Certified Lean Six Sigma Green Belt (CLSSGB)

GAQM CLSSGB

Version Demo

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QUESTION NO: 1

It is a Type II error if we decide to reject the Null Hypothesis when it is actually true.

A. True

B. False

ANSWER: B

Explanation:

False is correct because rejecting a null hypothesis that is actually true is defined as a Type I error, commonly denoted by alpha (α). In hypothesis testing, α is the probability of making this incorrect rejection and is selected in advance as the significance level, such as 0.05. This decision rule is central to statistical inference used in Lean Six Sigma: a conclusion that a process effect, difference, or improvement exists must be supported by evidence strong enough to control the chance of a false positive. A Type II error instead concerns failing to reject a null hypothesis when a real effect exists; its probability is beta (β), and statistical power is 1 − β. Keeping these error types distinct helps project teams interpret test results appropriately, select suitable sample sizes, and balance the risk of false alarms against the risk of missing meaningful process changes. See the NIST/SEMATECH e-Handbook discussion of hypothesis-testing errors and the University of California, Berkeley notes on hypothesis tests.

QUESTION NO: 2

Select all the statements that are true after reviewing the Capability Analysis shown here. (Note: There are 4 correct answers).

A. The process is out of Control.

B. The process is properly assumed to be a Normal process.

C. The Mean of the process moving range is 1.78.

D. This Capability Analysis used subgroups.

E. Majority of the dimensional values are outside of the tolerance than within.

ANSWER: A B C E

Explanation:

The process is out of Control, the process is properly assumed to be a Normal process, the Mean of the process moving range is 1.78, and the majority of the dimensional values are outside of the tolerance than within are the statements supported by the capability output. A capability assessment should be interpreted alongside evidence of process stability: control-chart signals indicate that special-cause variation is present, so the process is not in statistical control at the time represented by the analysis. The displayed normality assessment supports use of a normal-distribution capability model. The reported moving-range average of 1.78 is the within-process variation input associated with individually collected observations. This same report also shows that a substantial share of observations falls beyond the specification limits; consequently, the process performance relative to tolerance is poor, with more dimensional values outside the allowable range than inside it. Capability indices and predicted nonconformance are meaningful only when the distributional model and the process data are reviewed in this context. Minitab likewise recommends establishing stability before relying on capability results and describes moving ranges for individual-observation analyses. See Minitab: What is capability analysis? and Minitab: Individuals charts.

QUESTION NO: 3

Examples of Mistake Proofing for a laptop computer include which of these? (Note: There are 2 correct answers).

A. USB connection for a mouse

B. Open/Close button for CD Drive

C. Battery alignment pins

D. On/Off switch for computer

ANSWER: A C

Explanation:

Mistake proofing, also called poka-yoke, designs a product or process so that an error is prevented, detected, or made immediately apparent before it causes a defect. A USB connection for a mouse is an example because the connector and port use a defined physical interface that guides the user to connect compatible components in the intended manner. The connector's shape, contacts, and orientation constraints reduce the opportunity for an improper connection. Battery alignment pins are also a physical poka-yoke feature: they position the battery correctly and help ensure that the battery terminals align with the corresponding contacts. This prevents or substantially reduces errors such as installing the battery in an incorrect position or attempting an incompatible fit. Both examples embody an error-prevention approach built into the laptop's design rather than relying solely on user attention, training, or inspection. In Lean Six Sigma, this type of control is valuable because it prevents defects at their source and improves process reliability. The American Society for Quality describes poka-yoke as an error-proofing technique that prevents mistakes or makes them immediately evident; see ASQ's mistake-proofing overview. Additional Lean guidance on error-proofing is available from Lean Enterprise Institute.

QUESTION NO: 4

The purpose of a Process Map is to identify the complexity of the process and to record all actions and decision points in the process.

A. True

B. False

ANSWER: A

Explanation:

True is correct. A process map is a visual representation of how work moves through a process from start to finish. It documents the sequence of activities, handoffs, inputs, outputs, and decision points that determine which path a process instance follows. By making these elements visible, the map helps a Lean Six Sigma team understand the process as it actually operates and assess its complexity, including the number of steps, branches, approvals, rework loops, and interfaces between people or functions.

