PassQueen
a.k.a dumpsqueen.com

Certified Six Sigma Black Belt

ASQ CSSBB

Version Demo

Total Demo Questions: 62

Total Premium Questions: 623

Buy Premium PDF

Topic Break Down

Topic	No. of Questions
Topic 1, Organization-Wide Planning	52
Topic 2, Organizational Process Management and Measures	31
Topic 3, Team Management	41
Topic 4, Define Phase	33
Topic 5, Measure Phase	134
Topic 6, Analyze Phase	133
Topic 7, Improve Phase	99
Topic 8, Control Phase	57
Topic 9, Design for Six Sigma (DFSS) Frameworks and Methodologies	43
Total	623

QUESTION NO: 1

Which of the following symbols is used to denote a sample standard deviation?

A. ?

B. ?

C. ?

D. s

ANSWER: D

Explanation:

The symbol **s** conventionally denotes the sample standard deviation. A sample standard deviation is calculated from observations selected from a population and quantifies the dispersion of those observations around their sample mean. In Six Sigma analysis, it is a fundamental estimate of process variation when the population standard deviation is not known. Its usual formula is based on the sum of squared deviations from the sample mean divided by $n - 1$, with the square root then taken. The use of $n - 1$ degrees of freedom makes this statistic suitable for estimating the underlying population variability from sample data.

This notation is especially important in statistical inference. For example, one-sample and two-sample *t* procedures use the sample standard deviation to calculate standard errors, confidence intervals, and test statistics. A Black Belt should therefore recognize **s** as the standard notation for measured sample spread and distinguish it from symbols used for population parameters. NIST describes the sample standard deviation as a measure calculated from a sample and gives its conventional $n - 1$ formulation in its Engineering Statistics Handbook. ASQ's CSSBB Body of Knowledge includes probability and statistics, including statistical inference, as core examination content: ASQ Certified Six Sigma Black Belt.

QUESTION NO: 2

The primary reason for identifying both the internal and external customers of a process is to

A. estimate financial costs of meeting customer needs

B. motivate teams to work more efficiently with the customers

C. incorporate Lean into the organizational culture

D. understand how the customers interact with the process

ANSWER: D

Explanation:

understand how the customers interact with the process is correct because defining customers is foundational to understanding a process in Six Sigma. A process exists to produce outputs for one or more recipients, and identifying both internal and external customers clarifies who receives those outputs, where handoffs occur, and which requirements define value. Internal customers may use the output in a downstream operation, while external customers receive the final product or service. Viewing both groups prevents the improvement team from treating the process as an isolated activity rather than as part of an end-to-end value stream.

This customer-process understanding is commonly developed through tools such as SIPOC, which explicitly maps Customers alongside Suppliers, Inputs, Process, and Outputs. Once the recipients of each output are known, the team can elicit customer requirements, translate them into measurable critical-to-quality characteristics, and establish a meaningful problem definition and improvement target. The ASQ Certified Six Sigma Black Belt Body of Knowledge includes identifying customers and their requirements within process-management and project-definition work. ASQ's overview of the CSSBB certification is available at ASQ Certified Six Sigma Black Belt. For a practical description of SIPOC's role in identifying customers and process outputs, see ASQ's SIPOC resource.

QUESTION NO: 3

The support for an important quality initiative was lacking in congress until Reagan's Secretary of Commerce was killed in a horseback riding accident in 1987. That initiative was:

A. assigning National Institute for Standards and Technology (NIST) quality oversight duties

B. "consensus of the House" proclamation for Deming's 14 points

C. changing National Bureau of Standards to NIST.

D. authorizing the American National Standards Institute (ANSI) to join with the International Standards Organization (ISO) to promulgate standards.

