ASQ
AMERICAN SOCIETY FOR QUALITY

The Lighthouse
February 2007
Elyria/Lorain Section 814
Mission Statement

To advance community and member quality excellence thorough educational opportunities, non-competitive information exchange, networking, forming alliances and leadership growth

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Meeting February 6th

WHAT:	**Using the Internet and Library Resources for Business** **by Cynthia Hall, Deborah Rossman; Molly Campana**
WHEN:	**Tuesday, February 6th, 2007, Meeting starts at 6:00PM**
WHERE:	**Porter Library, Westlake** See Map Here

Cynthia Hall, Deborah Rossman; Molly Campana will explain how to best use the Internet and Library Resources for Business Research. This will be a hands on demonstration with computers during the class. Included will be information on

- Dunn and Bradstreet,
- ReferenceUSA™ "the No. 1 source of information on businesses and people for researchers, students, job seekers and government agencies."
- Magazines and newspaper of WPPL holdings,
- Locating business books (658's) are and the numbers for project management, quality control, & problem g. Working with Google
- US Patent and Trademark Office
- Standard & Poor's Netadvantage database
- InfoTrac magazine index Business center
- Barron's
- Using business data from companies including Nordson, Invacare, Energizer Battery, Sherwin-Williams, Ford, Shiloh, MTD (Modern Tool & Die),etc.

CERTIFICATION CLASS CALENDAR

Classes are always offered in conjunction with the certification and require a minimum of 6 students. If less that 6 students register for a class it may be canceled.

YOU NEED TO CONTACT Michael.Haessly@adelphia.net NOT LCCC to register for classes

Exam Date		March 3, 2007	June 2, 2007	October 20, 2007	December 1, 2007

Registration Date		January 19, 2007	April 6, 2007	August 17, 2007	October 5, 2007
CBA	**Biomedical Auditor**	X		X	
CCT	**Calibration Technician**		X		X
CHA	**HACCP Auditor -**	X		X	
CMQ/OE	**Quality Manager**	X		X	
CQA	**Quality Auditor**		X		X
CQE	**Quality Engineer**		X		X
CQI	**Quality Inspector**	X		X	
CQIA	**Quality Improvement Associate**		X		X
CQPA	**Quality Process Analyst**		X		X
CQT	**Quality Technician**	X		X	
CRE	**Reliability Engineer**	X		X	
CSQE	**Software Quality Engineer**		X		X
CSSBB	**Six Sigma Black Belt**	X		X	
SSGB	**Six Sigma Green Belt**		X		X

Chair's Message

As this year is coming to an end we are looking for places for a plant tour for April and May. This is a chance for you, the members, to host a small tour through your plant and show the section how your plant does what it does. Please contact anyone on the Executive Committee, with your ideas for a plant tour. Your help will be greatly appreciated.

Other news is that we are working with the Technology Department at Lorain CCC. to adjust the Quality Assurance programs to reflect the current directions in quality and better prepare the students to enter the quality area.

New Section Members

Please welcome the following new members to Section 0814.

No new members this Month

Tech Corner

Kurtosis

In probability theory and statistics, **kurtosis** is a measure of the "peakedness" of the probability distribution of a real-valued random variable. Higher kurtosis means more of the variance is due to infrequent extreme deviations, as opposed to frequent modestly-sized deviations.

Definition of kurtosis

The fourth standardized moment is defined as μ_4 / σ^4, where μ_4 is the fourth moment about the mean and σ is the standard deviation. This is sometimes used as the definition of kurtosis in older works, but is not the definition used here.

Kurtosis is more commonly defined as the fourth cumulant divided by the square of the variance of the probability distribution,

