CONFIDENCE INTERVALS - POSITIONAL TOLERANCE

How good must the evidence be for you to be convinced of something? If you flipped a coin and it came up "heads" 997 times out of 1000, would you be convinced you were using a loaded coin? Confidence intervals provide a way to relate the probability of being "right" with the size of the standard deviation which applies to the quantity being described. First, several comments about probability:

- **A simple definition of probability is the number of successful outcomes divided by the total number of attempts. There are 13 hearts in a deck of 52 cards. The probability of drawing a heart from a full deck is 13/52, equivalently stated as 1/4 or 0.25. The probability of drawing a second heart, given a heart has already been drawn, is 12/51 or 0.235.**

- **A probability of 1.0 is associated with total certainty. If it is pouring rain outside, the probability of it raining today is 100%. A probability of 0.0 means no chance of successful outcome (a snowball's chance in hell). A 50% probability means there is equal probability for success or failure. Typically, a coin toss will come up heads 50% of the time and tails 50% of the time.**

Standard deviation is related to probability by the area under the normal error distribution curve. The total area under the bell curve from minus infinity to plus infinity is 1.000. The area left of the mean is 50% and the area right of the mean is 50%. If one starts at the mean and counts all the area within 3 standard deviations to the right and to the left, the "captured" area is .997 or 997 out of 1000 chances of success.

One way of determining the pass/fail cut-off for licensing exams is to compute both the mean and standard deviation of the scores of all persons taking a particular exam. Everyone scoring more than the mean minus 1 standard deviation is given a passing grade. The result is that 16% of the people taking the test do not pass.

Intervals and percentages commonly used for spatial data are:

Mean +/- 1 standard deviation gives 68.3% of area under curve.
Mean +/- 2 standard deviations gives 95.4% of area under curve.
Mean +/- 3 standard deviations gives 99.7% of area under curve.