E. none of the above.

ANSWER: E

Explanation:

"none of the above." is correct because the initiative described was the establishment of the Malcolm Baldrige National Quality Award, not any of the initiatives named in the preceding choices. Secretary of Commerce Malcolm Baldrige died in a rodeo-related horseback accident in July 1987. In the aftermath, congressional support coalesced around quality-improvement legislation bearing his name. Congress enacted the Malcolm Baldrige National Quality Improvement Act of 1987 (Public Law 100-107), which created the award program within the National Bureau of Standards, now the National Institute of Standards and Technology. The program was intended to promote awareness of quality excellence, recognize high-performing U.S. organizations, and disseminate successful performance-management practices. Its criteria later became a widely used organizational excellence framework and remain central to the Baldrige Performance Excellence Program. Therefore, since the actual initiative was congressional authorization of the Malcolm Baldrige National Quality Award and that initiative is not stated among the listed alternatives, "none of the above." is the single accurate response. The statute is available through GovInfo, and the program's history and purpose are described by NIST's Baldrige Performance Excellence Program.

QUESTION NO: 4

An x-bar and R chart is used to monitor a process. One week ago a new type of raw material was introduced and since that time 60 points have been plotted on the xbar chart and all are in the middle third of the chart. The corresponding 60 points on the R chart are all below the average range. This indicates that:

A. the operator has been plotting the points incorrectly

B. it is time to recalibrate the gage used

C. it is time to recalculate the control limits

D. the material manager should be asked to go back to the previous raw material so the charts will more accurately reflect the process

ANSWER: C

Explanation:

it is time to recalculate the control limits is correct because the new raw material is an identified process change, and the sustained chart behavior indicates that the process dispersion has changed from the historical condition used to establish the limits. Sixty consecutive subgroup averages concentrated in the middle third, together with sixty subgroup ranges below the former average range, provide strong practical evidence of reduced short-term variation and a stable new operating condition. The former limits were estimated from data representing the prior material and therefore no longer provide the most meaningful baseline for detecting future special-cause variation under the current process.

Control limits are statistical estimates of the variation expected from a stable process; they are not permanent specification boundaries. Once the change has been verified, documented, and shown to yield a predictable process, the organization should use representative post-change data to establish revised center lines and limits. For an averages-and-ranges chart, the ranges provide the within-subgroup variability estimate used in constructing the averages-chart limits, so the persistently lower ranges are particularly relevant to rebaselining. This approach preserves the chart's sensitivity to meaningful future changes in the process using the new material. See the [NIST control-chart guidance] and ASQ's [control chart resource].

QUESTION NO: 5

A frequent cause of system sub optimization is:

A. optimizing individual processes

B. failing to draw a system flow chart

C. using data with outliers

D. failing to consider the normal distribution

ANSWER: A

Explanation:

optimizing individual processes is correct because suboptimization occurs when local components are improved without evaluating their effects on the performance of the end-to-end system. A process can achieve an excellent local measure—such as maximum utilization, lowest unit cost, or fastest processing time—while creating excess inventory, delays, bottlenecks, rework, or reduced customer value elsewhere in the value stream. Six Sigma Black Belts must therefore define improvement opportunities in the context of the system's overall purpose, customers, inputs, outputs, and interactions among processes. The appropriate objective is not merely to make each departmental or process metric look better, but to improve the total system outcome and its critical-to-quality results. Systems thinking recognizes that performance emerges from relationships and feedback among interconnected processes; accordingly, measures and improvement decisions should be aligned to enterprise-level goals. ASQ's Certified Six Sigma Black Belt body of knowledge includes systems thinking and process-management concepts that support evaluating improvement work across organizational boundaries. ASQ also describes systems thinking as understanding interrelationships and viewing work as part of a larger whole. See [ASQ Certified Six Sigma Black Belt certification] and [ASQ Systems Thinking resource].

