

Lean Six Sigma Terminologies at Glance

1. **ABSCISSA** The horizontal axis of a graph.
2. **ACCEPTANCE REGION** The region of values for which the null hypothesis is accepted.
3. **ACCURACY** The differences between observed average measurement and a standard
4. **ALPHA RISK** The probability of accepting the alternate hypothesis when, in reality, the null hypothesis is true.
5. **ALTERNATIVE HYPOTHESIS** A tentative explanation, which indicates that an event does not follow a chance distribution; a contrast to the null hypothesis.
6. **ANALYSIS OF VARIANCE (ANOVA)** A statistical method for evaluating the effect that factors have on process mean and for evaluating the differences between the means of two or more normal distributions.
7. **ARMI** CAP tool, A-approver, R- resource, M-Member, and I-Interested party
8. **ASSIGNABLE CAUSE** A process input variable that can be identified and that contributes in an observable manner to non-random shifts in process mean and/or standard deviation.
9. **ASSIGNABLE VARIATIONS** Variations in data, which can be attributed to specific causes.
10. **ATTRIBUTE DATA** Quality data that typically reflects the number of conforming or nonconforming units or the number of non-conformities per unit on a go/no go or accept/reject basis.
11. **AVERAGE** Sum of all measurements divided by the total number of measurements. Statistic, which is used to estimate the population mean. Same as MEAN.
12. **BACKGROUND VARIABLES** Variables which are of no experimental interest and are not held constant. Their effects are often assumed insignificant or negligible, or they are randomized to ensure that contamination of the primary response does not occur. Also referred to as environmental variables and uncontrolled variables.
13. **BALANCING** If in a factorial DOE, summation of normalized/coded (-1, 1) main effects is zero, the DOE is said to be an Balanced DOE. This helps to in solving matrix equation during regression.
14. **BENCHMARKING** A process for identification of external best-in-class practices and standards for comparison against internal practices.

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15. **BETA RISK** The probability of accepting the null hypothesis when, in reality, the alternate hypothesis is true.
16. **BINOMIAL DISTRIBUTION** A statistical distribution associated with data that is one of two possible states such as Go -No Go or Pass-Fail.
17. **BLACK BELT** A process improvement project team leader who is trained and certified in Six Sigma methodology and tools and who is responsible for successful project execution.
18. **BLOCKING VARIABLES** A relatively homogenous set of conditions within which different conditions of the primary variables are compared. Used to ensure that background variables do not contaminate the evaluation of primary variables.
19. **BOX PLOT** Helps understand the distribution of the data; a quick graphical comparison of two or more processes; Uses quartiles.
20. **BRAINSTORMING** A team-oriented meeting used in problem solving to develop a list of possible causes that may be linked to an observed effect.
21. **CAPABILITY INDICES** A mathematical calculation used to compare the process variation to a specification. Examples are Cp, Cpk, Pp, PpK, Zst, and Zlt. General Electric uses Zst and Zlt as the common communication language on process capability.
22. **CAUSALITY** The principle that every change implies the operation of a cause.
23. **CAUSATIVE** Effective as a cause.
24. **CAUSE** That which produces an effect or brings about a change.
25. **CAUSE AND EFFECT (C&E) DIAGRAM** One of the seven basic tools for problem solving and is sometimes referred to as a "fishbone" diagram because of its structure. Spine represents the "effect" and the major legs of the structure are the "cause categories." The substructure represents the list of potential causes which can induce the "effect." The 6M's (men & women, machine, material, methods, measurements, and Mother Nature) are sometimes used as cause categories.
26. **C CHARTS** Charts, which display the number of defects per sample. Used where sample size is constant.
27. **CENTRAL TENDENCY** Numerical average, e.g., mean, median, and mode; center line on a statistical process control chart.
28. **CENTER LINE** The line on a statistical process control chart, which represents the characteristic's tendency.

