



THE INSTITUTE OF
MANAGEMENT SCIENCES

NEWSLETTER OF THE
TIMS College
on
Simulation and Gaming

LOUIS MOORE, EDITOR and BARRY NELSON, ASSISTANT EDITOR

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CHAIRMAN'S MESSAGE

The College had unusually full meetings at the ORSA/TIMS Meeting and at the Winter Simulation Conference in Dallas last November. The primary efforts were devoted to modifying the procedures for our proposed Service Award and for the proposed Publication Award, which will replace our current award for the best paper in *Management Science* each year. The resulting proposals are found elsewhere in this issue. Please read them carefully and call or write to me as soon as possible with any suggestions. (School of Industrial Engineering, Purdue University, West Lafayette, IN 47907 (317) 494-5422.)

The Winter Simulation Conference was successful both financially (which is good since we are a co-sponsor) and professionally. Attendance was about 325, which is a few more than average. Scheduling the WSC immediately after the ORSA/TIMS meeting appears to have worked well for us, although by the end of the week those who had attended both conferences were ready to go home.

Elsewhere in this issue, David Kelton, the TIMS/CSG awards chairman, has assembled a ballot for our award for the best simulation paper in *Management Science*. Please take the time to vote.

This is the first issue of the *TIMS/CSG Newsletter* under the new editors Louis Moore and Barry Nelson. I thank them for assuming this responsibility.

Bruce Schmeiser, Chairman
March, 1985

MINUTES OF COLLEGE MEETING AT DALLAS TIMS/ORSA CONFERENCE

Attending: A. Alan B. Pritsker, William E. Biles, Dave Withers, Barry Nelson, Rajan Suri, Arne Thesen, Lloyd W. Koenig, Louis Moore, Ronald Dattero, Lee Schruben, Howard Lucas, Dick Nance, Andy Seila, Jeff Arthur, Laurence J. Moore, Bruce Schmeiser and Jim Wilson.

College Chairman Bruce Schmeiser called the meeting to order.

1. College Secretary Jim Wilson read the minutes of the 1984 TIMS/ORSA San Francisco meeting, which were unanimously approved.
2. College Treasurer Jim Wilson summarized the current financial status of the college.
3. In addition to the new college officers elected in September, Bruce Schmeiser announced the following appointments: Chairman of the Awards Committee, David Kelton; Newsletter Editor, Lou Moore (two year term); Associate Newsletter Editor, Barry Nelson (two year term).
4. Bruce Schmeiser announced a committee to review the college bylaws. Lee Schruben and Andy Seila were named as initial committee members.
5. Lee Schruben reported that the college will sponsor three invited paper sessions at the TIMS/ORSA meetings in Boston (spring 1985) and Atlanta (fall 1985). In addition he said that the college will coordinate five contributed paper sessions in Boston.
6. Alan Pritsker noted that he had recently attended a session which was entirely on simulation but was sponsored by TIMS College on the Practice of Management Science. He suggested that we coordinate more closely with this group.
7. Alan Pritsker reported on the 1983 Winter Simulation Conference, for which the College on Simulation and Gaming had primary responsibility. The following TIMS members served in key positions: General Chairman, Jerry Banks; Program Chairman, Bruce Schmeiser; Proceedings Editor, Steve Roberts; Business Chairman, Hank Grant. There were 416 attendees. In addition to recovering its advance of \$2000.00, the college received a profit of \$2807.17.

8. Reporting on the work of the committee that he chairs, Bill Biles presented a "Proposal for a Service Award." After a lengthy discussion in which various items were reworded, the proposal was unanimously approved for inclusion in the spring Newsletter. Discussion of additional revisions and a final vote on the adoption of this proposal were scheduled for the TIMS/ORSA meeting in Boston.
9. Bruce Schmeiser reported on a "Proposal for The Outstanding Simulation Paper Award" as a replacement for "The Best Simulation Paper in *Management Science* Award." Consensus was reached on some modifications to this document, including the new title "Proposal for The Outstanding Simulation Publication Award." The modified proposal was approved for inclusion in the spring Newsletter. Discussion of additional revisions and a final vote on the adoption of this proposal were scheduled for the TIMS/ORSA meeting in Boston.
10. Bruce Schmeiser adjourned the meeting.

Respectfully Submitted,
James R. Wilson,
Secretary.

