

STATISTICS Newsletter[©]

Volume 16, No. 7

Fall, 1997

Chair's Message

by Don Emerling



For the last few weeks I have been doing some thinking and preparation for the upcoming Long Range Planning meeting which will follow the Fall Technical Conference in Baltimore.

As a part of my preparation, I sat out on my deck last weekend (in Minnesota you take every opportunity to do that before the winter sets in, which could be any day now) and reviewed all of the past issues of the Statistics Division newsletters. I was struck by the explosive growth in the early days of the Division and the incredibly fast pace of product and service introductions by the Statistics Division. However, the strongest impact on me was Bill Hunter's inaugural message from the chairman.

I was so strongly impacted by his message that I am going to use the majority of my Chairman's Message reprinting a large part of Bill's message. I think you will enjoy reading the thoughts and observations of this great man. Following his message I will end with a few observations from an average man.

Excerpts from Bill Hunter's 'MESSAGE FROM CHAIRMAN', Statistics Division Newsletter, Volume 1, Number 1, February 21, 1980.

"When working in Nigeria not too long ago I bought a Japanese car which, on one trip, I drove north to the southern edge of the Sahara and west into Upper Volta over roads and non-roads of jarringly poor quality; for a year that car took a licking but kept

on ticking. No problems. Upon returning to the States, I bought an American car. Sometime after having its defective axle replaced, I drove it to northern Wisconsin. There a spring broke".

"I am not saying that Japanese products are always superior to American ones. As we all know, there are many high quality goods made in the United States. What I am saying, though, is that things have changed in Japan over the past thirty some years. Spectacular gains have been made in the area of quality. Statistical quality control played an important part in the development, with a leading role being played by Dr. W. Edwards Deming".

"Can U.S. industry undergo a similar transformation, becoming more conscious of quality at every level and more capable of making quality products, and in particular putting into

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Outgoing Newsletter Editor

by Janice Shade

Many thanks to the members and readers for making this job both rewarding and pleasurable. The past 2 years were a wonderful experience. We introduced the concept of a Special Publication which replaced the Spring edition of the Newsletter. The first publication entitled, "Statistical Thinking", was well received. Although a minor set back occurred this past spring, learnings from the event will result in a more robust process of ensuring articles are completed in a timely manner. On a personal note, I learned that there is always someone who is willing to help. (Thank you, Davis Balestracci.)

Just as Special Publication Series was introduced to meet reader needs and expectations, other programs may be appropriate. So.....If you have

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Editor's Corner

by Ralph St. John

When Don Emerling called me and asked me to consider taking over the editorship of the Statistics Division Newsletter, my initial reaction was "You've got to be kidding!! I just retired from Bowling Green State University after 24 years here. I want to relax now, sleep late in the morning, play chauffeur to my two middle school kids, watch soaps in the afternoon, etc. Besides, I've got Parkinson's so how can I be an editor if I can't write." I didn't say that to Don, but these were the thoughts running through my head. What I said to Don was "Give me a few days to think about it", hoping that my tone of voice was sufficiently pessimistic to get him thinking of an alternative soon. Then I talked to my wife about it and she was very positive about it ('Get him out of the house' she probably thought). Then my department chair (I'm still part-time faculty for three years) told me resources (secretary, computer, office space) should be no problem. Then I recalled my previous stint with the Stat Division Officers and Board

when I was FTC committee member....what a great group they were to work with (creative, respectful, cooperative, funloving, hardworking). Then my wife reminding me about how I used to come home from Stat Division meetings and rave to her about how nice it was to work with these folks. How could I pass up the opportunity?? Then I spoke to Janice Shade and she convinced me that the 'job' was fun and not the drudge that people think it is, and that writing isn't a major part of the job, but organizing is. So I called Don and told him I'd do it provided I didn't have to start until after my family vacation in July and August.

Upon my return from the Grand Canyon (we had a cabin ten yards from the north rim....wow!) and Bar Harbor (Whale watching...WOW!!), I learned that I had to move to a 'new', smaller, less spacious office. After 24 years of 'packrating' it was traumatic to clean out my old office, discard lots of 'treasures' (trash?), and reduce

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Criteria for Basic Tools and Mini-Paper Columns

Basic Tools

Purpose: To inform/teach the "quality practitioner" about useful techniques that can be easily understood, applied and explained to others.

Criteria:

1. Application oriented/not theory
2. Non-technical in nature
3. Techniques that can be understood and applied by non-statisticians.
4. Approximately three to five pages or less in length (8 1/2" x 11" typewritten, single spaced.)
5. Should be presented in "how to use it" fashion.
6. Should include applicable examples.

Possible Topics:

New SPC techniques
Graphical techniques
Statistical thinking principles
"Rehash" established methods

Mini-Paper

Purpose: To provide insight into application-oriented techniques of significant value to quality professionals.

Criteria:

1. Application oriented.

2. More technical than Basic Tools, but contains no mathematical derivations.
3. Focus is on insight into why a technique is of value.
4. Approximately six to eight pages or less in length (8 1/2" x 11" typewritten, single spaced.)
Longer articles may be submitted and published in two parts.
5. Not overly controversial.
6. Should include applicable examples.

General Information

Authors should have a conceptual understanding of the topic and should be willing to answer questions relating to the article through the newsletter. Authors do not have to be members of the Statistics Division.

Submissions may be made at any time to the Statistics Division Newsletter Editor. All articles will be reviewed. The editor reserves discretionary right in determination of which articles are published.

Acceptance of articles does not imply any agreement that a given article will be published.

VISION

- Our customers' needs will be continuously anticipated and met.
- Our members will be proud to be a part of the Division.
- Our Division's operations will be a model for other organizations.
- We will be a widely influential authority on scientific approaches to quality and productivity improvement.

MISSION

- Promote statistical thinking for quality and productivity improvement.
- Serve ASQ, business, industry, academia and government as a resource for effective use of statistical methods for quality and productivity improvement.
- Provide a focal point within ASQ for problem-driven development and effective use of new statistical methods.
- Support the growth and development of Division members.