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29. **CHAMPION** An executive level business leader who facilitates the leadership, implementation, and deployment of Six Sigma philosophies.
30. **CHANGE ACCELERATION PROGRAM (CAP)** A process which helps accelerate stakeholder buy-in and implementation of new philosophies and processes within a business.
31. **CHARACTERISTIC** A definable or measurable feature of a process, product, or service.
32. **CLASSIFICATION** Differentiation of variables.
33. **COMMON CAUSE** See RANDOM CAUSE.
34. **CONFIDENCE LEVEL** The probability that a randomly distributed variable "x" lies within a defined interval of a normal curve.
35. **CONFIDENCE LIMITS** The two values that define the confidence interval.
36. **CONFOUNDING** Allowing two or more variables to vary together so that it is impossible to separate their unique effects.
37. **CONSUMERS RISK** Probability of accepting a lot when, in fact, the lot should have been rejected (see BETA RISK).
38. **CONTINUOUS DATA** Data obtained from a measurement system, which has an infinite number of possible outcomes. Data that can be divided infinitely.
39. **CONTINUOUS RANDOM VARIABLE** A random variable, which can assume any value continuously within some specified interval.
40. **CONTROL CHARTS** A graphical rendition of a characteristic's performance across time in relation to its natural limits and central tendency.
41. **CONTROL LIMITS** Apply to both range or standard deviation and subgroup average (X) portions of process control charts and are used to determine the state of statistical control. Control limits are derived statistically and are not related to engineering specification limits in any way.
42. **CONTROL PLAN** A formal quality document that describes all of the elements required to control variations in a particular process or could apply to a complete product or family of products.
43. **CONTROL SPECIFICATIONS** Specification requirements for the product being manufactured.
44. **CORRELATION** The relationship between two sets of data such that when one changes, the other is likely to make a corresponding change. Also, a statistical tool for determining the relationship between two sets of data.

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45. **COST OF POOR QUALITY (COPQ)** Cost associated with providing poor quality products or services. Can be divided into four cost categories: Appraisal, Scrap, Rework, and Field Complaint (warranty costs).
46. **CRITICAL TO QUALITY (CTQ) CHARACTERISTIC** A drawing characteristic determined to be important for variability reduction based on a requirement from production, engineering, customer application, or regulatory agency. Can also apply to transactional or service delivery processes.
47. **CUTOFF POINT** The point, which partitions the acceptance region from the reject region.
48. **DATA** Factual information used as a basis for reasoning, discussion, or calculation; often refers to quantitative information.
49. **DATA TRANSFORMATION** A mathematical technique used to create a near normally distributed data set out of a non-normal (skewed) data set.
50. **DEFECT** Any product characteristic that deviates outside of specification limits.
51. **DEFECT PER MILLION OPPORTUNITIES (DPMO)** Quality metric used in the Six Sigma process and is calculated by the number of defects observed divided by the number of opportunities for defects normalized to 1 million units.
52. **DEGREES OF FREEDOM** The number of independent measurements available for estimating a population parameter.
53. **DENSITY FUNCTION** The function, which yields the probability that, a particular random variable takes on any of its possible values.
54. **DEPENDENT VARIABLE** A Response Variable; e.g., y is the dependent or "Response" variable where $Y = f(X_1 \dots X_N)$ is a function of the process input variables.
55. **DESIGN OF EXPERIMENT (DOE)** A formal, proactive method for documenting the selected controllable factors and their levels, as well as establishing blocks, replications, and response variables associated with a planned experiment. It is the plan for conducting the experiment and evaluating the results.
56. **DISCRETE DATA** Data obtained from a measurement system, which has a finite number of possible outcomes. Data that can only be counted and can not be further divided, such as pass and fail, yes and no, and counts of defects...etc.
57. **DISCRETE RANDOM VARIABLE** A random variable, which can assume values only from a definite number of discrete values.

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58. **DISTRIBUTIONS** Tendency of large numbers of observations to group themselves around some central value with a certain amount of variation or "scatter" on either side.
59. **EFFECT** That which was produced by a cause.
60. **ENTITLEMENT** Entitlement is the level of performance a process, a product, a factory, or a business should be able to achieve without substantial investment/reengineering
61. **EVOLUTIONARY OPERATIONS (EVOPS)** A DOE process used to optimize the key process input variables in a production environment, is usually limited to two to three variables, is performed over a long period of time, and is non-disruptive to the process.
62. **EXCEL** Spreadsheet package within Microsoft Office used for data manipulation and analysis.
63. **EXPERIMENT** A test under defined conditions to determine an unknown effect, to illustrate or verify a known law, or to establish a hypothesis. See DESIGN OF EXPERIMENT (DOE)
64. **EXPERIMENTAL ERROR** Variation in observations made under identical test conditions. Also called RESIDUAL ERROR. The amount of variation which cannot be attributed to the variables included in the experiment.
65. **EXPONENTIALLY WEIGHTED MOVING AVERAGE (EWMA)** A control charting method where the most current data point is weighted on an exponential basis such that older data points carry less value in calculating average. This charting technique is used to detect small shifts in a process average.
66. **EXPONENTIAL DISTRIBUTION** These distributions are a class of continuous probability distributions, and are often used to model the time between independent events that happen at a constant average rate.
67. **FACTORS** Independent variables
68. **FAILURE MODE & EFFECTS ANALYSIS (FMEA)** Analytical technique focused at problem prevention through identification of potential problems. The FMEA is a proactive tool that is used pragmatically to identify potential failures and their effects, to numerically rate the combined risk associated with severity, probability of occurrence and detectability, and to document appropriate plans for prevention. FMEAs can be applied to system, application, and product design

