the team chasing; the chasing team was in effect being penalized for bowling maidens or good overs in which they conceded just 1 or 2 runs. And, in the pre-D/L days, interruptions during the first innings weren't even considered in the calculation even though we now know that such interruptions deeply influence the equilibrium of opportunity for the two teams.

Q: Let's return to the D/L rule for a moment. I'm puzzled why there should be different rules depending on if *R1* is greater or less than *R2*.

SB: That's a blemish, if not a weakness. The simple answer is that the target T could scale up uncontrollably if *R2* >> *R1*. Suppose the first team has scored 80/0 in 20 overs and rain reduces it to a 20-over a side match. What should be the target for the second team? It turns out that *R1* = 22.9 (the team had only batted 20 overs, and had all 10 wickets available) while *R2* = 58.9. So a scale-up would have set the second team a 20-over target of 80* (58.9/22.9) = 205.8 (scaled up to 206) which was obviously ridiculous. The D/L rule sets the chasing team a less ridiculous target of 80 + (58.9 – 22.9) * 245 = 169 in 20 overs.

Q: Still something doesn't feel quite right.

SB: Isn't that always the dilemma that most models face? Some intemperate behavior in extreme situations always ruins the beauty and the elegance of the formulation; it would indeed have been wonderful if we had a simple D/L rule that could scale up or scale down seamlessly. D/L is further handicapped because limited-over cricket is evolving into a completely different animal.

Q: How did D/L come up with their model? What was their rationale?

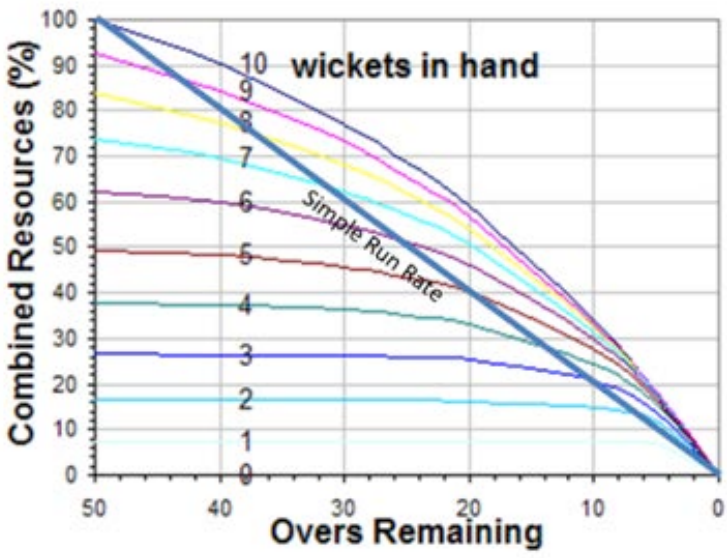
SB: Duckworth and Lewis went about their business like two old-fashioned professors of mathematics. Their "Eureka!" moment was when Frank Duckworth scribbled the following generic equation: $Z(u,w) = Z0\ F(w)[1 - exp\ \{-bu/F(w)\}]$, where Z0 is the average total score if there wasn't the 50-over restriction, b is an exponential decay constant (needed because as the overs *u* increase, there is a diminishing return in terms of runs), and $F(w)$ $(0 < F(w) < 1)$ is the fraction that models how the propensity to score more runs diminishes as the wickets fall. One might guess that $F(4)$ is probably about 0.5, because after losing 4 wickets a team has probably halved its propensity to score more runs. It is easy to see that $F(0) = 1$.

The D/L model essentially involves ten equations (corresponding to w = 0,1,2 …8,9). So we have equations for $Z(u,0)$, $Z(u,1)$ etc., etc. $Z(u,0)$ for instance denotes how many more runs is a team likely to score if it has u overs remaining (*u* can be 50,49,48 …3,2,1 or 0) and 0 wickets lost. The D/L equation says that $Z(u,0)$ equals Z0 $[1 – exp\ \{-bu\}]$. So if Z0 equals 260, then, depending on the choice of *b*, $Z(0,0)$ might equal 225. Likewise $Z(u,1)$ equals Z0 $F(1)$ $[1 – exp\ \{-bu/F(1)\}]$. So if $F(1) = 0.9$, $Z(0,1)$ might equal about 210.