MINUTES OF COLLEGE MEETING AT DALLAS WINTER SIMULATION CONFERENCE

Attending: Barry L. Nelson, Linda W. Friedman, Arne Thesen, Chuck White, Leonard Zettel, Andy Seila, David Kelton, Ronald Dattero, Robert Sargent, Dave Goldsman, Mike Taaffee, Randy Hudgens, Andy Andrews, Paul Sanchez, J. Johnson, Louis R. Moore, Alan Pritsker, Thomas J. Schriber, Ray Pipkin, Jerry Richards, Lee Schruben, Bruce Schmeiser and Jim Wilson.

College Chairman Bruce Schmeiser called the meeting to order.

1. Alan Pritsker reported on the 1983 Winter Simulation Conference. There were 416 attendees, compared to 274 attendees at the 1982 WSC in San Diego. In addition to recovering its advance of \$2000.00, the college received a profit of \$2807.17.
2. Secretary Jim Wilson read the minutes of the San Francisco meeting, which were unanimously approved.
3. Jim Wilson also gave the Treasurer's Report.
4. Bill Biles presented the "Proposal for a Service Award." Although questions were raised about the use of the phrase "long-standing, exceptional service" in items 1 and 5c (v), this phrase was left unchanged. The proposal was (again) unanimously approved for inclusion in the spring Newsletter. Discussion of additional revisions and a final vote on the adoption of this proposal were scheduled for the TIMS/ORSA meeting in Boston.
5. Bruce Schmeiser reported on a "Proposal for the Outstanding Simulation Publication Award" as a replacement for "The Best Simulation Paper in *Management Science* Award." Bob Sargent suggested that selection criteria for the outstanding simulation publication should be included in the proposal. Although this issue was not resolved, the proposal was approved for inclusion in the spring Newsletter. Discussion of additional revisions and a final vote on the adoption of this proposal were scheduled for the TIMS/ORSA meeting in Boston.
6. Bruce Schmeiser adjourned the meeting.

Respectfully Submitted,
James R. Wilson,
Secretary

TREASURER'S REPORT

The 1984 Financial Report to TIMS Headquarters is summarized below.

REVENUES:

Interest on savings (Security Trust, Rochester, NY)	\$321.79
Interest on NOW acct (Interfirst Bank NW Austin)	32.78
Profit on 1983 Winter Simulation Conference (WSC)	2807.17
Total Revenue	<u>\$3161.74</u>

DISBURSEMENTS:

College-sponsored mixers	\$ 88.17
NOW checks (Interfirst)	6.84
Board member expenses for 1983 WSC	404.50
Advance for 1984 WSC	2000.00
Total Disbursements	<u>\$2499.51</u>

ACCOUNT SUMMARY AS OF 12/31/84:

NOW account (Interfirst)	\$ 3422.42
180-day 11.3% CD due 4/7/85 (Interfirst)	7185.48
Funds held at TIMS Headquarters	278.84
Total liquid assets	<u>\$10886.74</u>

Since December 31, 1984, we made an advance of \$2000.00 to the 1985 WSC and we received our previous advance of \$2000.00 from the 1984 WSC.

Respectfully Submitted,
James R. Wilson,
College Treasurer.

DRAFT PROPOSAL FOR THE OUTSTANDING SERVICE AWARD

1. Purpose of the Award: Recognize longstanding, exceptional service to the Simulation Community.
2. Name of the Award: Award for Outstanding Service (hereafter called the *Award*).
3. Form of the Award: a plaque inscribed with the name of the Award, the year awarded, the name of recipient, and *Presented by The Institute of Management Sciences/College on Simulation and Gaming*.
4. Funding: The plaque will be purchased from funds from the treasury of the TIMS/CSG. The only reimbursed expenses are the cost of any meals associated with the awards ceremony. There is no cash prize associated with the Award. No other expenses associated with presenting the Award will be paid.
5. Procedure:
 - a. Announcement: The chairperson of the Selection Committee will call for nominations in the TIM/CSG Newsletter and ORMS/Today, as well as any other medium deemed necessary, during the first six months of the calendar year.
 - b. Nomination: Any person may nominate any person without restriction. The burden for offering evidence of merit falls on the nominator. Nominations must be in the hands of the Selection Committee chairperson by September 1.
 - c. Selection:
 - i) The Selection Committee shall consist of three members. Each year one new member shall be appointed by the chairperson of the TIMS/CSG to serve for three years. The member in the second year shall be the chairperson. The initial committee shall be appointed with assigned seniority by the College chairperson.