$$\gamma_2 = \frac{\kappa_4}{\kappa_2^2} = \frac{\mu_4}{\sigma^4} - 3,$$

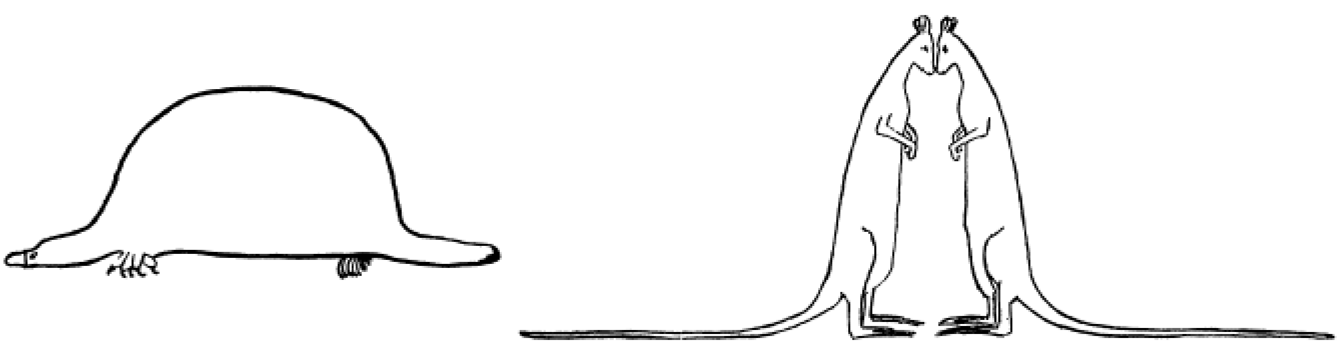
which is known as **excess kurtosis**. The "minus 3" at the end of this formula is often explained as a correction to make the kurtosis of the normal distribution equal to zero. Another reason can be seen by looking at the formula for the kurtosis of the sum of random variables. Because of the use of the cumulant, if Y is the sum of n independent random variables, all with the same distribution as X, then $\mathrm{Kurt}[Y] = \mathrm{Kurt}[X] / n$, while the formula would be more complicated if kurtosis were defined as μ_4 / σ^4.

More generally, if $X_1, \ldots, X_n$ are independent random variables all having the **same variance**, then

$$\mathrm{Kurt}\left(\sum_{i=1}^{n} X_i\right) = \frac{1}{n^2}\sum_{i=1}^{n}\mathrm{Kurt}(X_i),$$

whereas this identity would not hold if the definition did not include the subtraction of 3.

* In case any of my readers may be unfamiliar with the term "kurtosis" we may define mesokurtic as "having β_2 equal to 3," while platykurtic curves have $\beta_2 < 3$ and leptokurtic > 3. The important property which follows from this is that platykurtic curves have shorter "tails" than the



normal curve of error and leptokurtic longer "tails." I myself bear in mind the meaning of the words by the above *memoria technica*, where the first figure represents platypus, and the second kangaroos, noted for "lepping," though, perhaps, with equal reason they should be hares!

Terminology and examples

A high kurtosis distribution has a sharper "peak" and fatter "tails", while a low kurtosis distribution has a more rounded peak with wider "shoulders".

Distributions with zero kurtosis are called **mesokurtic**. The most prominent example of a mesokurtic distribution is the normal distribution family, regardless of the values of its parameters. A few other well-known distributions can be mesokurtic, depending on parameter values: for example the binomial distribution is mesokurtic for $p = 1/2 \pm \sqrt{1/12}$.

A distribution with positive kurtosis is called **leptokurtic**. In terms of shape, a leptokurtic distribution has a more acute "peak" around the mean (that is, a higher probability than a normally distributed variable of values near the mean) and "fat tails" (that is, a higher probability than a normally distributed variable of extreme values). Examples of leptokurtic distributions include the Laplace distribution and the logistic distribution.

A distribution with negative kurtosis is called **platykurtic**. In terms of shape, a platykurtic distribution has a smaller "peak" around the mean (that is, a lower probability than a normally distributed variable of values near the mean) and "thin tails" (that is, a lower probability than a normally distributed variable of extreme values). Examples of platykurtic distributions include the continuous or discrete uniform distributions, and the raised cosine distribution. The most platykurtic distribution of all is the Bernoulli distribution with $p = \frac{1}{2}$ (for example the number of times one obtains "heads" when flipping a coin once), for which the kurtosis is -2.

Sample kurtosis

For a sample of *n* values the **sample kurtosis** is

$$g_2 = \frac{m_4}{m_2^2} - 3 = \frac{n\,\sum_{i=1}^n (x_i - \overline{x})^4}{\left(\sum_{i=1}^n (x_i - \overline{x})^2\right)^2} - 3$$

where m_4 is the fourth sample moment about the mean, m_2 is the second sample moment about the mean (that is, the sample variance), x_i is the i^{th} value, and $\overline{x}$ is the sample mean.