Q: I'm sorry but all these equations are overwhelming me.

SB: Let me explain using a famous Wikipedia D/L picture reproduced below. Just as we said, there are ten curves here. But instead of curves corresponding to $Z(u,0)$, $Z(u,1)$, … $Z(u,8)$, $Z(u,9)$, the plot here shows curves corresponding to combined resource percentages, obtained after dividing by $Z(50,0)$. The top curve corresponds to $Z(u,0)/Z(50,0)$, the next curve to $Z(u,1)/Z(50,0)$, …and so on to $Z(u,8)/Z(50,0)$ and $Z(u,9)/Z(50,0)$.

At the start of the innings, the team has all 50 overs to bat, and all 10 wickets in hand. So it starts off with a resource percentage of 100, i.e., at the top left corner. Just to make it easy, pretend that there is an ant at this top left corner. After every ball is bowled, this ant moves one step to the right along the top curve. And so it continues, till a wicket falls. When a wicket falls, the ant vertically drops down to the curve immediately below (corresponding to 1 wicket lost). When all 50 overs are completed, or all 10 wickets are lost, the ant will end up at the bottom right corner.



This picture tells us many stories. Two are most noteworthy: (*a*) by how much does the ant drop after a wicket falls (this is the effect of $F(w)$ kicking in), and (*b*) although every curve terminates at the bottom right corner, its 'rate' of descent can be more or less 'leisurely' (based on values picked for b and $F(w)$).

Finally, it is also possible to draw a straight line joining the top left and bottom right corner (see above). A moment's reflection will suggest that this straight line corresponds to the simple run rate method – in which the resource diminishes only in proportion to the number of overs, without considering wickets.

While we are looking at this picture, let us also visualize how interruptions look like. Think of the ant again. As long as the game is on, and evolving, the ant is always on the move. Suppose there is an interruption after over 30, and 10 overs are lost. Then, when the match resumes, the ant 'fast-forwards' along the same curve, moving to the right by a distance equivalent to 10 overs, before resuming its 'play' mode.

Q: Thank you, that was helpful. But, tell me, how good is the D/L method? Are all these painful exponential decay functions really necessary?

SB: Recent work by McHale and Asif (2012) [1] suggests that exponential decay functions were not the best choice. But you have to concede that what Duckworth and Lewis did twenty years ago was truly remarkable. There have been blemishes, and hiccups, but D/L truly changed the cricket playing field.

Q: What would you classify as a big D/L weakness?

SB: In the early years, D/L had a serious problem if the team batting first made a massive score, and … in fact, let me explain this using a very famous example. This was the harrowing moment in the 2003 WC final between India and Australia. Ponting's Australia scored a mammoth 359/2 batting first. In reply, a rampaging Sehwag had taken India to 145/3 in 23 overs under thick clouds that promised heavy rain. If the match had ended with India at 159/3 in 25 overs, Ganguly – not Ponting – would have held the World Cup aloft! That would have been a complete travesty of justice.

Q: Why? What was the problem?

SB: The real problem was that the D/L model was simply not equipped to cope with massive first innings totals. The model assumed an average 50-over score of about 245, and its inherent robustness allowed a variation of + 50 runs around this average. But it couldn't cope comfortably with scores well over 300.

Look at the D/L chart again. At the 25-over mark, only 30-40% of the resource is used if you have lost just 0-3 wickets. If the first team has scored 350 this translates to a par score as low as 105-140. That's why something like 140/3 in 25 overs could win you the match even if you are chasing 350.

Q: Oh yes, I see that. So what's the way out?

SB: Elementary! The higher the first team's score, the faster the resource must deplete. That means the descent of the curves must become 'less leisurely'

– they must slope down faster! Think of an extreme case when the first team scores 600 runs. What's the best strategy for the chasing team? Just come out and start trying to hit sixes or fours. Every ball must contribute significantly to the tally, and if you must sacrifice wickets so be it! It reminds me of our childhood maxim while playing cricket: "Hit out or get out!"

Q: So how do you do that?