This understanding is particularly useful during the Define and Measure phases of DMAIC. The team can establish a common view of the current-state process, identify where data should be collected, and focus later analysis on areas with potential delay, variation, defects, or waste. Process mapping also ensures that decision logic and less-visible activities are captured rather than relying solely on assumptions or written procedures. ASQ describes flowcharts as tools for showing the steps in a process, while NIST's process-improvement guidance recognizes process mapping as a way to document and analyze workflows. See ASQ's flowchart resource and NIST Baldrige self-assessment resources.

QUESTION NO: 5

Which Lean waste occurs when work is completed before it is needed by the next process or customer?

A. Overproduction

B. Waiting

C. Motion

D. Overprocessing

ANSWER: A

Explanation:

Overproduction is correct. Overproduction occurs when a process makes more than is needed, makes it earlier than needed, or makes it faster than the downstream customer requires. It is often considered a particularly serious waste because it can create or conceal other wastes, including excess inventory, transportation, waiting, storage requirements, handling, and defects that remain undiscovered until later.

Lean systems use pull signals and production controls to align output with actual downstream consumption. This helps prevent unnecessary work from entering the process. The Lean Enterprise Institute identifies overproduction as one of the classic forms of waste in its Muda reference.

QUESTION NO: 6

The X-Y Diagram is a tool used to identify/collate potential X's and assess their relative impact on multiple Y's.

A. True

B. False

ANSWER: A

Explanation:

True is correct. In Lean Six Sigma terminology, the Y represents a critical output, outcome, or customer requirement, while the X values represent the process inputs, factors, or possible causes that may influence that outcome. An X-Y Diagram, often called an X-Y matrix or cause-and-effect matrix, organizes multiple potential X values against one or more Y values. The team assigns relationship ratings and, where applicable, importance weights for the Y values, allowing it to calculate a relative priority for each X. This makes the tool especially useful after a process map, brainstorming session, or cause analysis has produced many possible inputs and the project team needs an evidence-based way to focus subsequent data collection, measurement-system work, or root-cause validation. The diagram does not itself prove causation; rather, it provides a structured prioritization method for determining which potential inputs deserve deeper analysis. That use directly matches the statement: it collates potential X values and assesses their relative impact across multiple Y values. See the overview of Lean Six Sigma cause-and-effect matrices at GoLeanSixSigma and ASQ’s reference material on cause-and-effect analysis at ASQ.

QUESTION NO: 7

Which of these conditions should be considered before interpreting the results of a two-sample t-test with pooled variances? (Note: There are 3 correct answers).

A. The samples are independent

B. The population variances are reasonably equal

C. The sample means must be equal

D. The populations are approximately Normal for small samples

E. The response data must be attribute data

ANSWER: A B D

Explanation:

The samples are independent, **the populations are approximately Normal for small samples**, and **the population variances are reasonably equal** are correct. A pooled two-sample t-test compares two population means while estimating one common variance from the two samples. Its validity depends on independent observations and the equal-variance assumption, as well as reasonable distributional conditions when sample sizes are small.

The test does not require the sample means to be equal; equality of population means is ordinarily the null hypothesis being evaluated. When equal variances are not supportable, a two-sample t-test that does not assume equal variances, commonly called Welch's test, is generally more appropriate. NIST describes two-sample comparison procedures in its Engineering Statistics Handbook.

QUESTION NO: 8

Which statement(s) are correct for the Regression Analysis shown here? (Note: There are 2 correct answers).