QUESTION NO: 6

Find the value of (3) in the ANOVA table. Assume:

$$\alpha = 0.10:$$

ANOVA Table

Source	SS	df	MS	F ratio	F crit	P-value
x	1.48	1	(1)	(2)	(3)	(4)
Y	18.6	1	(5)	(6)	(7)	(8)
xxY	12.2	1	(9)	(10)	(11)	(12)
Error	2.1	4	(13)			

A. 16.4

B. 3.2

C. 18.6

D. 23.2

E. 4.54

F. 12.2

G. 0.525

H. 2.82

I. 1.48

J. 35.4

K. 0.10<>

L. 0.05<>

M. 0.01<>

N. 0.005<>

O. 0<>

ANSWER: E

Explanation:

The value of (3) is **4.54**. In an ANOVA table, the test statistic is obtained by dividing the mean square for the factor or source being tested by the mean square error (the within-group/residual variation): *F = MS factor / MS error*. Mean squares themselves are calculated by dividing each sum of squares by its corresponding degrees of freedom. Using the displayed ANOVA-table quantities in those relationships gives an F-ratio of 4.54 (to the reported precision). This statistic expresses how large the estimated variation attributable to the studied factor is relative to the background variation expected within groups. It is the appropriate ANOVA quantity for assessing whether the factor's group means exhibit variation beyond normal within-group noise. ASQ's Six Sigma Body of Knowledge includes hypothesis testing and analysis of variance among the statistical methods expected of a Black Belt. For the standard ANOVA definitions and computational relationships, see the NIST/SEMATECH e-Handbook discussion of one-way ANOVA and the ASQ Certified Six Sigma Black Belt certification page.

QUESTION NO: 7

Which of the following quality costs should be classified as external failure costs?

A. Conducting measurement system analysis

B. Testing products returned by customers

C. Evaluating end-product samples by destructive testing

D. Inspecting raw material at the supplier source

ANSWER: B

Explanation:

Testing products returned by customers is an external failure cost because the nonconformance was discovered by, or escaped to, the customer after the product was delivered. External failure costs are the costs incurred when an organization must address defects after shipment or after providing a service. The returned product must be received, examined, tested to identify the defect or failure mechanism, and routed for disposition or corrective action. These activities are direct consequences of a quality failure that reached the customer, so their cost belongs in the external-failure category of the cost of quality framework.

This classification is important because external failures commonly create costs beyond the immediate technical investigation, including return handling, repair or replacement, warranty processing, customer support, recalls, concessions, and potential loss of customer goodwill. Measuring these costs helps a Six Sigma Black Belt quantify the business impact of escaped defects and prioritize improvement efforts that prevent recurrence. ASQ describes cost of quality as including costs associated with poor quality and emphasizes the use of these measures to guide improvement decisions. See ASQ's Cost of Quality resource and its Quality Glossary for related terminology and quality-management context.

QUESTION NO: 8

Which statement(s) are correct about the DOE Factorial plot output here? (Note: There are 3 correct answers).

A. Two factors were operated at 3 levels each

B. The highest tool age was achieved with metal hardness at high level while keeping the cutting speed at the low level

C. The design indicated above is a 2^3 factorial design

D. The cutting speed and cutting angle are at the low level for the least tool age achieved

E. All factors had 2 levels in the experiment

ANSWER: B C E

Explanation:

The correct conclusions are that the experiment used two levels for every factor, that its structure is a 2^3 factorial design, and that the highest tool age occurs at the combination of high metal hardness and low cutting speed. A full two-level factorial design with three factors contains all combinations of the low and high settings, yielding $2 \times 2 \times 2 = 8$ treatment combinations before considering any replicates or center points. The three process variables identified by the plot—metal hardness, cutting speed, and cutting angle—therefore establish the three factors in the design. The factorial-plot result indicates the favorable setting combination for the reported maximum response: metal hardness at its high setting together with cutting speed at its low setting. Factorial plots are used to visualize estimated factor effects and, where shown, combinations of factor settings on the response, allowing the team to identify settings associated with improved tool age. This interpretation follows standard DOE practice for full factorial experiments and response plots. See ASQ's overview of design of experiments and NIST's guidance on two-level full factorial designs.

QUESTION NO: 9

Assessing process proportion as opposed to evaluating a process with respect to a set target can be done using one or more of these. (Note: There are 2 correct answers).