STRATEGY

- Our primary customers are Statistics Division members. Other key customers are:
 - Management,
 - Users and potential users of statistical methods for quality and productivity improvement,
 - Educators of the above customers.
- Our orientation to customers is customer focused.
- Our markets, within which we intend to offer products, are weighted as follows: greatest weight on intermediate statistical methods, nearly as much weight on basic methods, and much less weight on advanced methods.
- Our primary products are educational services.

PRINCIPLES

- Focus on a few key things.
- Balance short-term and long-term efforts.
- Recognize that we exist for our customers.
- Value diversity (including geographical and occupational) of our membership.
- Be proactive.
- View statistics from the broad view of quality management.
- Apply statistical thinking ourselves (that is, practice what we preach).
- Uphold professional ethics
- Continuously improve

CHAIR'S MESSAGE

Continued from page 1

practice in design departments and on production lines effective statistical quality control procedures? Maybe. Maybe not. But I believe the Statistics Division should set its sights high. It should try to have a real impact on American industry and other elements of our economy. Of course, more is involved than statistical quality control but we should try to be a positive catalyst for a general move in this desired direction (I say 'desired' in part because there are signs that U.S. consumers increasingly value quality in making purchasing decisions). If we don't try, who will?"

I had many thoughts racing through my head as I read Bill's words. But the primary thought was one of pride and satisfaction for Statistics Division members. Those of us who lived through this period of turmoil in American Industry remember back to when there was serious doubt that American companies would ever 'catch up', or even survive. Many of you will remember the various graphs that showed the

widening gap between American product performance and Japanese product performance. The war cry of the day was "The Japanese are improving at a faster rate than we are, how can we ever close the gap?" I think we can all take pride in the fact that the evidence today is that the gap has closed or is closing. 17 years later, I think we have answered Bill's question "Can U.S. industry undergo a similar transformation?" with a resounding YES! And I believe that the Statistics Division members can take a significant part of the credit for making that happen. We hear so much bad news these days, layoffs, downsizings, etc., but I think, reflecting on where we were in 1980, the response of American industry to the 'quality gap' is a great example of good news. I think we did try, and I think it made a difference.

Now we are faced with a different challenge. We have demonstrated so well the critical need for statistical methods in the race for quality. Now I believe we have to demonstrate to

Corporate America the critical need for statistical thinking as a component to lead their enterprises. The challenge is new. The challenge is certainly different, we have to add methodologies and tools to our knowledge base that are not 'statistical science', such as team tools, teamwork skills, 'idea data' tools and methods. But the membership of the Statistics Division are a diverse lot. We are not all 'statisticians'; our members, and our Division, are focused on practical application of statistical methods and statistical thinking.

So I offer a fresh challenge to the members of the Statistics Division. Let us demonstrate to the leaders of Corporate America the critical need for statistical thinking to be a fundamental component to lead their enterprises to success in the coming century.

As Bill said seventeen years ago, "We should try to be a positive catalyst for a general move in this desired direction. If we don't try, who will?"

EDITOR'S MESSAGE

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the total volume of material by 50%. That consumed three weeks. But it's done and now I'm trying to learn the ropes and get this newsletter out in reasonable time. Of course, I'm sure there will be lots of glitches ('opportunities for improvement'), and I hope you won't be bashful about stepping forward to help nourish that improvement.

Above all, I NEED YOUR HELP! This is YOUR newsletter. The news items we include must come from YOU. The Basic Tools articles should cover topics that YOU want to hear about and learn about. The Minipapers must relate to applications relevant to our readers. Please, let me know what YOU want to read about. Anyone with ideas for the newsletter, please send them to me. You can send ideas, names of people with ideas, rough drafts of Tutorials or Minipapers, news items, requests for help (see below), corrections, complaints, etc. My only criterion is that you read the Statistics Division Vision and Mission statement found in this newsletter, and can say "Yes, my idea/comment/paper matches up with that statement."

Many of you have access to the internet, and so you are probably familiar with the newsgroups **sci.stat.consult** and **sci.stat.math**. One of the real benefits of these newsgroups is that people can ask questions like "How do I do a normal probability plot", or "Is there any software to perform XYZ analysis?" Within hours these questions will be answered by sometimes dozens of people and the original questioner will have names and email addresses of people to contact to follow up on those comments. If all of our readers had access to the internet, then this story could end here; reality is that most of our readers don't have internet access yet. I propose starting a new column in this newsletter, a column titled "**HOW DO I ... ?**". Readers would write (email, US postal mail, telephone) with their questions, I would post those questions to the appropriate internet newsgroups, edit the responses into a coherent letter, and include the question and responses in the next newsletter. What do you think readers??"

If you're submitting written material

to me (news, announcements, articles, etc.), my preference is that you send me Microsoft WORD documents, either on a floppy disk or as an attached (not embedded) MIME file via email. This will assure that your formatting intentions are most likely to be respected. Other formats (WordPerfect, txt, etc) are perfectly acceptable, but I will reformat those files to MS WORD. If necessary, you may anonymous ftp files to me at cio.cba.bgsu.edu (directory INCOMING). You should note that all of the above preferred methods of submission are via electronic file. You may send me fax copies or paper copies of materials, but those are my least favorite media, and may not be 'processed' as fast as electronic files. I would be overjoyed to find my mailboxes overflowing with messages from you. Please write... My addresses are:

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53rd Deming Conference on Applied Statistics

When: December 8-10, 1997 Tutorials: December 11-12, 1997 Short Courses

Where: Resorts Casino Hotel, Atlantic City, NJ

Co-sponsoring by: Statistics Division and Metropolitan Section of ASQ and Biopharmaceutical Section of ASA

Speakers include: Ed Vonesh (Longitudinal Data), Mark Anderson (Robust Design-Reducing Transmitted Variation), Peter Hartwick (Jurassic Park Leadership), Steve Piantadosi (Clinical Trials) and Cecilia Kilian (Ed Deming's Secretary!!). There are a total of 18 speakers and 4 short courses.