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- and to manufacturing and non-manufacturing processes (i.e., services and transactional processes).
69. **FIRST TIME YIELD** Yield that occurs in any process step prior to any rework that may be required to overcome process shortcomings.
 70. **FIXED EFFECTS MODEL** An experimental model where treatments are specifically selected by the researcher. Conclusions only apply to the factor levels considered in the analysis. Inferences are restricted to the experimental levels.
 71. **FLUCTUATIONS** Variances in data, which are caused by a large number of minute variations or differences.
 72. **FREQUENCY DISTRIBUTION** The pattern or shape formed by the group of measurements in a distribution based on frequency of occurrence.
 73. **GAGE ACCURACY** The average difference observed between a gage under evaluation and a master gage when measuring the same parts over multiple readings.
 74. **GAGE LINEARITY** A measure of gage accuracy variation when evaluated over the expected operating range.
 75. **GAGE REPEATABILITY** A measure of the variation observed when a single operator uses a gage to measure a group of randomly ordered (but identifiable) parts on a repetitive basis.
 76. **GAGE REPRODUCIBILITY** A measure of average variation observed between operations when multiple operators use the same gage to measure a group of randomly ordered (but identifiable) parts on a repetitive basis.
 77. **GAGE STABILITY** A measure of variation observed when a gage is used to measure the same master over an extended period of time.
 78. **GREEN BELT** Six Sigma role similar in function to Black Belt, but length of training and project scope are reduced.
 79. **GRPI** One of the CAP tool, Team building tool, G-Goals, R-Role, P-Processes, I-Interpersonal
 80. **HEIJUNKA** A foundation of the Toyota Production System, *heijunka* is the leveling or smoothing out of the production schedule by averaging out both the volume and model mix of products. Production leveling allows a consistent workflow, which makes it possible to set standards and identify abnormalities. (Pronounced *hey-june-kah*)

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82. **HISTOGRAM** Vertical display of a population distribution in terms of frequencies; a formal method of plotting a frequency distribution.
83. **HOMOGENEITY OF VARIANCE** The variances of the data groups being contrasted are equal (as defined by a statistical test of significant difference).
84. **HYPOTHESIS** When used as a statistical term, it is a theory proposed or postulated for comparing means and standard deviations of two or more data sets. A "null" hypothesis states that the data sets are from the same statistical population, while the "alternate" hypothesis states that the data sets are not from the same statistical population.
85. **INDEPENDENT VARIABLE** A controlled variable; a variable whose value is independent of the value of another variable.
86. **INTERACTION** The tendency of two or more variables to produce an effect in combination which neither variable would produce if acting alone.
87. **INSTABILITY** Unnaturally large fluctuations in a process input or output characteristic.
88. **INTERVAL** Numeric categories with equal units of measure but no absolute zero point, i.e., quality scale or index.
89. **JIT** (Just in time) is a theory of production characterized by (1) producing according to TAKT time, (2) single piece flow, and (3) pulling of material from upstream process while keeping inventory at minimum, established levels.
90. **JIDOKA** Machines that have "human intelligence" built into them, giving them the ability to shut down automatically in the case of an abnormality to stop defective products from flowing into the next process. Jidoka measures are incorporated in the assembly process by use of Andons and Pin-Pan-Pon; stopping when abnormality is detected. There are two main elements of Jidoka 1.Stop at Every Abnormality 2.Autonomation ... Human intelligence built into machines or systems.
92. **KANBAN** Japanese for 'sign'. The *kanban* system is a tool of the PULL System that signals to the production floor that the customer has 'pulled' or bought the product from the producer. Cards, carts, boxes, and electronic signals are examples of types of *kanban* in common usage. Squares that are painted on the floor to indicate storage areas are often mistakenly referred to as *kanbans* ; however without the element of acting as a visual instruction for when to produce