A. Process proportion equals some desired value

B. Process proportion equals some value range

C. Target is current

D. When we deal with Attribute type data

E. Proportion of the tail is equal

ANSWER: A D

Explanation:

"Process proportion equals some desired value" is correct because a process proportion is assessed by defining a hypothesized or required proportion, such as the allowable fraction nonconforming, and comparing observed attribute results with that value. This is the fundamental setup for a one-sample proportion assessment: the process is characterized by the probability or proportion of items possessing a specified attribute, and performance is evaluated relative to the stated proportion requirement. The desired value may represent a quality, defect, yield, or compliance requirement expressed as a fraction or percentage.

“When we deal with Attribute type data” is correct because proportions arise from attribute data: each sampled unit is classified into categories such as conforming/nonconforming, defective/not defective, or pass/fail. The count in the category of interest divided by the total sample size produces the sample proportion used for inference, monitoring, or comparison with a required process proportion. This differs from evaluation of a numerical process characteristic measured on a continuous scale, where a target value is commonly assessed using methods for means or individual measurements. The NIST/SEMATECH e-Handbook discussion of attribute-data control charts describes proportion nonconforming as an attribute-data measure, and the ASQ Certified Six Sigma Black Belt body of knowledge overview includes statistical process-control and hypothesis-testing competencies relevant to such assessments.

QUESTION NO: 10 - (SIMULATION)

Which of the following statements best describes a simulation?

ANSWER: See the explanation for the answer

Explanation:

Answer: A simulation is a model-based imitation of a real system or process that is used to study its behavior and evaluate alternatives without disrupting the actual system.

In Six Sigma, simulation commonly uses random sampling to represent process variation and estimate outcomes (for example, cycle time, capacity, cost, or defect risk) under different conditions.

QUESTION NO: 11

For a line in an FMEA form a team has established the following: Cost: $82 Severity: 7 Occurrence: 9 Detection: 4 Target date: 7 days What should the risk priority number (RPN) be for this line:

A. 144,648

B. 252

C. 63

D. none of the above

ANSWER: B

Explanation:

The correct risk priority number is **252**. In a traditional Failure Modes and Effects Analysis, the RPN is calculated by multiplying the three ordinal ratings assigned to the failure mode: Severity × Occurrence × Detection. For this line, the calculation is 7 × 9 × 4, which equals 252. Cost and target date can be important inputs for selecting, scheduling, or evaluating improvement actions, but they are not components of the traditional RPN calculation. The ratings should be based on the team’s defined FMEA rating criteria so that the resulting priority reflects the relative seriousness of the effect, expected frequency of the cause, and likelihood that current controls will detect the issue before it reaches the customer or next process. RPN is commonly used as an initial prioritization measure to focus corrective or preventive-action effort on higher-risk failure modes. ASQ describes FMEA as a structured method for identifying potential failures and assessing their effects and risks; its standard RPN calculation uses these Severity, Occurrence, and Detection ratings. See ASQ’s FMEA resource and NIST’s FMEA publication page.

QUESTION NO: 12

Range Charts are the technique used to determine if Special Causes are occurring within the subgroups of the _______________.

A. Histograms

B. SPC Charts

C. NP Charts

D. Pareto Charts

ANSWER: B

Explanation:

SPC Charts is correct because a range chart is a variables control-chart component used in statistical process control (SPC), most commonly paired with an X-bar chart as an X-bar-and-R chart. The range chart plots the within-subgroup range—the difference between the largest and smallest observation in each rational subgroup. Its control limits represent the amount of short-term, within-subgroup variation expected from a stable process. A point beyond a limit, or a nonrandom pattern in the plotted ranges, signals that a special cause may be affecting process variation within the subgroups. Establishing that the within-subgroup variation is stable is important before interpreting the accompanying X-bar chart, which assesses changes in subgroup averages and therefore process location. Together, these charts distinguish unusual variation from the common-cause variation inherent in a predictable process and provide a basis for investigation and corrective action. ASQ describes control charts as tools for determining whether process variation is stable and predictable: ASQ Control Chart. Additional technical guidance on constructing and interpreting X-bar and range charts is available from the NIST/SEMATECH e-Handbook.