More detail (including the complete program, abstracts of all presentations, and registration procedures) is available at the Web Site (<http://nimbus.temple.edu/~kghosh/deming/>)

Ellis R. Ott Scholarships

The ASQ Statistics Division congratulates the following students on receiving Ellis R. Ott Scholarships in the amount of \$5000 each to support their continued graduate studies in statistics and quality management.

The winners are:

William R. McDaniel, Northwestern University
Christopher R. Bilder, Kansas State University
Delia Grenville, Virginia Polytechnic Institute and State University

Davie B. Dahl, Brigham Young University

Several Ellis R. Ott Scholarships are offered each year.

Recipients must be:

1. A student who is planning to enroll or is currently enrolled in an MS or higher degree program that has concentration in the theory and application of statistical inference, statistical decision making, experimental design, analysis and interpretation of data, quality control, statistical process control, quality assurance, quality management and related fields.
2. A student who has a grade point average of 3.25 or higher on a 4.0 scale in any field of undergraduate study.

Applications for the 1998-9 academic year will be accepted during February and March. Check the Statistics Division Web page (<http://www.asqc.org/about/divisions/stats/>) for updated information regarding application forms and mailing addresses.

CALL FOR PAPERS... 1998 FALL TECHNICAL CONFERENCE

42nd Annual Fall Technical Conference - October 22-23, 1998
Radisson Hotel - Corning, New York

Management Analytics: Statistics, Quality, and Decision Making

Co-sponsored by: American Society for Quality, Statistics Division
American Society for Quality, Chemical and Process Industries Division
American Statistical Association, Section on Physical and Engineering Sciences

Management Analytics is the scientific approach to quality decision making for management. If you are interested in presenting an applied or expository paper in any of three parallel sessions (Statistics, Quality Control, or Tutorial/Case Studies), request detailed submission instructions from any of the individuals below, preferably by e-mail. Work should be strongly justified by application to a problem in engineering, process/chemical industry, or physical sciences and it should be relevant to management decision making. The mathematical level of the papers may range from none to what is used in the Journal of Quality Technology or Technometrics, and may include hands-on approaches from the fields of Operations Research and Simulation.

Submission deadline is January 17, 1998.

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LETTERS TO THE EDITOR

To the Editor:

I have noticed some serious errors in the minipaper "A Note on EWMA" by Sumedha Sengupta in the Summer, 1997 ASQ Statistics Division newsletter.

1. The control charting and forecasting applications of the EWMA statistic have been confused. This issue was discussed in the panel discussion on control charting in the April 1997 JQT. I refer interested readers to this discussion. If the EWMA is used for forecasting, the usual control limits cannot be applied.

2. Also, it is not true that the EWMA chart resembles a CUSUM as the smoothing parameter approaches zero. As the parameter approaches zero, the EWMA statistic changes less and less and essentially remains at its starting value. This same error appeared in the paper by Khamis(1996) and evidently first appeared in the paper by Hunter(1986).

3. Also, one does not determine the EWMA control chart parameter by minimizing the sum of squared forecast errors. If the data are independent and in-control this method is likely to give a smoothing value of zero!

I hope you will bring these to the attention of your readers.

Thank you.

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References

- Hunter, J.S. (1986), "The Exponentially Weighted Moving Average," *Journal of Quality Technology*, 18, 203-210.
- Khamis, H.J. (1996), "A Note About the Exponentially Weighted Moving Average," *Joint Newsletter for the Physical and Engineering Sciences Section and the Quality and Productivity Section of the American Statistical Association*, Volume 2, Number 2, December, 10.
- Sengupta, Sumedha (1997), "A note on EWMA", *Statistics Division of the American Society for Quality Newsletter* Summer, 1997.

Reply from Dr. Sengupta

To the Editor:

Dr. Woodall's comments on my paper are respectfully noted. I beg to differ with him on the grounds that I have not 'confused' the issue of EWMA in using it in the applications that were cited in my mini paper. He has referred the reader to the panel discussion that was published in the April, 1997, Vol. 29, #2, issue of the *Journal of Quality Technology (JQT)*. I would also like to draw the attention of the reader to the same issue, and in particular to page 132, third paragraph under "Review & Critique...", where discussions on this issue are made.

In my paper I have used EWMA in two different situations. The first one discusses an application in a process control primarily for predictive purpose for a process characteristic which is autocorrelated. In rectifying the situation where a Shewhart chart was initiated on the assumption of independence of the characteristics, the control limits were modified. The modified control limits were computed to show how the limits became tighter with the appropriate corrections for the standard deviation and the weight factor. I have cited the modified limits that have been published and which have been used by many people. In lieu of any other published and satisfactory control limits for EWMA, these limits serve the purpose. Readers may consult the references cited in the mini paper. So far, I have not seen any alternative control limits for EWMA other than what has been widely used.

As for CUSUM and EWMA, all I can say is that for low values of the weight factor, the recursive relationship for EWMA uses more and more of the past data from the process and less and less of recent data. As the weight factor approaches zero, the second term in the relationship eventually vanishes leaving only the accumulated information provided from the averages based on past data. It is in this way that it resembles the CUSUM, which is the accumulated sum of the observations. As those who have worked with both know, the EWMA

and CUSUM are used in different situations. I have seen very few applications of EWMA with weight factor equal to zero. The statement made in the mini paper was made in this light, and not in the sense that EWMA 'becomes' CUSUM for weight factor equal to zero.

I don't know why comment #3 was made. If the data are independent and under control, the EWMA does not apply and I have not used such a situation in my paper.

Sincerely,
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ERRATA

Please note these corrections to "A Note on EWMA" printed in the Summer 1997 issue of the *Statistics Division Newsletter*:

1. Part 1, section 1, paragraph 1, line 9, Replace 176 by 1976.

2. Part 1, section 2, line 5 from the bottom. Replace $\mu \pm 3 \frac{\sigma}{2}$ by $\mu \pm 3 \frac{\sigma}{2}$

3. Part 1, subsection 2.1. Replace e^t by e_t .

4. Part 1, subsection 2.1. Replace 40 ± 4.63 by 40 ± 6.93 .

Sumedha Sengupta

OUTGOING EDITOR

Continued from page 1

ideas, suggestions or comments please let us know. The numbers and Email addresses of the Division Infrastructure are printed in every newsletter. We want to hear from you.