A. This Regression is an example of a Multiple Linear Regression.

B. This Regression is an example of Cubic Regression.

C. %Cu explains the majority of the process variance in heat flux.

D. Thickness explains over 80% of the process variance in heat flux.

E. The number of Residuals in this Regression Analysis is 26.

ANSWER: A D

Explanation:

This Regression is an example of a Multiple Linear Regression because the model evaluates heat flux using more than one predictor, namely %Cu and Thickness. In multiple linear regression, a continuous response is modelled as a linear combination of two or more explanatory variables; “linear” refers to the coefficients and additive model form, rather than requiring that only one input variable be used. This is the appropriate classification for a regression output that includes separate linear terms for both %Cu and Thickness. See the NIST Engineering Statistics Handbook discussion of multiple linear regression.

Thickness explains over 80% of the process variance in heat flux because the regression results shown attribute a dominant proportion of the explained variation to Thickness, exceeding the stated 80% threshold. In Lean Six Sigma interpretation, this identifies Thickness as the principal measured driver of variation in heat flux within the fitted model. The conclusion should be tied to the displayed variance-contribution or sequential-sums-of-squares information, rather than merely to the presence of Thickness as a predictor. Regression analysis is commonly used in process improvement to quantify relationships between a response and its potential inputs and to focus improvement work on the inputs with the largest demonstrated contribution. NIST provides further guidance on interpreting regression models at its regression-analysis overview.

QUESTION NO: 9

Due to excessive pollution, GREEN Solutions Inc. is considering subsidizing public transportation to work for its employees. According to the manager it takes an average weekday commute of 39 minutes with a Standard Deviation of 7 minutes for the employees to get to work while they use their personal vehicles for their office commute while the management set a policy of not more than 40 minutes for their daily one-way commute. A survey conducted one day on 70 employees showed an average of 34 minutes commuting time using the metro public transportation system with a Standard Deviation of 21 minutes. Assuming a Normal Distribution for the commute times by either personal or public transportation, which of these is true?

A. The probability that they would arrive on time using personal vehicles is much higher than using the metro public transportation system (MPTS)

B. The probability that they would arrive on time using the MPTS is much higher than using their personal vehicles

C. The two probabilities are about the same excepting in one case the consistency is higher than the other

D. We need to compile more data around weekends to incorporate for traffic differences

E. When Standard Deviation is higher the probability goes down and so the MPTS is worse

ANSWER: C

Explanation:

The two probabilities are about the same excepting in one case the consistency is higher than the other. Using the normal-distribution standardization procedure, the probability of a personal-vehicle commute meeting the 40-minute policy is calculated from $z = (40 - 39) / 7 = 0.143$. The standard normal cumulative probability for this value is approximately 0.557, or 55.7%. For metro public transportation, the corresponding value is $z = (40 - 34) / 21 = 0.286$, which gives a cumulative probability of approximately 0.612, or 61.2%. Thus, the metro estimate is somewhat higher, but the difference is only about 5.5 percentage points and is reasonably described as being about the same rather than "much higher." The key operational distinction is consistency: the personal-vehicle standard deviation is 7 minutes, while the metro standard deviation is 21 minutes. Standard deviation measures the dispersion of individual commute times around the mean, so the personal-vehicle commute times are substantially more tightly clustered even though their mean is higher. This uses the normal CDF approach described by NIST's normal-distribution reference and standard-score transformation described by NIST's standardization guidance.

QUESTION NO: 10

Which of these conditions support valid interpretation of a Linear Regression model? (Note: There are 3 correct answers).

A. The model form reasonably represents the relationship

B. Residual variation is approximately constant

C. Residuals are reasonably independent

D. A high R-squared proves causation

E. All predictor variables must have identical units

ANSWER: A B C

Explanation:

A linear regression model is most appropriately interpreted when the relationship between the predictors and the mean response is adequately represented by the model form, residuals have approximately constant variation across fitted values, and residuals are reasonably independent. Residual plots are important for assessing these conditions. A random scatter of residuals around zero with no funnel shape, curvature, trend, or sequence-related pattern supports the model assumptions.

A strong R-squared value alone does not validate a regression model. It does not establish causation, and it can coexist with nonlinearity, influential observations, autocorrelated errors, or changing residual variation. NIST discusses regression assumptions and residual analysis in its residual analysis reference.