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- (empty square), and when not to produce (full square), this cannot fulfill the pure definition of 'sign'. In process *kanbans* are sometimes used as a method to balance material flow between otherwise unbalanced operation times. (Pronounced *kahn-bahn*).
96. **KAIZEN** Japanese for 'change for the better' or 'improvement'. A methodology of continuous cost reduction, quality improvement, and delivery time reduction through shopfloor involvement and rapid action. *Kaizen* is generally practiced as a continuous series of activities where instances of waste (*MUDA*) are identified through real - time and place observation, and eliminated one by one at minimal cost. This is accomplished through teamwork between workers and managers to pool their wisdom and experience to increase efficiency in a timely manner. *Kaizen* normally emphasizes manual work operations rather than equipment capabilities. (Pronounced *ky-zen*).
98. **KEY PROCESS INPUT VARIABLES (KPIVs)** The vital few input variables, called "xs" (normally 2-6), that drive 80% of the observed variations in the process output characteristic ("y").
101. **LEAN** The relentless pursuit of the perfect process Through waste elimination
103. **LINE CHARTS** Charts used to track the performance without relationship to process capability or limits.
104. **LINEARITY** The consistency of the measurement system across the entire range of the measurement system.
105. **LOWER CONTROL LIMIT** A horizontal dotted line plotted on a control chart which represents the lowest process deviation that should occur if the process is in control (free from assignable cause variation).
106. **LURKING VARIABLE** A variable that has an important effect and yet is not included among the factors under consideration.
107. **MASTER BLACK BELT** A person who is an "expert" on Six Sigma techniques and on project implementation. Master Black Belts play a major role in training, coaching and in removing barriers to project execution in addition to overall promotion of the Six Sigma philosophy.
108. **MEAN** See AVERAGE

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109. **MEAN TIME BETWEEN FAILURES (MTBF)** Average time to failure for a statistically significant population of a product operating in its normal environment.
110. **MEASUREMENT SYSTEMS ANALYSIS (MSA)** Means of evaluating a continuous or discrete measurement system to quantify the amount of variation contributed by the measurement system. Refer to Automotive Standard (AIAG STD) for details.
111. **MEDIAN** The mid value in a group of measurements when ordered from low to high.
112. **MINITAB** Statistical software package that operates on Microsoft Windows with a
113. spreadsheet format and has powerful statistical analysis ability.
114. **MISTAKE PROOFING** Mistake proofing is a proactive technique used to positively prevent errors from occurring.
115. **MIXED EFFECTS MODEL** Contains elements of both the fixed and random effects models.
116. **MUDA** Japanese for 'waste'; more specifically 'waste in manufacturing'. Any activity that absorbs resources and adds no value is considered *MUDA*. Elimination of the *MUDA* that is inherent in ALL production and office processes leads to improved profitability. (Pronounced *moo-dah*).
117. **MULTI-VARI** Method used in the measure/analyze phase of Six Sigma to display in graphical terms variation within parts, machines, or processes between machines or process parts, and over time.
118. **NONCONFORMING UNIT** A unit which does not conform to one or more specifications, standards, and/or requirements.
119. **NONCONFORMITY** A condition within a unit which does not conform to some specific specification, standard, and/or requirement; often referred to as a defect; any given non-conforming unit can have the potential for more than one nonconformity.
120. **NORMAL DISTRIBUTION** A continuous, symmetrical density function characterized by a bell-shaped curve, e.g., distribution of sampling averages.
121. **NORMALIZED ROLLED THROUGHPUT YIELD (RYTN)** The estimate of the average process yield used to determine RTY. It is determined by taking the