As the outgoing editor, I must admit the most difficult part of the job was to find Mini Papers and Basic Tools articles to print. In every Division survey, these articles are rated very high in importance to the readers. Yet, I was lucky to receive one or two submissions a quarter. Yes, this gap needs to be abridged.

I leave the newsletter in the very capable hands of Ralph St. John. Good luck, Ralph. I know you will do a great job!

Janice Shade

NOMINATIONS SOUGHT FOR 1998 DEMING LECTURER

To honor the many accomplishments of W. Edwards Deming, the ASA Board of Directors created the Deming Lectureship in April 1994 to be presented at the ASA annual meetings. The Deming Lecturer will receive travel expenses to give the lecture, an honorarium of \$1000, and an award plaque. The lecture is routinely videotaped to enable its viewing by a wider audience. The Deming Lectureship Committee is seeking input for nominations for the lectureship.

Criteria for Selecting the Deming Lecturer:

1. An individual who knows Deming's methodology and has made significant contributions in fields related to those in which Dr. Deming devoted his career. The person selected is not required to be a member of the ASA.

2. The lecture should be presented in the spirit of Deming's own views about his statistical practice (Code of Professional Conduct, 1972), which were:

"I aim to engage only in work that offers opportunity to create new statistical methods, or to use existing methods (i) to help other scientists and professional men to improve their research; or (ii) to acquire new knowledge through planned research about materials and about man; or (iii) to improve efficiency, uniformity, quality service, and performance of product; or (iv) to achieve smoother operation and more effective administration and management in industry and government."

Areas in which Dr. Deming was active include: statistical theory and application of methodology to improve quality and productivity; sampling in business (accounting, auditing, etc.); sample surveys; issues related to census; statistics and litigation; integration of statistical thinking with other areas such as systems theory; and theory of knowledge and psychology in developing principles of management.

Nominations will be reviewed by the Deming Lectureship Committee, which will be composed of George Benson (Rutgers), Tom Boardman (Colorado State University), Ron Fecso (USDA-ASS), Nancy Mann (QES Inc.), Bill Parr (University of Tennessee-Knoxville), Bob Starbuck (Wyeth-Ayerst Research), and Aaron Tenenbein (New York University).

If you would like to nominate an individual, please prepare a document addressing each of the two major elements of the criteria set above, including a brief curriculum vitae for the nominee. Send seven copies of the nomination to: Deming Lecturer Nominations, Meetings Department, American Statistical Association, 1429 Duke Street, Alexandria, VA 22314-3402. You may e-mail Bob Starbuck (starbur@war.wyeth.com) with questions or comments. Nominations must be received by 1 January 1998. A decision will be made by February 1.

The 1998 annual ASA meeting will be held in Dallas, Texas on August 9-13 and the presentation will be held on the afternoon of Tuesday, August 11, in a special invited paper session.

Gordon Research Conference Statistics in Chemistry and Chemical Engineering

Salve Regina University, Newport, Rhode Island
June 28 - July 3, 1998

Chair: Sijmen de Jong, Unilever Research Laboratorium, Vlaardingen, The Netherlands

Vice-chair: Anthony C. Atkinson, London School of Economics, United Kingdom

The Gordon Research Conference on Statistics in Chemistry and Chemical Engineering, which has met annually since 1951, is designed to foster the exchange of new ideas among researchers and workers in statistics, chemistry and chemical engineering. Outstanding statisticians and chemometricians present current work on methods of potential relevance for chemists and chemical engineers, while the chemists and engineers present real-life problems and proposed solutions. The conference is designed to maximize the interaction between the different groups.

The scientific program is in the early stages of preparation. At the moment it comprises:

Speaker: George E.P. Box, University of Wisconsin, Madison, USA

Topic: **Feedback Control in SPC**

Discussant: John F. MacGregor, McMaster University, Hamilton, Canada

Speaker: Peter J. Rousseeuw, University of Antwerp, Belgium

Topic: **Recent Applications of Robust Methods**

Discussant: Anita Singh, Lockheed-Martin Environmental Systems, Las Vegas, USA.

Speaker: Age K. Smilde, University of Amsterdam, The Netherlands

Topic: **Multi-way Component and Regression Models in Chemistry**

Discussant: Rasmus Bro, Royal Veterinary & Agricultural University, Frederiksberg, DK

Other sessions to be announced. Please, check the GRC website for latest updates:

<http://www.grc.uri.edu/progra-2/stats.htm>

All conferees are invited to present a poster on their work. Please e-mail a title and a brief abstract to the vice-chair: A.C.Atkinson@lse.ac.uk .

For further information on other aspects of the conference visit the GRC website:

<http://www.grc.uri.edu>

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MINI PAPER

A TUTORIAL ON PROBABILISTIC RISK ASSESSMENT FOR NET PACKAGE CONTENTS

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Introduction

In both the US and foreign countries, government regulations are in place to monitor the contents of packaged products. Inspectors from regulatory agencies routinely sample packaged products from store shelves and measure the contents of the sampled packages to guarantee that the consumer receives the amount of product indicated by the product label.

In most package filling processes, packages are filled by some sort of filling mechanism which dispenses product into the bag or container. These filling mechanisms fill packages to a specified fill level sometimes called the target fill level. Each package to be filled is subject to the inherent variability of the filling mechanism or process which causes the actual package fill levels to be dispersed around the target fill level.

The dilemma faced by the producer is where to set the target fill level for the filling process. The producer wishes a fill level which will minimize the overfilling of packages and the risk of filling packages below their labeled content value.

An interesting application of probabilistic modeling concerns the computation of the risk of the producer being in violation of package contents regulations based on a sample of product taken from store shelves. It is the purpose of this paper to discuss some basic examples in the calculation of probabilistic risk assessment of violations of package fill regulations. Since many sets of regulations exist, no one set will be singled out but rather two of the most general sorts of regulations will be discussed.