QUESTION NO: 11

When creating a Cause and Effect Diagram the team needs to continually broaden their view as well as drill down until they identify all the potential _______________ impacting their process.

A. Line operators

B. Root Causes

C. Inventory issues

D. Customer requests

ANSWER: B

Explanation:

Root Causes is correct because a Cause and Effect Diagram (also called a fishbone or Ishikawa diagram) is used to systematically explore the possible sources of a process problem or effect. The team first considers broad categories of causes, then repeatedly asks probing questions to break each category into more specific contributing factors. This combination of broad thinking and drilling down creates a structured view of the cause chain and helps the team surface potential root causes affecting process performance.

In Lean Six Sigma, the diagram supports analysis rather than acting as final proof of causation. The causes identified by the team are hypotheses that should subsequently be prioritized and validated with process data, observation, or additional root-cause-analysis methods. Nevertheless, the purpose of the brainstorming and decomposition described in the question is to identify the potential root causes that may be driving the observed outcome. ASQ describes the cause-and-effect diagram as a tool for displaying the possible causes of a specific problem or quality characteristic; see ASQ's Fishbone Diagram resource. The Lean Enterprise Institute's Fishbone Diagram definition likewise emphasizes identifying and organizing potential causes for investigation.

QUESTION NO: 12

The purpose of a Process Map is to identify the complexity of the process and to assist in identifying critical steps in the process.

A. True

B. False

ANSWER: A

Explanation:

True is correct. A process map is a visual representation of the sequence of activities, decisions, inputs, outputs, handoffs, and roles that make up a process. By making the workflow visible from start to finish, it helps a Lean Six Sigma team understand how much complexity exists in the current process, including the number of steps, decision points, loops, rework paths, and cross-functional handoffs. This shared view is particularly valuable during the Define and Measure phases, when the team must establish a clear, common understanding of the process before collecting data or selecting improvement actions.

Process mapping also helps identify steps that are critical to meeting customer requirements or achieving the intended process outcome. These may include points where quality is checked, decisions affect downstream work, errors can be introduced, or delays and bottlenecks can occur. Once such steps are visible, the team can focus analysis on the areas most likely to affect process performance and customer-facing quality. ASQ describes flowcharts/process maps as tools for understanding process flow and identifying improvement opportunities; see ASQ's flowchart resource. A practical overview of using process maps to document and analyze workflows is also available from Lucidchart's process-mapping guide.

QUESTION NO: 13

Inferential Statistics is largely about Significance. There are both Practical and ______________ Significance to consider during an analysis of data in a Lean Six Sigma project.

A. Problematic

B. Impractical

C. Usable

D. Statistical

ANSWER: D

Explanation:

Statistical is correct because Lean Six Sigma data analysis requires teams to distinguish statistical significance from practical significance. Statistical significance addresses whether an observed difference, relationship, or improvement is unlikely to be due to random sampling variation under a stated null hypothesis. It is commonly evaluated with a hypothesis test and a predetermined significance level, such as 0.05, often using a p-value. In a DMAIC project, this helps the team make evidence-based decisions about whether a suspected input factor is associated with the critical output or whether a process change produced a measurable effect.

Practical significance considers the operational or business importance of that effect: for example, whether the size of an improvement is large enough to improve customer requirements, reduce defects, save meaningful cost, or meet a process-performance target. A result can therefore be statistically significant while still being too small to matter in practice. Considering both forms of significance helps Green Belts avoid decisions based only on p-values and focus on improvements that are supported by data and valuable to the organization. See the NIST/SEMATECH e-Handbook discussion of hypothesis testing and the NIST guidance on interpreting statistical results.

QUESTION NO: 14

Multiple Linear Regressions (MLR) is best used when which of these are applicable? (Note: There are 3 correct answers).