- ii) Selection Committee membership shall be offered to the last three past chairpersons of the TIMS/CSG before other persons are offered membership.
 - iii) The chairperson of the Selection Committee will have full responsibility for obtaining and presenting the plaque and for arranging for publicity in the TIMS/CSG Newsletter and ORMS/Today, as well as any other medium deemed desirable.
 - iv) The Selection Committee will make the final decision of the winner by majority vote.
 - v) The Selection Committee is to select from the set of nominees the individual who, in their opinion, has the best record of longstanding, exceptional service to the Simulation Community.
 - vi) The Selection Committee may choose to make no award.
 - vii) The Selection Committee is to make every reasonable effort to keep the names of the nominees other than that of the winners confidential.
 - viii) The Selection Committee is not to name multiple winners nor to give an honorable mention designation to any nominee.
- d. Presentation: The Selection Committee chairperson shall arrange for a suitable presentation of the Award at a national or international meeting of which TIMS is a sponsor. The presentation is to be made sometime during the last three months of the year in which it is awarded, if possible.
- e. Default: The chairperson of the TIMS/CSG may dissolve the Selection Committee at any time for cause. Such action may be protested by the chairperson of the Selection Committee, in which case the decision to dissolve the Selection Committee may be submitted to a vote of the TIMS/CSG membership. If the Selection Committee is dissolved, the TIMS/CSG chairperson shall appoint another Selection Committee. The new Selection Committee shall have the full powers of the former Selection Committee.

March 1985

DRAFT PROPOSAL FOR THE OUTSTANDING SIMULATION PUBLICATION AWARD

- Purpose:** To recognize outstanding contributions to the simulation literature.
- Eligibility:** — Anyone is eligible to win the award.
 — Journal articles, proceedings articles, books and monographs are eligible. Technical reports, research memoranda, working papers, and dissertations/theses are not eligible. Works for which the award has been given are not eligible.
 — The written work for which the award is given must be copyrighted during the three previous calendar years.
- Award:** A plaque to each author and a \$500 prize to be divided among the authors.
- Procedure:** 1. The procedures will be implemented by the TIMS/CSG Awards Committee.
 One new member is appointed for a three year term by the College chairperson each year. The member in the second year shall serve as the committee chairperson. The initial Awards Committee shall be appointed with assigned seniority by the College chairperson.
 2. Nominations will be solicited in the spring of each year via notices in the TIMS/CSG Newsletter and ORMS/Today, as well as any other method deemed desirable by the committee.
 3. Nominations may be made by anyone, including the author(s). Nominations may not be anonymous.

4. Nominations shall include
 - a. a copy of the written work (including all bibliographical information)
 - b. a short statement suitable for reading at the award ceremony if the work is chosen
 - c. and any other information thought relevant by the nominator.
5. Nominations are closed September 1.
6. Nominators and nominees will be held confidential by the Awards Committee, with the exception that they may consult (in confidence) with anyone they deem necessary.
7. Only a single award may be given each year.
8. No honorable mention awards may be made.
9. The Awards Committee reports to the chairperson of the TIMS/CSG the number of nominated papers and the winners as soon as possible after the selection and before the award ceremony.
10. The winning author is notified as soon as possible after the selection and invited to the awards ceremony by the awards chairman.
11. The awards chairman contacts the program chairperson of the spring Joint National TIMS/ORSA meeting and requests a spot in the awards ceremony.
12. The awards chairman ensures that plaques and checks are available at the ceremony. No expenses other than meals at the awards ceremony shall be reimbursed.
13. The award is presented at the awards ceremony at the spring Joint National Meeting of ORSA and TIMS by the chairperson of the Awards Committee or a substitute named by the TIMS/CSG chairperson.
14. The winner is announced in both the TIMS/CSG Newsletter and ORMS/Today, as well as in any other medium deemed desirable by the Awards Committee.
15. The decision of the awards committee is final.
- 16.* Default: The chairperson of the TIMS/CSG may dissolve the Awards Committee at any time for cause. Such action may be protested by the chairperson of the Awards Committee, in which case the decision to dissolve the Awards Committee may be submitted to a vote of the TIMS/CSG membership. If the Awards Committee is dissolved, the TIMS/CSG chairperson shall appoint another Awards Committee. The new Awards Committee shall have the full powers of the former Awards Committee.

* Item # 16 was not discussed at either Dallas business meeting. I have added it for symmetry with the procedures for the service award proposal. We will discuss it at the Boston business meeting.