Statistical Considerations

For all of the discussion in this paper, it will be assumed that the distribution of actual package fill levels follow the normal distribution (bell shaped curve) and that package fill levels are independent over time. It is also assumed that the target fill level of the filling process is not subject to error or drift, i.e., once the target fill level is set on the filling mechanism this level represents the center of the fill level distribution until such time that the target fill level is reset. Any of the examples discussed below could be modified to compute risk for non-normally distributed or serially correlated package fill levels but the statistical theory becomes more complex and the ability to compute the risk probabilities requires more sophisticated statistical software.

Case I. Regulations Based on Mean Contents

Suppose that the regulatory agency policy is to require that the average fill level of a sample of ten cans cannot be less than the labeled fill level (LFL) of the package. Denoting the sample mean as \bar{X}_{10} , the risk of being in violation of the regulatory agency guideline is the probability that the sample mean of ten packages is less than the LFL. In statistical notation, this is $P(\bar{X}_{10} < LFL)$. Note that this probability is a function of the mean of the distribution of the package contents. The mean of this distribution is given by the setting of the filling mechanism, i.e., the target fill level.

It can be shown through probabilistic arguments that

$$P(\bar{X}_{10} < LFL) = P\left(Z < \frac{LFL - \mu}{\sigma / \sqrt{n}}\right)$$

where Z has a standard normal distribution, μ is the target fill level and σ is the process standard deviation. This last probability can be read from widely available tables of the standard normal distribution or can be computed using the standard normal probability function that is available on many hand calculators.

Example

Let's look at an example using the above probability calculations. Suppose the labeled weight of a package of granular garden fertilizer is 64 ounces. The filling mechanism is set to fill packages at 64.05 ounces. From historical data on the filling mechanism, the distribution of fill weights around the target fill level has a standard deviation of .3 ounces. For a sample of size $n=10$,

$$P(\bar{X}_{10} < LFL) = P\left(Z < \frac{64 - 64.05}{.3 / \sqrt{10}}\right) = P(Z < -.52705) = .29908,$$

i.e., there is about a 30% chance of being in violation of the regulatory agency policy at a filler setting of 64.05 ounces. A projection of the risk for different settings of the filler mechanism is shown in Table 1.

In this case, there is approximately a 30% chance that the average of ten packages will be below the LFL if the target fill level is 64.05 ounces. If the target fill level is set at 64.16 ounces, there will be less than a 5% chance that the average of ten randomly sampled packages is below the LFL. The risk of being in violation decreases as the target fill level increases. It is the job of management to reach

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MINI PAPER

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a compromise between the level of risk of being in violation and the amount of package overfill to be tolerated.

Table 1. Risk of Being in Violation for Various Filling Mechanism Settings Under the Case I Regulation

Target Fill Level (in ounces)	Risk of Violation
64.05	.29908
64.06	.26354
64.07	.23030
64.08	.19954
64.09	.17139
64.10	.14592
64.11	.12313
64.12	.10295
64.13	.08529
64.14	.07001
64.15	.05692
64.16	.04585

Case II. Regulations Based on Individual Package Contents

Another type of regulatory requirement is to place a restriction on the fill levels of individual packages sampled from store shelves. Suppose that a regulatory agency requires that all the packages in a sample of size n must exceed a specified cutoff level, say, for example, 99% of the LFL.

If a random sample of size n is collected from the store shelves, the risk of being in violation of this type of regulation is

$$1 - P(\text{all } X_i > .99 \times LFL) = 1 - [1 - P(Z < (.99 \times LFL - \mu)/\sigma)]^n$$

where Z has a standard normal distribution, μ is the target fill level and σ is the process standard deviation. This probability can be computed with the help of the standard normal probability function which is available on many hand calculators.

Example

Returning to our example concerning packages of garden fertilizer, with a labeled fill weight of 64 ounces and a standard deviation of .3 ounces, the risk that any of the fill levels in a sample of size n=10 from store shelves are less than the labeled fill weight is

$$1 - [1 - P(Z < \frac{.99 \times 64 - 64.05}{.3})]^{10} = 1 - [1 - .01072]^{10} = .10221,$$

i.e., the risk of being in violation of the regulatory agency policy at this filler setting is .10221. A projection of the risk for different settings of the filler mechanism is shown in Table 2.

Table 2. Risk of Being in Violation for Various Filling Mechanism Settings Under the Case II Regulation

Target Fill Level (in ounces)	Risk of Violation
64.01	.14140
64.02	.13065
64.03	.12055
64.04	.11108
64.05	.10221
64.06	.09393
64.07	.08621
64.08	.07902
64.09	.07233
64.10	.06613
64.11	.06039
64.12	.05508
64.13	.05017
64.14	.04565

By comparing Tables 1 and 2, it can be seen that the regulation described in Case II provides a smaller risk to the producer of being violation for a particular target fill level. This will allow the company to operate at a lower target fill level while maintaining the "same" level of risk as the Case I regulation. The Case II regulation requires a target fill level of 64.14 ounces to produce a less than 5% chance of being in violation while the Case I regulation requires a target fill level of 64.16 ounces to produce the "same" level of risk.

An Extension to Case II

An extension of the Case II regulation described above is to allow no more than k of the n sampled packages to be below a specified cutoff value (99% of LFL in the case of our example). This type of regulation recognizes the fact that a few spurious fill levels can occur from time to time in the process and does not penalize the producer for these outliers.

Continued on page 9

MINI PAPER

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In order to compute the risk for this generalization of the Case II regulation, it is necessary to compute the probability that $k+1$ or more packages in a sample of size n are below the LFL. From well known results for the binomial distribution given in statistics texts such as Snedecor and Cochran (1980), the general formula for this risk is

$$1 - \sum_{i=0}^k \binom{n}{i} \cdot p^i \cdot (1-p)^{n-i}$$

where p is the probability that an individual package is below the LFL. This probability is given by

$$p = P(X_i < .99 \times LFL) = P\left(Z < \frac{.99 \times LFL - \mu}{\sigma}\right)$$

where Z has a standard normal distribution, μ is the target fill weight and σ is the process standard deviation. Both the above probabilities can be computed using a hand calculator or packaged statistical software.