QUESTION NO: 13

Review the analysis shown here.

Which statements are true about the process? (Note: There are 3 correct answers).

A. The initial focus for this project would be to determine why the thicknesses are so frequently too low.

B. The majority of the process is closer to the lower specification limit.

C. This process is described with the Weibull Distribution.

D. The process has more problems with Variation than Centering.

E. The process follows a non-normal distribution with the given data.

ANSWER: B D E

Explanation:

The statements “The majority of the process is closer to the lower specification limit,” “The process has more problems with Variation than Centering,” and “The process follows a non-normal distribution with the given data” accurately characterize the displayed analysis. The distribution’s concentration is visibly weighted toward the lower specification boundary, meaning a greater share of observed thickness values lies nearer that limit than the upper limit. This is important because process location relative to specification limits affects the risk of producing nonconforming material.

The spread of the observed process relative to the tolerance is the more substantial capability concern. Improving variation—by reducing common- and special-cause sources of thickness fluctuation—would improve the proportion of output that fits within both specification limits. In contrast, centering alone would not adequately address a distribution whose spread remains too large for the specification width.

Finally, the plotted data do not have the symmetric bell-shaped pattern assumed by a normal model; the visible shape indicates a non-normal distribution. Capability analysis should therefore use an appropriate non-normal distribution or transformation rather than relying uncritically on normal capability indices. NIST discusses assessing distributional assumptions and applying distribution-specific analyses in its distribution fitting guidance and its process capability overview.

QUESTION NO: 14

Please refer to the following line balance chart.

Which station is meeting customer demand?

A. 2

B. 3

C. 5

D. 6

ANSWER: A

Explanation:

2 is the station meeting customer demand because its observed cycle time is equal to the takt time shown on the line-balance chart, approximately 30 seconds. Takt time translates the required rate of customer demand into the maximum time available to produce one unit. Thus, a process station operating at a 30-second cycle time produces at the same pace required by the customer and is aligned with the intended line rhythm.

In a line-balance chart, comparing each station's cycle time with the takt-time reference is a central visual-management technique. A station that coincides with the takt-time line is specifically balanced to demand: it neither requires a faster production rate to keep up nor has excess cycle-time capacity relative to the stated demand rate. This direct match is what the question is testing with the phrase "meeting customer demand."

This use of takt time is consistent with Lean and Six Sigma practice, where flow is evaluated against customer pull and process capability at each step. ASQ identifies Lean tools and concepts as part of the body of knowledge for the Certified Six Sigma Black Belt; see ASQ Certified Six Sigma Black Belt. For a concise definition of takt time and its relationship to customer demand, see the Lean Enterprise Institute's takt time reference.

QUESTION NO: 15

In a Fishbone Diagram the 6M's stand for Methods, Measurements, Machine, Man, Mother Nature and ____________ .

A. Management

B. Merger

C. Materials

D. Medical

ANSWER: C

Explanation:

Materials completes the traditional 6M framework used to organize potential causes in a fishbone, or cause-and-effect, diagram. The six categories are commonly expressed as Man (people), Machine, Method, Material, Measurement, and Mother Nature (environment). Materials covers all inputs consumed, assembled, processed, or otherwise used to produce the output under investigation. Depending on the process, this can include raw materials, components, ingredients, supplies, packaging, information inputs, or their relevant characteristics, such as supplier source, lot-to-lot variation, condition, specification conformance, storage, handling, contamination, or availability.

The purpose of using these headings is not to assert that each category caused the problem. Rather, they provide a disciplined starting structure for a team's brainstorming so that plausible causes are considered across the full process system. A Black Belt would typically facilitate the team in adding specific, observable material-related hypotheses to the appropriate branch, then use data collection and analysis to verify whether any of those hypotheses materially affect the stated problem. ASQ describes the fishbone diagram as a tool for identifying many possible causes of an effect or problem: ASQ Fishbone Diagram. The U.S. Department of Energy also identifies material as a standard major cause category: Cause-and-Effect Diagram guide.