SB: Duckworth and Lewis labored hard with this one [2]. They modified their model, making it look even more ghastly. Look at this: $Z(u,0,I) = Z0F(w)InF(w)+1\{1-exp(-bu/[InF(w)F(w)])\}$.

Q: Phew! What's this I?

SB: You can informally think of I as a kind of 'turning knob' that you fix at the bottom right of our resource curves, and pretend that the 'thread' of each of the ten curves – that terminate at the bottom right – is fastened to this knob. It is now quite simple; the higher the first team scores, the more you tighten the I knob. This will make the curves slope down faster … and therefore raise the par score higher. In the limiting case, we'll be back to the good old run rate rule.

Q: But, wait a minute! As soon as you turn your I knob, your resource percentage table changes! So we are no longer looking at a single table with 300 rows and 10 columns. And I'm also presuming that there will be a severe computational overhead.

SB: That's correct. The combined resource percentages will change. And while it may be hard to call the computation overhead 'severe', there's no doubt that with this change, the D/L targets can no longer be calculated at the back of an envelope. You'll now need a computer.

Q: So is this the so-called Professional Edition of D/L? I've always been confused with all this talk of Standard vs Professional Edition.

SB: Yes, the D/L edition with the I is the Professional Edition. All international matches now use the D/L Professional Edition, although the Standard Edition is still used for smaller games. In most cases, you won't need to turn the I knob unless the first team's score exceeds 235 or 245.

Q: Do you still use the G50 criterion – with different rules based on *R1:R2* **parity – in the Professional Edition?**

SB: There's no clarity on this question. The ICC official website says we don't use G50 in the Professional Edition, but the Duckworth-Lewis book, published in 2011, is somewhat ambiguous on this question. I'm guessing that D/L initially decided they don't need G50 in the Professional Edition, but then encountered rare, but feasible, scenarios that gave ridiculous targets …and so they quietly brought it back.

Q: I see that as a second D/L weakness. They can't get the G50 monkey off their back!

SB: It is just possible that McHale and Asif might have found an answer to that one. The duo revisits the original D/L model and asks if there's a way to tweak it to obtain better behavior. They come up with a better model for $F(w)$ and suggest – what many had already suspected – that the D/L $F(w)$ exhibits "erratic patterns", They further argue that the exponential fit for $Z(u,w)$ wasn't such a good idea at all because the curves sink too rapidly at the end; a distribution function with a heavier tail, that exhibits a more leisurely dip, is much better.

Q: This seems like a complete overhaul!

SB: Yes, while retaining the outer D/L shell, McHale and Asif appear to have completely refurbished the D/L interiors. To handle very high first team totals, they too recommend the I criterion … but because the McHale-Asif $F(W)$ and $Z(u,w)$ are better-modeled, they find that their revised model can scale up without giving ridiculously high targets in all situations. The G50 monkey could finally be off the D/L back!

Q: So whither D/L?

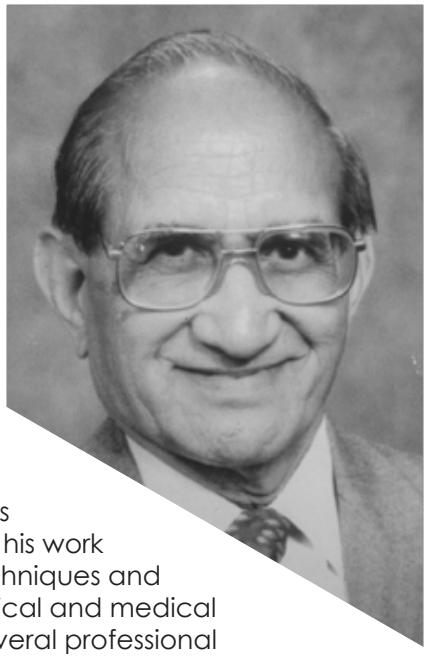
SB: You want my frank answer? The D/L Professional Edition – perhaps with the McHale-Asif correction – could continue in 50-over games, because it has given a good account of itself over almost two decades. But I think it is time for D/L to retire in T20 cricket. Even Sachin Tendulkar had to retire one day!

[1] McHale, I., and Asif, M., "A modified Duckworth-Lewis method for adjusting targets in interrupted limited overs cricket", European Journal of Operational Research, 225(2), pp. 353-362, 2013.