Example

To illustrate the more general type of regulation, assume now that for packages of bird seed the regulation states that there is no violation if no more than one package in a sample of size $n=20$ is below 99% of the LFL. The LFL is 64 ounces. For a target fill level of 64.05 ounces and a process standard deviation of .4 ounces, the risk is given by

$$1 - \sum_{i=0}^1 \binom{20}{i} \cdot (.042264)^i \cdot (1-.042264)^{20-i} = .20627$$

since

$$p = P(X_i < .99 \times LFL) = P(Z < (.99 \times 64 - 64.05)/.4) = .042264$$

i.e., the risk of being in violation of this regulatory requirement at the target fill level of 64.05 ounces is .20627. A comparison of the risk projections for different settings of the filler mechanism and different values of k is shown in Table 3.

In Table 3, it can be seen that as the regulation is relaxed (i.e., the allowable number of packages below 99% of LFL is increased), the risk to the producer becomes smaller and the target fill weight required to produce a prespecified risk to the producer is lowered. For instance, if $k=0$ packages are allowed to be below 99% of the LFL, the target fill level must be 64.50 ounces to produce a less than 5% chance of being in violation. If the regulation

requires that one or less packages be below 99% of LFL, the target fill level must be 64.20 ounces. If the regulation requires that two or less packages be below 99% of the LFL, the target fill level must be 64.10 ounces to produce a less than 5% chance of being in violation.

Table 3. Risk of Being in Violation for Various Filling Mechanism Settings Under the Extended Case II Regulation

Target Fill Level (in ounces)	Risk of Violation k=0	Risk of Violation k=1	Risk of Violation k=2
64.05	.57838	.20627	.05028
64.10	.47988	.13426	.02517
64.15	.38652	.08308	.01178
64.20	.30269	.04901	.00518
64.25	.23090	.02765	.00214
64.30	.17190	.01496	.00084
64.35	.12513	.00779	.00031
64.40	.08921	.00390	.00011
64.45	.06237	.00189	.00004
64.50	.04282	.00088	.00001
64.55	.02889	.00040	<.00001
64.60	.01918	.00018	<.00001

Conclusions

This paper has looked at some of the basics of risk calculations relating to some general package fill regulations. It has been shown that the basic calculations can be carried out on calculators with the ability to compute probabilities using the standard normal and the binomial cumulative distribution functions. For an example of regulations concerning net contents of packaged goods, see Brickenkamp et al (1981) and the accompanying review article published by Lauer (1982).

References

Brickenkamp, C.S., Hasko, S. and Natrella, M. (1981). **Checking the Net Contents of Packaged Goods (National Bureau of Standards Handbook 133)**, U.S. Department of Commerce, U.S. Government Printing Office, Washington, DC.

Lauer, G.N. (1982). Probabilities of Noncompliance for Sampling Plans in NBS Handbook 133, **Journal of Quality Technology**, vol. 14, no. 3, 162-165.

Snedecor, G.W. and Cochran, W.G. (1980). **Statistical Methods**, Ames, IA: Iowa State University Press, seventh edition.

New ASQ Journal: Software Quality Professional

CALL FOR CONTRIBUTORS

The American Society for Quality is preparing to launch a new quarterly journal, Software Quality Professional, dedicated to individuals involved in applying quality principles to the development and use of software. Each issue will feature authoritative, practical articles that span the Body of Knowledge as established for the ASQ's Certified Software Quality Engineer. (For more information, consult the ASQ Software Division's web site at <http://www.asq.org/sd/swqweb.html>.)

The American Society for Quality is a membership organization dedicated to promoting the principles and practices of quality improvement, with a mission to "be recognized throughout the world as the leading authority on, and champion for, quality." The ASQ Software Division, which represents over 5000 professionals, is dedicated "to improve the ability of individuals and organizations to satisfy their customers with quality software products and services through education, communication, research, outreach, and professional development." Together, the American Society for Quality and the ASQ Software Division will strive for Software Quality Professional to serve as a continuing-education resource for the practitioner. The journal will be the official publication of the ASQ Software Division, reaching thousands of subscribers who will use it as their leading personal-development tool.

The journal will begin publishing in 1998, and will feature useful articles on world-class software quality practices. SQP urges you, as a software practitioner, to share your experiences and insights. Submissions can take the form of:

- * experience-based reports on techniques, tools, or other issues;
- * illustrative case studies;
- * topical surveys, including annotated bibliographies;
- * practical applications of research results; or
- * short communications on relevant concerns.

INVITATION TO REVIEWERS

Individuals involved in the design or use of software or software-based systems might wish to share their expertise by serving as volunteers who would review manuscripts for technical and presentation excellence.

If appropriate, the editor would also welcome a representative from the Statistics Division to serve on the journal's Editorial Board. That kind of liaison with the Statistics Division members could be most valuable. Any individuals interested in serving as the Stat Division member on this Editorial Board should contact Don Emerling.

Interested? Submit your manuscripts or inquiries to (or call, fax, or e-mail):

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Taz Daughtrey, Editor-in-Chief
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SQP_Editor@asqnet.org
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American Society for Quality
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Milwaukee, Wisconsin 53201-3005 USA

NIST Web Page With 'Standard' Datasets

The National Institute of Standards and Technology (NIST) announces release of the Statistical Reference Datasets (StRD) Web site (<http://www.nist.gov/itl/div898/strd/>). This site contains reference datasets with certified results enabling the objective evaluation of the computational accuracy of statistical software. Both users and developers of statistical software can use these datasets to ensure and improve software accuracy.

The StRD web pages contain datasets with certified computational results in the areas of:

- 1) analysis of variance
- 2) linear regression
- 3) non-linear regression
- 4) univariate summary statistics.