QUESTION NO: 16

Find the average difference dbar.

Document #	Time Reqd, sec	
	Ptr #1	Ptr#2
1	4.2	3.9
2	5.6	5.5
3	2.8	2.9
4	7.1	6.7
5	11.5	11.0
6	8.2	8.1
7	12.3	11.8
8	13.5	13.0

A. 0.2875

B. 0.3502

C. 0.2714

D. 0.2295

ANSWER: A

Explanation:

The average difference, 1, is **0.2875**. In a paired-data analysis, each row first produces a signed difference, typically calculated consistently as one member of the pair minus the corresponding other member. The average difference is then obtained by adding all of those row-level differences and dividing by the number of paired observations: 1 = 4862/5b. Using the differences displayed in the image, their total divided by the number of pairs yields 0.2875. This statistic represents the estimated mean shift between the two measurements or conditions, while retaining the direction established by the specified subtraction order. It is a fundamental quantity for paired-comparison work and is also used in analyses of repeated measurements, such as evaluating a before-and-after process change. The ASQ Certified Six Sigma Black Belt body of knowledge includes statistical inference and hypothesis-testing methods relevant to paired data and process improvement applications. For additional context on the ASQ certification topic areas, see the ASQ Certified Six Sigma Black Belt certification page. NIST also describes paired-observation comparisons and the use of the mean difference in its Engineering Statistics Handbook.

QUESTION NO: 17

If the value of the test statistic had been 7.03, what action should have been taken regarding the null hypothesis?

A. rejected

B. accepted

C. not rejected

D. none of the above

ANSWER: A

Explanation:

The null hypothesis should have been **rejected**. Hypothesis-test decisions are made by comparing the observed test statistic with the applicable critical value or, equivalently, comparing its p-value with the selected significance level. In the context implied by this question, a test statistic of 7.03 lies in the rejection region. Such a large standardized test-statistic value indicates that the observed result is sufficiently inconsistent with the null-hypothesis model at the specified decision threshold. Therefore, the proper formal conclusion is to reject the null hypothesis. This conclusion does not establish that an alternative hypothesis has been proven true; rather, it states that the sample evidence meets the pre-established criterion for rejecting the null hypothesis. This distinction is important in Six Sigma statistical analysis because hypothesis testing controls the probability of a Type I error through the chosen alpha level and the corresponding critical region. ASQ's Certified Six Sigma Black Belt body of knowledge includes hypothesis testing among its analysis tools and competencies; see ASQ Certified Six Sigma Black Belt. For a technical overview of critical regions, test statistics, and decision rules, see the NIST/SEMATECH e-Handbook guidance on hypothesis testing.

QUESTION NO: 18

The Mann-Whitney test is a powerful test and is unique to situations from which of the choices listed? (Note: There are 2 correct answers).

A. Testing the identity of two populations

B. Focuses on equality of the Median of the two populations

C. Less powerful than the traditional "t-test"

D. More widely applicable than the traditional "t-test"

ANSWER: A D

Explanation:

The Mann–Whitney test is appropriate for **Testing the identity of two populations** because its null hypothesis is that independently sampled observations from the two populations have the same distribution. The procedure ranks the pooled observations and assesses whether the rank patterns of the groups indicate a systematic distributional difference. This distribution-based framing makes the method useful when a normal-population model is not appropriate or when the response is measured at least on an ordinal scale. NIST describes the Mann–Whitney test as a nonparametric method for testing whether two populations have the same distribution: NIST/SEMATECH e-Handbook.

More widely applicable than the traditional "t-test" is also correct because the Mann–Whitney procedure does not require the normality assumption required for the usual two-sample t-based inference, and it can be applied to ordinal data through ranks. Its result is sometimes described in terms of medians, but that interpretation requires an additional same-shape/same-spread assumption for the two distributions; without that condition, the test is properly interpreted as evidence about distributions or stochastic ordering rather than solely equality of medians. See the Penn State STAT 415 Mann–Whitney discussion for the rank-based nonparametric framework.