BWS
March 1985

NEW BOOKS

Models of Reality: Shaping Thought and Action. Jacques Richardson, editor. 1984. 328pp. Index \$22.95. ISBN 0-912338-35-0. (Microfiche edition: \$15.00. ISBN 0-912338-36-9.) Contact: Lomond Publications, Incorporated, P.O. Box 88, Mt. Airy, MD 21771, telephone (301) 829-1496. The book treats concepts of modeling and simulation and presents several examples of their application throughout the fields of knowledge. It does not treat methodology as a major topic.

ABSTRACTS OF PAPERS

ASYMPTOTIC VARIANCE ESTIMATION FOR STATIONARY PHI-MIXING PROCESSES, Bor-Chung Chen and Robert G. Sargent, Working Paper #84-006, November 1984, Department of Industrial Engineering and Operations Research, Syracuse University, Syracuse, N.Y. 13210.

This paper describes variance estimation for strictly stationary phi-mixing stochastic processes. This estimation is based upon the asymptotic properties of the standardized time series of observations from the process. This includes point and interval estimators for the variance and comparison of them to the classical estimator. The results show that the four new estimators have asymptotic properties that clearly dominate the classical estimator. Also, asymptotic confidence interval estimators for the ratio of two variances representing two independent processes are discussed.

CONFIDENCE INTERVAL ESTIMATION FOR THE DIFFERENCE BETWEEN TWO STOCHASTIC PROCESSES USING STANDARDIZED TIME SERIES; Bor-Chung Chen and Robert G. Sargent, Working Paper #84-004, October 1984, Department of Industrial Engineering and Operations Research, Syracuse University, Syracuse, N. Y. 13210.

This paper describes confidence interval estimation for the difference between the means of two independent strictly stationary ϕ -mixing stochastic processes. This estimation is based on the asymptotic properties of the standardized time series of observations from the two stochastic processes. Interval estimators for the cases of equal sample sizes with unknown variances, unknown common variance, and unequal sample sizes with unknown variances are developed. Two applications of these intervals are validating stationary discrete event simulation models and comparing two alternative policies or system designs via simulation.

AN ILLUSTRATION OF THE SAMPLE SPACE DEFINITION AND VARIANCE REDUCTION, Barry L. Nelson, Department of Industrial and Systems Engineering, The Ohio State University, 1971 Neil Avenue, Columbus, Ohio 43210.

A simulation experiment performed to estimate the expected number of customers served per day in a bank is used to illustrate a new definition of simulation experiments, a new framework for variance reduction, and several variance reduction techniques (VRTs). Particular emphasis is placed on techniques that might be suitable for automated variance reduction procedures.

EDITOR'S CORNER

REGENERATIVE PROCESSES AND THE ϕ -MIXING PROPERTY, by Peter W. Glynn, Department of Industrial Engineering, University of Wisconsin, Madison, Wisconsin 53706.

The development of limit theory for steady-state output analysis algorithms is often simplified by assuming that the output process is either ϕ -mixing or regenerative. The purpose of this note is to show that, contrary to the folklore, stationary positive recurrent regenerative processes are not necessarily ϕ -mixing.

Let $X = (X_n : n \geq 0)$ be a Markov chain on state space $E = (0, 1, \dots)$, with transition matrix

$$\begin{aligned} P_{i,i+1} &= p \quad , \quad i \geq 0 \\ P_{i,i-1} &= q \quad , \quad i \geq 1 \\ P_{0,0} &= q \end{aligned}$$

where $p > q = 1-p > 1/2$. If $P(X_0 = j) = (1-p/q)^{-1} (p/q)^j$, then X is a stationary Markov chain which is a positive recurrent regenerative sequence with respect to hitting times of state 0 (for instance).

In order that X be ϕ -mixing (see BILLINGSLEY (1968), there must exist constants $\phi(n)$ decreasing to zero such that

$$(1) \sup \{ |P(E_2 | E_1) - P(E_2)| : E_1 \in \mathcal{F}_0^k, E_2 \in \mathcal{F}_{k+n}^\infty, k \geq 0 \} \leq \phi(n)$$

where \mathcal{F}_1^j consists of all events generated by X_1, \dots, X_j ($i \leq j$). The left-hand side of (1) clearly dominates

$$\begin{aligned} &\sup \{ |P(X_n = 0 | X_0 = j) - P(X_n = 0)| : j \geq 0 \} \\ &\geq |P(X_n = 0 | X_0 = n+1) - P(X_n = 0)| \\ &\geq P(X_n = 0) = (1-p/q)^{-1}; \end{aligned}$$

The second inequality is a consequence of the fact that a birth-death chain cannot move more than n states in n steps. It follows that the left-hand side of (1) does not converge to zero as n tends to infinity. Hence, X is not ϕ -mixing.