[2] Duckworth, F.C., Lewis, A.J., "A successful operational research intervention in one-day cricket". The Journal of the Operational Research Society 55, 749–759. 2004.

Obituary for Jagdish Rustagi

by H.N. Nagaraja



Jagdish Sharan Rustagi, one of the eminent statisticians of Indian origin and a supporter of IISA, passed away on September 21, 2014, in Sunnyvale, California. He was born on August 13, 1923, in the village of Sikri located in the state of Utter Pradesh in British India. He obtained his BA (1944) and MA (1946) degrees in Mathematics from University of Delhi, and taught at Hindu College, Delhi before moving to Stanford University with a fellowship in 1952. He was at Red Fort, Delhi, to celebrate India's First Independence Day!

Upon completing his PhD degree in Statistics under the guidance of Professor Herman Chernoff in 1956, Professor Rustagi served on the faculties of Carnegie Institute of Technology (now Carnegie Mellon University; 1955-7), Michigan State University (1957-8), Aligarh Muslim University (India; 1958-60), University of Cincinnati College of Medicine (1961-3), and finally at The Ohio State University (1963-88), where he began his career as an Associate Professor of Mathematics. He was instrumental in the development of the Department of Statistics and the Biostatistics PhD program, and retired as Professor and Chairman Emeritus at Ohio State.

Professor Rustagi was a fellow of the American Statistical Association, Institute of Mathematical Statistics, and Indian Society for Medical Statistics. He was an elected member of the International Statistical Institute. He supervised 14 PhD dissertations and two masters theses, authored four books, and edited or co-edited five volumes. He had over 50 publications and was known for his work on optimization techniques and modeling of biological and medical data. He served several professional organizations in various capacities and on journal editorial boards.

Professor Rustagi continued his vibrant life during his retirement, settling down in the Bay area, with a visiting faculty position at the University of Philippines and IBM San Jose. He wrote on his experiences as he crossed continents in *Sikri to Sunnyvale* (2007) (Hindi version in 2004). He was deeply molded by his early education in schools run by Jain trusts and Arya Samaj. Encouraged by a group of Indian friends from the group Chhajju ka Chaubara, named after an Indian historical figure from 1600's, he wrote *Reflections of Life*, a compendium of 58 short essays.

Professor Rustagi radiated a high level of enthusiasm and optimism for all around him until the end of his life. He established an endowment at Ohio State to honor his parents with an annual lecture series in 1987 that has brought distinguished researchers to the Department of Statistics over the years. His Ohio State colleagues cherished the hospitality of the Rustagis at their Worthington, Ohio home and his mentorship, philanthropy, and community service will be missed by all. He is survived by his wife, Kamla, three children, and their families. Please visit http://www.jagdishrustagi.com/, created by Professor Rustagi's family, to leave a message in the guest book and for further information.

2014 American Statistical Association Fellows

We would like to congratulate the following IISA members for getting elected as ASA fellows

Sanjib Basu (Northern Illinois University)
Aloka Chakravarty (U.S. Food and Drug Administration)
A. Richard Entsuah (Merck Research Laboratories)
Amarjot Kaur (Merck Research Laboratories)
K.B. Kulasekera (University of Louisville)
Shesh Nath Rai (University of Louisville)

Conferences

International Conference on Operational Research & 47th Annual Convention of Operational Research Society of India
December 1-3, 2014
S.V. University, Tirupati, India
http://www.orsi.in/pages/events/international-conference.php

Applied Statistics and Public Policy Analysis
December 11-12, 2014
Charles Sturt University, Wagga Wagga, New South Wales, Australia
http://csusap.csu.edu.au/~azrahman/ASPPAC2014

Statistics Careers in Clinical Trials
December 14, 2014
Cytel Statistical Software & Services, Pune, India
http://cytel.co.in/workshop-announcement/

5th International Statistical Conference of the Institute of Applied Statistics, Sri Lanka
December 28-30, 2014
Galadhari Hotel, Colombo, Sri Lanka
http://www.iappstat.lk/home/index.php/events/iasc-2014