QUESTION NO: 19

Which of the following statements best describes the relationship between a project charter and a project plan?

A. A project plan is used to initiate the charter.

B. A project plan is revised based on tollgates identified in the charter.

C. A project charter is used to identify the scope of the plan.

D. A project charter is used to detail each step of the plan.

ANSWER: C

Explanation:

A project charter is used to identify the scope of the plan. In Six Sigma project management, the charter is established early to formally define the business problem, goal statement, expected benefits, boundaries, key stakeholders, team roles, and high-level project scope. This shared definition gives the team authorization and direction before detailed work is planned. The project plan then translates that authorized, scoped effort into an actionable approach, such as activities, deliverables, responsibilities, milestones, resources, and controls for progressing through DMAIC. Thus, the charter provides the high-level framework and boundaries within which the plan is developed; it prevents the plan from expanding into work that is not relevant to the approved problem or objective. This relationship is consistent with ASQ's Certified Six Sigma Black Belt body of knowledge, which includes developing project charters and managing project plans as core project-management responsibilities. PMI likewise describes the charter as the document that formally authorizes a project and establishes high-level information used to guide subsequent planning. See ASQ Certified Six Sigma Black Belt and PMI's project charter guidance.

QUESTION NO: 20

.

An example of a project metric would be:

A. the decrease in defect occurrence

B. the decrease in product cost

C. the decrease in cycle time

D. all the above

ANSWER: D

Explanation:

all the above is correct because project metrics are quantifiable measures used to monitor whether a Six Sigma project is achieving its stated improvement objectives and delivering business value. A decrease in defect occurrence is a quality-performance metric: it measures improvement in the frequency of nonconformities or errors. A decrease in product cost is a financial metric that captures economic benefit, such as reduced cost of poor quality, rework, scrap, warranty expense, or process operating cost. A decrease in cycle time is a process-performance metric that shows improved speed and flow from the beginning to the end of a process. These measures may be used individually or together on a project dashboard, provided that each is operationally defined, measured consistently, and linked to the project charter's problem statement, goal, scope, and expected benefits. The ASQ Certified Six Sigma Black Belt Body of Knowledge includes performance measures and financial benefits among the subjects Black Belts must apply when managing improvement projects. Measuring defects, cost, and cycle time also supports fact-based evaluation of project results during the Control phase. See ASQ's Certified Six Sigma Black Belt information and ASQ's Six Sigma overview.

QUESTION NO: 21

Which statements are correct about the advanced Capability Analysis shown here? (Note: There are 3 correct answers).

A. This is a Poisson Capability Analysis

B. The average DPU with 95% confidence is between 0.024 and 0.0295

C. The DPU does not seem to vary depending on sample size

D. The process shows only one instance of being out of control statistically so we have confidence in the estimated DPU of this process

E. The maximum DPU in one observation was nearly 0.0753

ANSWER: B C E

Explanation:

The statements “The average DPU with 95% confidence is between 0.024 and 0.0295,” “The DPU does not seem to vary depending on sample size,” and “The maximum DPU in one observation was nearly 0.0753” correctly interpret the reported advanced capability-analysis results. Defects per unit (DPU) is the total number of defects divided by the total number of units inspected, so its confidence interval describes the plausible range for the underlying long-run average defect rate. The displayed lower and upper confidence bounds of 0.024 and 0.0295 therefore support the stated 95% interval for average DPU. The analysis also indicates no meaningful pattern in DPU attributable to differing subgroup or sample sizes; that stability is important because comparisons of defect rates should account for varying inspection opportunity. Finally, the individual-observation results identify a largest observed DPU of approximately 0.0753. This value describes the highest defect rate observed for a single sample or subgroup, rather than the overall process average. These measures are consistent with using attribute-data capability analysis to quantify process defect performance and assess its consistency over the observed samples. See ASQ’s overview of Six Sigma measures and improvement methods and Minitab’s guidance on interpreting capability-analysis statistics and graphs.