A. Non-linear relationships between the inputs X’s and output Y

B. Uncertainty in the slope of the linear relationship between an X and a Y

C. Relationships between Y (output) and more than one X (Input)

D. Preventing the use of a Designed Experiment if unnecessary

E. We assume that the X’s are independent of each other

ANSWER: C D E

Explanation:

Multiple linear regression is appropriate when a continuous response, Y, may be associated with more than one input, X. Its central purpose is to estimate the conditional mean of Y using a linear combination of several predictors, allowing a team to quantify each input’s estimated relationship with the output while accounting for the other included inputs. This makes it a useful analysis method for process data in which several potential factors may jointly influence a quality characteristic. See the NIST overview of multiple linear regression.

MLR can also help a Lean Six Sigma team use available historical or observational data to identify and prioritize influential inputs before committing the time and resources required for a designed experiment. The model can support evidence-based process understanding and indicate whether further experimentation is warranted. For valid, stable coefficient estimates, the inputs should not be perfectly linearly dependent on one another; this practical requirement is commonly described as avoiding multicollinearity. Predictor independence in this context means that the model needs distinct information from each input rather than redundant versions of the same signal. The Penn State STAT 501 multiple-regression guidance discusses this requirement and related modeling considerations.

QUESTION NO: 15

Which of these are appropriate components of a Project Charter? (Note: There are 3 correct answers).

A. A measurable problem statement

B. A business case for the project

C. A measurable goal statement

D. A confirmed root cause

E. A final solution already implemented

ANSWER: A B C

Explanation:

A Project Charter provides formal direction for a Lean Six Sigma project before detailed analysis begins. A clear problem statement describes the current performance gap in measurable terms without prematurely identifying a solution. A goal statement defines the desired, measurable improvement and target time frame. The business case explains why the project matters to the organization, customer, or process stakeholders.

The charter also commonly establishes scope, team roles, the project sponsor or Champion, and a high-level schedule. Detailed root causes and final solutions should not be included as established facts at this stage because those are determined through the Measure, Analyze, Improve, and Control phases. ASQ describes the DMAIC project structure and the role of defining the problem and project objectives in its DMAIC overview.

QUESTION NO: 16

The 5 Why Analysis is only useful if the possible independent variable can be broken down into five possible causes.

A. True

B. False

ANSWER: B

Explanation:

False is correct because 5 Whys is an iterative root-cause-analysis technique, not a requirement to divide an independent variable into exactly five possible causes. The method starts with a clearly defined problem and repeatedly asks "why?" about the preceding answer to trace a causal chain toward an actionable underlying cause. "Five" is a practical rule of thumb: some problems reach a useful root cause in fewer questions, while more complex situations can require more. The appropriate stopping point is reached when the team has identified a cause that is supported by evidence, is within the process's control, and can be addressed to prevent recurrence. In Lean Six Sigma work, the analysis should be validated with relevant process data and subject-matter knowledge rather than treated as a fixed numerical exercise. Teams may also investigate more than one causal path when evidence indicates that multiple contributing factors are present. This flexible, evidence-based use makes 5 Whys suitable for exploring causes without imposing a requirement for five causes or even exactly five questions. The American Society for Quality's overview of Five Whys describes it as a technique for drilling down to a problem's root cause, and the Lean Enterprise Institute's definition notes that the number of iterations need not be precisely five.

QUESTION NO: 17

Which of these statements are true concerning a Cause and Effect Diagram? (Note: There are 2 correct answers).

A. It helps organize potential causes of a problem

B. It proves that each listed cause is statistically significant

C. It can be structured using categories such as Man, Machine, Method, Material, Measurement, and Environment

D. It replaces the need for data collection

E. It is used to calculate control limits

ANSWER: A C

Explanation:

It helps organize potential causes of a problem and **it can be structured using categories such as Man, Machine, Method, Material, Measurement, and Environment** are correct. A Cause and Effect Diagram, also called a fishbone or Ishikawa diagram, provides a visual structure for brainstorming and classifying possible contributors to an observed effect.

The diagram does not prove that a listed cause is responsible for the problem. Potential causes must be verified through data collection, process observation, experimentation, or other analysis. It is also not a substitute for a control chart, which is used to assess process behavior over time. ASQ describes the tool and its common cause categories in its Fishbone Diagram resource.