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- nth root of the RTY (where "n" is the # of process steps) included in the RTY calculation.
122. **NULL HYPOTHESIS** An assertion to be proven by statistical analysis where two or more data sets are stated to be from the same population.
 123. **ONE-SIDED ALTERNATIVE** The value of a parameter which has an upper bound or a lower bound, but not both.
 124. **ORDINAL** Ordered categories (ranking) with no information about distance between each category, i.e., rank ordering of several measurements of an output parameter.
 125. **ORDINATE** The vertical axis of a graph.
 126. **ORTHOGONALITY** If in a factorial DOE, summation of normalized/coded interaction effects (-1, 1) is zero, the DOE is said to be an Orthogonal DOE. This helps to separate main and interaction effects.
 127. **OUT OF CONTROL** Condition which applies to statistical process control chart where plot points fall outside of the control limits or fail an established run or trend criteria, all of which indicate that an assignable cause is present in the process.
 128. **PARAMETER** A constant defining a particular property of the density function of a variable.
 129. **PARETO DIAGRAM** A chart which places common occurrences in rank order.
 130. **P CHARTS** Charts used to plot percent defectives in a sample where sample size is variable.
 131. **PERTURBATION** A nonrandom disturbance.
 132. **POKAYOKE** Japanese for 'goof-proof'. Mistake-proofing and fool-proof devices made by designing parts, processes, or procedures in a way that mistakes cannot physically or procedurally be allowed to happen. Commonly refers to the use of fail-safe devices in machine operations that detect or prevent defects and insure quality. This is the key ingredient that is added to automation to yield automation. (Pronounced *Poh-kah Yoh-kay*)
 133. **POPULATION** A group of similar items from which a sample is drawn. Often referred to as the universe.

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134. **POISSON DISTRIBUTION** A statistical distribution associated with attribute data (the number of nonconformities found in a unit) and can be used to predict first pass yield.
135. **POPULATION** The entire set of items from which a sample is drawn.
136. **POWER OF AN EXPERIMENT** The probability of rejecting the null hypothesis when it is false and accepting the alternate hypothesis when it is true.
137. **PRECISION TO TOLERANCE** A ratio used to express the portion of engineering specification consumed
138. **RATIO (P/T)** by the 99% confidence interval of measurement system repeatability and reproducibility error. (5.15 standard deviations of R&R error)
139. **PREVENTION** The practice of eliminating unwanted variation before the fact, e.g., predicting a future condition from a control chart and then applying corrective action before the predicted event transpires.
140. **PRIMARY CONTROL VARIABLES** The major independent variables used in the experiment.
141. **PROBABILITY** The chance of an event happening or condition occurring by pure chance and is stated in numerical form.
142. **PROBABILITY OF AN EVENT** The number of successful events divided by the total number of trials.
143. **PROBLEM** A deviation from a specified standard.
144. **PROBLEM SOLVING** The process of solving problems; the isolation and control of those conditions which generate or facilitate the creation of undesirable symptoms.
145. **PROCESS** A particular method of doing something, generally involving a number of steps or operations.
146. **PROCESS AVERAGE** The central tendency of a given process characteristic across a given amount of time or at a specific point in time.
147. **PROCESS CONTROL** See STATISTICAL PROCESS CONTROL
148. **PROCESS CONTROL CHART** Any of a number of various types of graphs upon which data are plotted against specific control limits.
149. **PROCESS ENTITLEMENT** Entitlement is the level of performance a process should be able to achieve without substantial investment/re-engineering
150. **PROCESS MAP** A detailed step-by-step pictorial sequence of a process showing process inputs, potential or actual controllable and uncontrollable

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- sources of variation, process outputs, cycle time, rework operations, and inspection points.
151. **PROCESS SPREAD** The range of values which a given process characteristic displays; this particular term most often applies to the range but may also encompass the variance. The spread may be based on a set of data collected at a specific point in time or may reflect the variability across a given period of time.
 152. **PRODUCER'S RISK** Probability of rejecting a lot when, in fact, the lot should have been accepted (see ALPHA RISK).
 153. **PROJECT** A problem, usually calling for planned action.
 154. **QUALITY FUNCTION DEPLOYMENT (QFD)** QFD is a disciplined matrix methodology used for documenting and transforming customer wants and needs - "the voice of the customer" - into operational "requirement" terms. It is an effective tool for determining critical-to-quality characteristics for transactional processes, services and products.
 155. **R CHART** Plot of the difference between the highest and lowest in a sample. Normally associated with the range control portion of an X, R chart.
 156. **RANDOM CAUSE** A source of variation which is random, usually associated with the "trivial many" process input variables, and which will not produce a highly predictable change in the process output response (dependent variable), e.g., a correlation does not exist; any source of variation results in a small amount of variation in the response; cannot be economically eliminated from a process; an inherent natural source of variation.
 157. **RANDOM SAMPLE** Selecting a sample such that each item in the population has an equal chance of being selected; lack of predictability; without pattern.
 158. **RANDOM VARIABLE** A variable, which can assume any value from a distribution which represents a set of possible values.
 159. **RANDOM VARIATIONS** Variations in data, which result from causes, which cannot be pinpointed or controlled.
 160. **RANDOMNESS** A condition in which any individual event in a set of events has the same mathematical probability of occurrence as all other events within the specified set, i.e., individual events are not predictable even though they may collectively belong to a definable distribution.