The collection includes both generated and "real-world" datasets, of varying levels of difficulty. Generated datasets are designed to challenge specific computations. Real-world datasets include both benign and challenging datasets from the NIST laboratories and other sources. The certification method for each statistical method is described on the corresponding web page.

We would appreciate any suggestions you have for improving the web site. Please email your comments to strd@nist.gov or call Eric Lagergren at 301-975-3245.

The StRD web page is a joint effort of the Statistical Engineering Division and the Mathematics and Computational Sciences Division of the Information Technology Laboratory of the National Institute of Standards and Technology, U.S. Dept. of Commerce.

MEMBER SURVEY

The ASQ Statistics Division is conducting a Long Range Planning meeting this October to develop its new Five Year Strategic Plan. We would like to gather your input to the LRP process by asking you to answer the following questions:

1. What, in your opinion, should be the purpose of the Statistics Division?

2. Are you a member of the Statistics Division?
If 'NO', please skip to question 6.

3. Why did you become a member?

4. What did you perceive as the benefits of membership?

5. How well is the Statistics Division meeting your expectations:
 - a. Very dissatisfied (Does not meet my needs)
 - b. Dissatisfied (Rarely meets my needs)
 - c. Indifferent (Meets my minimum needs)
 - d. Satisfied (Meets my expectations)
 - e. Very Satisfied (Exceeds my expectations)

6. If you were the chair of the Statistics Division what one thing would you change tomorrow?

7. Have you read and do you understand the Statistics Division's Mission and Vision Statements? What do the Mission and Vision Statements mean to you?

8. How important is it that the Statistics Division have a Mission and Vision?

9. Where would you like to see the Statistics Division focus its resources in the next five years?

10. Any other comments and/or opinions you'd like to share with the Statistics Division officers?

Responses should be faxed or emailed to Don Williams [fax: (940) 387-2251]
[email: d.r.williams@ieee.org]

ASQ Statistics Division Job Openings and Member Interest Form

Job Openings

We currently need volunteers to serve in the following positions:

- Regional Councilor**
- Section Liaison**

If you are interested in volunteering for one of these positions, please fill out the form below and send it to:

Past Chair Beth Propst
41 West 202 Whitney Road
St. Charles, IL 60175

In addition, proposals for newsletter Mini-Papers and Basic Tools articles are always welcome.

Member Interest Form

Name: _____ Date: _____

Title: _____ Member No.: _____

Address: _____

Phone: _____ Fax: _____

E-mail: _____ Membership: ___ Reg. ___ Sr. ___ Fellow

Education/Certifications/Experience: _____

Time Availability/Company Support: _____

Please check or circle all areas of interest:

- | | | |
|---|--|---|
| <input type="checkbox"/> Education Committee | <input type="checkbox"/> Awards Committee | <input type="checkbox"/> Standards Committee |
| <input type="checkbox"/> Examining Committee | <input type="checkbox"/> Certification Committee | <input type="checkbox"/> Newsletter Committee |
| <input type="checkbox"/> Membership Committee | <input type="checkbox"/> Program Committee | |

Positions include: Annual Quality Congress (AQC) Division Session Manager, AQC Short Course Chair, AQC Technical Paper Reviewers, AQC Topic Session Manager, Fall Technical Conference (FTC) Technical Program Chair and FTC Short Course Chair.

Publications Committee

Positions include: Acquisitions Coordinator, Glossary Editor, Briefings Editor, How-To Series Editors and New Products Coordinator.

Other: _____

WEB SPINNING/SURFING (A CONTEST?)

by Ralph St.John

As recently as five years ago, when we mentioned webs everyone understood that we were talking about those beautiful silk-like networks that spiders spun in corners in order to entrap flies. We used to love to walk in the woods to see huge webs hanging between tree branches, and they were especially beautiful in early morning when dew drops hung from the web and the early morning sun reflected through those dew drops giving the effect of glistening diamonds hanging from the branches. Last week I joined my sixth grade daughter's class on a morning nature walk along the shore of Lake Erie. As we were admiring a web one of Jessica's classmates said "I wonder if Mr. Spider has a Web page". Whoa!!

Today the 'Web' is a loose-knit network of computer sites which we can access to look up sports information, collect pictures, check the stock market, etc. More specifically we can look up scores at ESPNET SportsZone (<http://espnnet.sportszone.com>), look up phone numbers anywhere in the U.S. under any name (<http://www.switchboard.com>) (try typing in your own name and see how many other Ralph St.Johns there are!!), get maps to anywhere from anywhere with door to door driving instructions (<http://www.mapquest.com>), make airplane and hotel reservations, or just check availability and prices (<http://www.travelweb.com>), find lots of free computer games for your kids (or you) to play (<http://www.happypuppy.com>), tour the White House (<http://www.whitehouse.gov>), visit the Louvre without having to fly to Paris (<http://www.paris.org/Musees/Louvre>), select a future college which meets certain criteria (<http://www.collegeview.com>), visit the world's biggest bookstore (<http://www.amazon.com>), clip coupons (<http://www.couponsdirect.com>) and search the entire web using key words (using <http://www.yahoo.com> for example). This all sounds very entertaining, and my kids will probably enjoy it, so maybe I will get hooked up to the 'net' and spend some time 'surfing'. It'll be fun. But this stuff is just for fun, and can't help me with my job or my career. As Johnny Carson used to say to Ed, "Wrong!! Buzzardbreath".

The American Society for Quality has a web page (<http://www.asqc.org>) which contains information about membership benefits, certification exams, Quality Press (you can browse the entire catalog and order through the web) the Annual Quality Congress, etc. You can link to the various divisions, like the Statistics Division

(<http://www.asq.org/about/divisions/stats/>), where you can meet the officers, learn about division projects, apply for division scholarships, read all about the Fall Technical Conference, and visit the division's Virtual Academy (you first read about it here in the Winter 1997 issue). For those of you who are more statistically inclined the American Statistical Association has a web page (<http://www.amstat.org/>) with lots of links to other statistical resources (like the S.P.E.S. and Q + P Sections of A.S.A., or to a linked list of all statistics departments in the world, or to various statistics journals, like Technometrics). As with most web sites, the ASQ and ASA sites have links to other sites with specific resources [e.g. conferences in statistics, statistics jobs with the government, industry or teaching (<http://www.stat.ufl.edu/vlib/jobs.html>), statistics software (<http://www.sas.com> or <http://www.minitab.com>), etc]. These links allow users to jump from a site in Washington, D.C. to State College, PA to College Station, TX to University Station, WY while pursuing an article on the black-footed ferret.