The formula

$$D = \frac{1}{n}\sum_{i=1}^n (x_i - \bar{x})^2,$$

$$E = \frac{1}{nD^2}\sum_{i=1}^n (x_i - \bar{x})^4 - 3$$

is also used, where n - the sample size, *D* - the pre-computed variance, x_i - the value of the x'th measurement and $\overline{x}$ - the pre-computed arithmetic mean.

Estimators of population kurtosis

Given a sub-set of samples from a population, the sample kurtosis above is a biased estimator of the population kurtosis. The usual estimator of the population kurtosis (used in SAS, SPSS, and Excel but not by MINITAB or BMDP) is G_2, defined as follows:

$$\begin{aligned} G_2 &= \frac{k_4}{k_2^2} \\ &= \frac{n^2\,((n+1)\,m_4 - 3\,(n-1)\,m_2^2)}{(n-1)\,(n-2)\,(n-3)}\;\frac{(n-1)^2}{n^2\,m_2^2} \\ &= \frac{n-1}{(n-2)\,(n-3)}\left((n+1)\,\frac{m_4}{m_2^2} - 3\,(n-1)\right) \\ &= \frac{n-1}{(n-2)(n-3)}\,((n+1)\,g_2 + 6) \\ &= \frac{(n+1)\,n\,(n-1)}{(n-2)\,(n-3)}\;\frac{\sum_{i=1}^n (x_i - \bar{x})^4}{\left(\sum_{i=1}^n (x_i - \bar{x})^2\right)^2} - 3\,\frac{(n-1)^2}{(n-2)\,(n-3)} \\ &= \frac{(n+1)\,n}{(n-1)\,(n-2)\,(n-3)}\;\frac{\sum_{i=1}^n (x_i - \bar{x})^4}{k_2^2} - 3\,\frac{(n-1)^2}{(n-2)(n-3)} \end{aligned}$$

where k_4 is the unique symmetric unbiased estimator of the fourth cumulant, k_2 is the unbiased estimator of the population variance, m_4 is the fourth sample moment about the mean, m_2 is the sample variance, x_i is the i^{th} value, and $\bar{x}$ is the sample mean. Unfortunately, G_2 is itself generally biased. For the normal distribution it is unbiased because its expected value is then zero.

References

- Joanes, D. N. & Gill, C. A. (1998) Comparing measures of sample skewness and kurtosis. *Journal of the Royal Statistical Society (Series D): The Statistician* **47** (1), 183–189. doi:10.1111/1467-9884.00122

Message from the Editor

This newsletter is our method for informing you, the members of Section 0814, on meetings, plant tours, educational opportunities and other valuable information to you as Quality professionals. We hope that this information is useful and relevant to your daily activities both professionally at work and personally at home. In addition, attending the meetings, plant tours, and classes will earn you recertification units (RU's) to help maintain your certifications.

To make this newsletter more useful to you we would like your input on how to improve it. In addition to your suggestions we would also like give you the opportunity to publish some of your experiences or knowledge to the other members of the section. Please send your suggestions to michael.haessly@adelphia.net

If you would like to opt out of receiving this e-mail please update your profile on the ASQ website as such. If this is the first time that you have received this newsletter then you need to opt in to receiving e-mails and also need to update your profile on the ASQ website.

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Statistics Humor

"What is Pi?"

A mathematician: "Pi is the ratio of the circumference of a circle to its diameter."

A computer programmer: "Pi is 3.141592653589 in double precision."

A physicist: "Pi is 3.14159 plus or minus 0.000005."

An engineer: "Pi is about 22/7."

A nutritionist: "Pie is a healthy and delicious dessert!"

What's the difference between a physicist, a mathematician, and a statistician?

The physicist calculates until he gets a correct result and concludes that he has proven a fact.

The mathematician calculates until he gets a wrong result and concludes that he has proven the contrary of a fact.

The statistician calculates until he gets a correct result about an obviously wrong proposition and concludes NOTHING, because the explanation is the task of the scientist who consulted the statistician.

*Thanks to Robert Hacker from Austria for this one. I hope I have not done damage to the underlying humor in the translation.

Executive Committee

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