Stationary positive recurrent regenerative sequences do satisfy a somewhat weaker mixing hypothesis, namely that of strong mixing:

$$\sup \{ |P(E_1 \cap E_2) - P(E_1)P(E_2)| : E_1 \in \mathcal{F}_0^k, E_2 \in \mathcal{F}_{k+n}^\infty, k \geq 0 \} \leq \alpha(n)$$

where the $\alpha(n)$'s converge to zero (see GLYNN (1982)). It turns out that strong mixing is sufficient to prove a large variety of limit theorems that are relevant to simulation; see, for example, HALL and HEYDE (1980).

$$\sup \{ |P(E_1) | P(E_2 | E_1) - P(E_2) | : E_1 \in \mathcal{F}_0^k, E_2 \in \mathcal{F}_{k+n}^\infty, k \geq 0 \} \leq \alpha(n)$$

Acknowledgement: The preparation of this note was supported by the National Science Foundation under Grant No. ECS-8404809.

REFERENCES

- [1] BILLINGSLEY, P. (1968). *Convergence of Probability Measures*. John Wiley, New York.
- [2] GLYNN, P. (1982). Some new results in regenerative process theory. Technical Report 16, Department of Operations Research, Stanford University, Stanford, CA.
- [3] HALL, P. and HEYDE, C. C. (1980). *Martingale Limit Theory and its Applications*. Academic Press, New York.

(Please address comments to the author. Ed.)

SPEAKING FOR TIMS ON PROPER PRACTICE

No individual is empowered to speak for The Institute of Management Sciences in any public sense on what does or does not constitute proper practice of management science, not the members, not the subdivision officers, not the Council members, and not the President.

Nor is any subdivision so empowered.

The Council alone has this power, but in my view, has wisely refrained from exercising it.

TIMS is not an organization whose functions normally include political or other public pronouncements. TIMS is an organization which provides a collection of forums, some completely open, like the submitted-paper mechanism at meetings, and some restricted, like the refereed journals. In these forums, individuals can express their individual opinions on matters relevant to the Management Sciences.

BALLOT FOR COLLEGE AWARD FOR BEST SIMULATION PAPER IN MANAGEMENT SCIENCE

Five papers have been nominated for selection as the best paper on simulation published in the last two volumes (29 and 30) of *Management Science*. (This award covers volume 29 as well as volume 30 since fewer than three nominations were received for last year's award, covering volume 29 alone.) The ballot below contains the authors' names, paper titles, and bibliographic information.

The definition of "best" was intentionally left undefined by the committee that set up the award five years ago, so that each member of the College could use whatever criteria desired.

Each member of the College may cast one vote for one paper. Although not necessary, any comments about your selection are appropriate and appreciated.

NOTE: In order for your ballot to be counted, include your **Newsletter** address label in the envelope with your ballot. This information will be kept confidential and is only to ensure ballot validity.

Mail to: David Kelton
Department of Industrial and Operations Engineering
The University of Michigan
Ann Arbor, Michigan 48109-2117

Ballots must be postmarked by **August 15, 1985**.

1983-1984 "BEST PAPER ON SIMULATION AND GAMING" IN MANAGEMENT SCIENCE

VOTE FOR ONLY ONE

- [] Roger I. Hall and William B. Menzies, "A Corporate System Model of a Sports Club: Using Simulation as an Aid to Policy Making in a Crisis," *Management Science* 29, No. 1, January 1983, pp. 52-64.
- [] Nabil R. Adam, "Achieving A Confidence Interval for Parameters Estimated by Simulation," *Management Science* 29, No 7, July 1983, pp. 856-866.
- [] Carl A. Mauro and Dennis E. Smith, "Factor Screening in Simulation: Evaluation of Two Strategies based on Random Balancing Sampling," *Management Science* 30, No. 2, February 1984, pp. 209-221.
- [] David Goldsman and Lee Schruben, "Asymptotic Properties of some Confidence Interval Estimators for Simulation Output," *Management Science* 30, No. 10, October 1984, pp. 1217-1225.
- [] James R. Wilson and A. Alan B. Pritsker, "Experimental Evaluation of Variance Reduction Techniques for Queueing Simulation using Generalized Concomitant Variables," *Management Science* 30, No. 12, December 1984, pp. 1459-1472.