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161. **RATIONAL SUBGROUP** A subgroup is usually made up of consecutive pieces chosen from the process stream that the variation represented within each subgroup is as small as feasible. Any changes, shifts and drifts in the process will appear as differences between the subgroups, selected over time.
162. **RANGE** The difference between the highest and lowest values in a "subgroup" sample.
163. **RANK** Values assigned to items in a sample to determine their relative occurrence in a population.
164. **REJECTION REGION** The region of values for which the alternate hypothesis is accepted.
165. **REPLICATION** Repeat observations made under identical test conditions.
166. **REPRESENTATIVE SAMPLE** A sample which accurately reflects a specific condition or set of conditions within the universe.
167. **REGRESSION** A statistical technique for determining the best mathematical expression that describes the functional relationship between one response and one or more independent variables.
168. **REPEATABILITY** Variation when one person repeatedly measures the same unit with the same measuring equipment.
169. **REPRODUCIBILITY** Variation when two or more people measure the same unit with the same measuring equipment.
170. **RESEARCH** Critical and exhaustive investigation or experimentation having for its aim the revision of accepted conclusions in the light of newly discovered facts.
171. **RESIDUAL ERROR** See EXPERIMENTAL ERROR
172. **RESPONSE SURFACE METHODOLOGY (RSM)** A graphical (pictorial) analysis technique used in conjunction with DOE for determining optimum process parameter settings.
173. **RESOLUTION** The resolution of the design defines the amount of confounding. The higher the resolution, the less confounding present.
174. **ROBUST** The condition or state in which a response parameter exhibits a high degree of resistance to external causes of a nonrandom nature; i.e., impervious to perturbing influence.

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175. **ROLLED THROUGHPUT YIELD (RTY)** The product (series multiplication) of all of the individual first pass yields of each step of the total process.
176. **ROOT SUM SQUARED (RSS)** Square root of the sum of the squares. Means of combining standard deviations from independent causes.
177. **SAMPLE** A portion of a population of data chosen to estimate some characteristic about the whole population. One or more observations drawn from a larger collection of observations or universe (population).
178. **SCATTER DIAGRAMS (PLOTS)** Charts, which allow the study of correlation, e.g., the relationship between two variables or data sets.
179. **SHORT RUN STATISTICAL PROCESS CONTROL** A statistical control charting technique which applies to any process situation where there is insufficient frequency of subgroup data to use traditional control charts (typically associated with low-volume manufacturing or where setups occur frequently). Multiple part numbers and multiple process streams can be plotted on a single chart.
180. **SIX M'S** The major categories that contribute to effects on the fishbone diagram (men & women, machine, material, methods, measurement, and Mother Nature).
181. **SIX SIGMA** A term coined by Motorola to express process capability in parts per million. A Six Sigma process generates a maximum defect probability of 3.4 parts per million (PPM) when the amount of process shifts and drifts are controlled over the long term to less than +1.5 standard deviations.
182. **SKEWED DISTRIBUTION** A non-symmetrical distribution having a tail in either a positive or negative direction.
183. **SPECIAL CAUSE** See ASSIGNABLE CAUSE
184. **STABLE PROCESS** A process, which is free of assignable causes, e.g., in statistical control.
185. **STABILITY** Variation obtained when the same person measures the same unit with the same equipment over an extended period of time.
186. **STANDARD DEVIATION** A statistical index of variability, which describes the process spread or width of a distribution.
187. **STATISTICAL CONTROL** A quantitative condition, which describes a process that is free of assignable/special, causes of variation (both mean and

