Black Belt/Quality Engineering Statistics

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Collecting and Summarizing Data

- Continuous vs. discrete data
- Measurement scales: nominal, ordinal, interval, and ratio
- Data collection methods: check sheets, coding data, and automatic gauging
- Effective sampling techniques: randomized, stratified, systematic, and representative
- Overview of measurement assurance and gauge R&R analysis
- Basic graphical tools: stem-and-leaf plots, box-and-whisker plots, run charts, scatter diagrams, frequency distributions, histograms, etc.

Basic Probability and Statistics

- Descriptive vs. inferential statistics
- Sample statistics vs. population parameters
- Basic probability concepts
- Measures of central tendency: mean, median, and mode
- Measures of dispersion: range, standard deviation, and variance

Properties and Applications of Probability Distributions

- Effective use of the normal, binomial, Poisson, chi-square, student's t, and F distributions
- Overview of the hypergeometric, bivariate, exponential, lognormal, and Weibull distributions
- Testing distribution assumptions: normal probability plots, skewness and Kurtosis, chi-square goodness-of-fit tests
- Central limit theorem and sampling distribution of the mean

Confidence Intervals and Hypothesis Testing

- Statistical significance issues: statistical vs. practical significance, interpreting p-values, and type I and Type II (alpha and beta) errors
- Point and interval estimation: confidence intervals for means and proportions, prediction intervals, and tolerance intervals
- Hypothesis tests for population means, proportions, and variances
- Estimating sample sizes for confidence intervals and hypothesis tests
- Paired-comparison tests
- Contingency tables
- Nonparametric tests: Mood’s median, Levene’s test, Kruskal-Wallis, and Mann-Whitney.
- Analysis of Variance (ANOVA)

Exploratory Data Analysis

- Multi-vari charts: Distinguishing between positional, cyclical, and temporal variation
- Simple and multiple least-squares linear regression
- Simple linear correlation and correlation vs. causation
- Model diagnostics: evaluating model residuals