But how does that help me in my job? If you are using statistical software (and who isn't?), or work with someone who uses statistical software, you have probably heard at least once the comment/question "That's a pretty strange answer. I wonder if our software has a bug in it and maybe gives wrong answers to certain unusual cases". Well, in this issue, you'll find the **NIST** web site with 'standard' datasets. There are known answers for these data. These are designed to test software in areas where software often fails, and thus let you know if your software is deficient. Or, if you want to look into the progress of the Statistics Partnerships among Academe, Industry and Government (SPAIG), you can go to <http://funnelweb.utcc.utk.edu/~wparr/spaig.html>. Using the Yahoo ! search engine to look up sites which mention 'Taguchi methods' or 'normal probability plots' results in two long lists of sites with reference materials on this subject. Peruse the last few issues of the Statistics Division Newsletter and you'll find many web page addresses (URL's). Go visit them and tell me what you think of them. Were they helpful? Were they easy to maneuver? Did you find information easily and quickly?

Since my primary function is as an educator, and since many students are very job oriented, and since they're always asking me about jobs, my favorite web sites are job

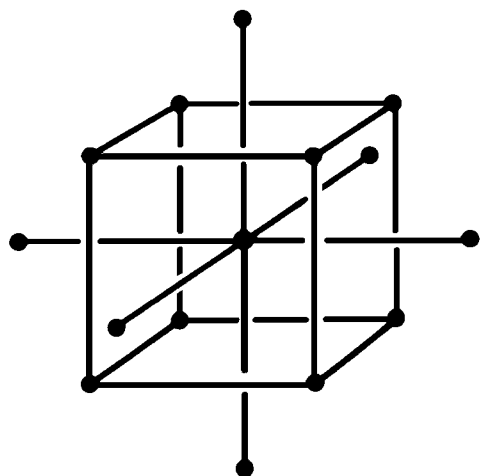
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WEB SPINNING/SURFING

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listing sites. Duke University maintains a nice listing of statistics jobs (<http://www.isds.duke.edu/jobs/>), some federal, some industrial, some teaching. For those who have specific geographic needs, try Career Mosaic (<http://www.careermosaic.com/>), which today listed 152 statistics positions throughout the U.S. You may also specify geographic preferences (eg 'Quality Engineer' in New York State turned up 35 listings). Those of you who yearn to return to (or visit) Europe should try 'Vincent's Statistics Page' (<http://www.statslab.cam.ac.uk/~vincent/stat/index.htm>). It's loaded with lots of English and European links. A U.K. site with lots of jobs listed can be found at (http://www.stats.gla.ac.uk/cti/links_stats.htm). A very comprehensive statistics resource web page is maintained by Clay Helberg at (<http://www.execpc.com/~helberg/statistics.html>). This page has tons of links to software, statistical societies, online courses and books, publishers, and more.

So, to stimulate those of you who 'need' a contest (always one to stimulate discussion, aren't I?), I nominate Clay Helberg's page as my choice for best all-purpose statistics/quality web site. There are lots of webslingers out there, and many of you have favorite sites that contain statistics and/or quality resources that have helped you do your job better and more easily. Please drop me a note telling me about the site. Send me the URL and a brief description of the site, including specific reasons why you



* For reference to this graphic, see
http://www.statease.com/out_rsm.htm
or
<http://www.sas.com/otherprods/jmp/jmppoints/optimum/optimum.html>

find it useful. I'll try to have a continuing short column called 'STATISTICS & QUALITY ON THE WEB'. I'll include information about your sites and acknowledge your contribution. By this time next year we should have received a dozen or so nominees for best statistics/quality web site. Then we can have an email-in ballot to see what you the Statistics Division Newsletter readers prefer.

Finally, web pages are an easy way to 'meet' people. For example, if you visit my page (<http://www.cba.bgsu.edu/asor/facstaff/rstjohn>), you'll see a picture of me, my resume, and some of my interests. Then when you see me at the FTC you'll already 'know' me and won't be bashful about walking up to me and saying 'I've got some news/an article/photos/an opinion for the Stat Division Newsletter. Can I send it to your email address?' 'Of course you can!' (rstjohn@cba.bgsu.edu).

P.S. Quality Resources Online would be my second nominee (<http://www.quality.org>).

COMING NEXT ISSUE

Recap of the Fall Technical Conference:
Stat Division Council Meeting
Attendance at Short Courses and
Technical Sessions
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Hunter Award
Highlights and Photos

Report from Long Range Planning
Meeting

Preview of the Annual Quality Congress

Preview of Annual Quality & Productivity
Conference

Minipaper

Basic Tools Paper

Discussion of Stat Division committee
positions open

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¹Chaired by the Officer (or Past Chair) at the top of the column



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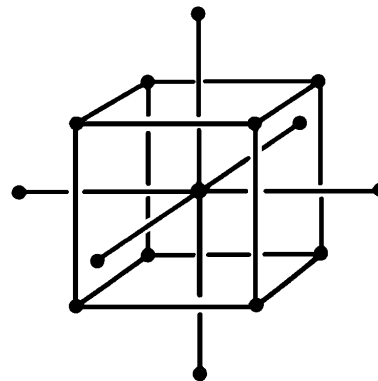
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UPCOMING NEWSLETTER DEADLINES

Issue	Vol. No.	Due Date
Winter '98	17 1	Nov. 14, 1997
Spring '98	17 2	Feb. 14, 1998
Summer '98	17 3	May 15, 1998



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