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- standard deviation). Such a condition is most often evidenced on a control chart, i.e., a control chart which displays an absence of nonrandom variation.
188. **STATISTICAL PROCESS CONTROL (SPC)** The application of standardized statistical methods and procedures to a process for control purposes.
189. **STUDENT t-DISTRIBUTION** In probability and statistics, the *t*-distribution or Student *t*-distribution is a probability distribution that arises in the problem of estimating the mean of a normally distributed population when the sample size is small. It is the basis of the popular Student's *t*-tests for the statistical significance of the difference between two sample means, and for confidence intervals for the difference between two population means.
190. **SUBGROUP** A logical grouping of objects or events which displays only random event to- event variations, e.g., the objects or events are grouped to create homogenous groups free of assignable or special causes. By virtue of minimizing within subgroup variability, any change in the central tendency or variance of the universe will be reflected in the "subgroup-to-subgroup" variability. A predetermined sample of consecutive parts or other data bearing objects removed from the process for the purpose of data collection.
191. **SYMPTOM** That which serves as evidence of something not fully understood in factual terms.
192. **SYSTEM** That which is connected according to a scheme.
193. **SYSTEMATIC VARIABLES** A pattern, which displays predictable tendencies.
194. **TAUGHI LOSS FUNCTION** Is a financial measure of the user dissatisfaction with a product's performance as it deviates from a target value.
195. **TAKT Time - (*takuto taimu*)** TAKT is actually a German word for 'beat' or 'rhythm'. TAKT time is the pace at which the customer is buying a particular product or service. TAKT time is calculated by taking the available time to work and dividing it by the demand for that same period of time. TAKT time is not how long it takes to perform a task. TAKT time cannot be reduced or increased except by changes in sales or available time to work. All cycle times must be within TAKT time for customer demand to be met. TAKT time is one of the three elements of Just-in-Time. (Pronounced ***tah - koo - toe ty - moo***)
197. **THEORY** A plausible or scientifically acceptable general principle offered to explain phenomena.

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198. **TEST OF SIGNIFICANCE** A statistical procedure used to determine whether or not a process observation (data set) differs from a postulated value by an amount greater than that due to random variation alone.
199. **TWO-SIDED ALTERNATIVE** The values of a parameter, which designate both an upper and lower bound.
200. **TYPE I ERROR** See ALPHA RISK
201. **TYPE II ERROR** See BETA RISK
202. **UNNATURAL PATTERN** Any pattern in which a significant number of the measurements do not group themselves around a central tendency. When the pattern is unnatural, it means that non-random disturbances are present and are affecting the process.
203. **UPPER CONTROL LIMIT** A horizontal line on a control chart (usually dotted) which represents the upper limits of capability for a process operating with only random variation.
204. **VALUE STREAM** The set of specific actions required to bring a specific product through the three critical management tasks of any business : Problem solving, Information management, and physical transformation. The following definition is from the experts: A Value Stream is all the actions (both value added and non value added) currently required to bring a product through the main flows essential to every product: 1) the production flow from raw material into the arms of the customer, and 2) the design flow from concept to launch. Taking a value stream perspective means working on the BIG picture, not just the individual processes, and improving the whole, not just optimizing the parts.
206. **VARIABLE** A characteristic that may take on different values.
207. **VARIABLES DATA** Data collected from a process input or output where the measurement scale has a significant level of subdivisions or resolution., e.g., ohms, voltage, diameter, etc.
208. **VARIATION** Any quantifiable difference between individual measurements; such differences can be classified as being due to common causes (random) or special causes (assignable).
209. **VARIATION RESEARCH** Procedures, techniques, and methods used to isolate one type of variation from another (for example, separating product variation from test variation).

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210. **WEIBULL DISTRIBUTION** This distribution is invented by the Swedish engineer Waloddi Weibull in the 1950's. The most commonly used form of this distribution, the two-parameter Weibull, describes failures over time, represented by lower case T, using two key parameters, the Shape Parameter "Beta" and the Scale Parameter "Eta". There is another form, the three parameter Weibull, which adds a location parameter Gamma, but we will not describe this form in the course. When assigned a variety of values for the Shape and Scale factors, the Weibull probability density function can mathematically mimic a number of different distributions such as normal, lognormal and more, and thus can describe a wide variety of failure modes.
211. **X & R CHARTS** A control chart, which is a representation of process capability over time; displays the variability in the process average and range across time.
212. **Zscore** See CAPABILITY INDICES.