International Conference on Robust Statistics 2015
January 12-16, 2015
Indian Statistical Institute, Kolkata India
http://www.isical.ac.in/%7Eicors2015/

Biometrics Colloquium
March 15-19, 2015
Technische Universität Dortmund, Germany
http://www.statistik.tu-dortmund.de/Biom2015/en/index.html

Graduate Workshop on Current Trends in Statistical Ecology
April 15-17, 2015
NIMBioS, Knoxville, TN USA
http://www.nimbios.org/education/WS_gradconf2015

Undergraduate Modeling Workshop
May 17-22, 2015
North Carolina State University in Raleigh, North Carolina, USA
http://www.samsi.info/workshop/2014-15-eo-undergraduate-modeling-workshop-may-17-22-2015

10th Conference on Bayesian Nonparametrics
June 22-26, 2015
Raleigh, North Carolina, USA
https://stat.duke.edu/bnp10/

2015 International Work-Conference on Time Series
July 1-3, 2015
Science Faculty, University of Granada, Granada, Spain
http://itise.ugr.es

Industrial Mathematical & Statistical Modeling Workshop for Graduate Students
July 12-22, 2015
North Carolina State University, Raleigh, North Carolina, USA
http://www.samsi.info/workshop/2015-industrial-mathstat-modeling-workshop-graduate-students-july-12-22-2015

Joint Statistical Meetings 2015
August 8-13, 2015
Seattle, WA, USA
http://www.amstat.org/meetings/jsm/2015/

Opening Workshop for Computational Neuroscience
August 17-21, 2015
NC Biotech Center in Research Triangle Park, North Carolina, USA
http://www.samsi.info/programs/2015-16-program-statistics-and-applied-mathematics-forensic-science-forensics

Opening Workshop for Statistics and Applied Mathematics in Forensics
August 31-September 4, 2015
NC Biotech Center in Research Triangle Park, North Carolina, USA
http://www.samsi.info/programs/2015-16-program-statistics-and-applied-mathematics-forensic-science-forensics

9th International Conference on Multiple Comparison Procedures
September 2-5, 2015
The Westin Hyderabad, India
http://www.mcp-conference.org/hp/2015/

Job Ads

University of Haifa, Haifa, Israel

Postdoctoral Research Fellow in Statistical Methods for Ordered and Rank Data

Position title: Post-doctoral Research Fellow.

Duties and Responsibilities: The Department of Statistics at the University of Haifa Israel has a Postdoctoral Research Fellow position available. The Fellow will develop statistical methods for analyzing varied types of ordered and rank data. Specifically, the candidate will pay careful attention to the theory methodology and underlying complexities in the data and the question of scientific interest.

Position qualifications: A PhD or equivalent degree in statistics, biostatistics or a related area is required. In addition to having a strong background in statistics and strong computational skills, the ideal candidate would be very keen on applications. Strong communication skills are highly desirable.

Special requirements: The candidate must hold an Indian or Chinese Passport and must apply by December 15, 2014.

Contact: To apply, please send your CV, a research statement and contact information and three references letters to:
Email: *davidov@stat.haifa.ac.il*
Ori Davidov
Department of Statistics Senior Investigator
University of Haifa
Mount Carmel, Haifa, 31905
Israel

Wright State University, Dayton, Ohio, USA

Chair, Department of Mathematics and Statistics

Position title: Department Chair – Mathematics & Statistics

Wright State University invites applications for the position of Chair, Department of Mathematics and Statistics, which offers undergraduate and master degree programs with a strong commitment to teaching and research.

Position qualifications: Candidates must have a Doctorate in Mathematics, Statistics, or a related area and a record that warrants appointment as a full professor. Wright State University, an equal opportunity/affirmative action employer, is committed to an inclusive environment and strongly encourages applications from minorities, females, veterans and individuals with disabilities. First consideration date: 1/5/2015.

Contact: Go to *http://science-math.wright.edu/math-statistics/about/employment-opportunities* for detailed information and to apply.

Getting IISA membership

Join the IISA community! To become a member, please visit http://www.intindstat.org/membership. Fees differ based upon country of residence. Reduced prices are available for students. Life memberships are USD 300 (or INR 1,500 for residents in the Indian subcontinent).