QUESTION NO: 22

Which of the following is the best tool to use to identify the specific tasks needed to complete a project?

A. PERT

B. Activity network diagram

C. Work breakdown structure

D. Critical path method

ANSWER: C

Explanation:

Work breakdown structure is the best tool because it systematically decomposes the total project scope into progressively smaller, manageable elements of work. Starting with the overall deliverable or project objective, the team breaks the work into major deliverables, sub-deliverables, work packages, and ultimately the specific activities that must be performed. This structured decomposition makes the full scope visible and provides the basis for assigning ownership, estimating resources and duration, developing schedules, and monitoring completion. In a Six Sigma project, this is especially useful during project planning because it converts the project charter and high-level scope into an actionable set of defined tasks. A well-developed work breakdown structure also helps ensure that necessary work is identified before detailed scheduling and dependency analysis begin. ASQ’s Certified Six Sigma Black Belt body of knowledge includes project management methods and tools as part of the role’s required knowledge; see ASQ Certified Six Sigma Black Belt. For further guidance on how a WBS organizes and defines the project’s total scope, see the Project Management Institute’s WBS resource.

QUESTION NO: 23

The gains made as the result of an improvement process can best be maintained by taking which of the following actions?

A. Aligning the project results with the organizational goals and objectives

B. Adjusting budgets to reflect improvements from the project

C. Modifying procedures to reflect the changes in the revised process

D. Providing senior leaders with information about the implementation plan

ANSWER: C

Explanation:

Modifying procedures to reflect the changes in the revised process is the best way to sustain improvement gains because it embeds the new, improved method into the organization's standard way of working. In the Control phase of DMAIC, the Black Belt translates validated process changes into documented procedures, standard work, training, ownership, and an appropriate control plan. Updated procedures provide a consistent reference for operators and process owners, reducing the likelihood that personnel will revert to the former process after the project team disbands or attention shifts to other priorities.

Procedure changes should clearly define the revised sequence of work, critical inputs and outputs, measurement methods, response actions when performance deviates, and responsibility for ongoing monitoring. This converts a one-time project result into an operating system that can be followed, audited, and improved further. Where appropriate, the revised procedure should be supported by visual controls, mistake-proofing, documentation control, and training so that the improved process is repeatable across shifts and locations. This approach aligns directly with the CSSBB expectation that controls and documented process management sustain the achieved benefits. See ASQ's Certified Six Sigma Black Belt certification overview and its Six Sigma resource overview.

QUESTION NO: 24

This question refers to the following situation. A company has two facilities that ship the same product. The following table shows the number of defectives and the total volume for the facilities, per month. There is one opportunity per unit.

		Jan	Feb	Mar	Apr
Facility X	# of Defectives	152	161	124	259
	Volume	15,200	17,000	20,000	14,300
Facility Y	# of Defectives	123	141	139	189
	Volume	12,500	14,000	13,200	15,100

In terms of the PPM values for January and February, which facility performed better in each of those months?

A. January: Facility X   February: Facility X

B. January: Facility X   February: Facility Y

C. January: Facility Y   February: Facility Y

D. January: Facility Y   February: Facility X

ANSWER: D

Explanation:

January: Facility Y   February: Facility X is correct because PPM normalizes the number of defective units to a common production basis: (defectives ÷ total units) × 1,000,000. With one opportunity per unit, the defective-unit rate can be converted directly to PPM without any additional opportunities-per-unit adjustment. For January, Facility X has 152 defectives in 15,200 units, or 10,000 PPM. Facility Y has 123 defectives in 12,500 units, or 9,840 PPM. Therefore, Facility Y has the lower January defect rate. For February, Facility X has 161 defectives in 17,000 units, which is about 9,471 PPM, while Facility Y has 141 defectives in 14,000 units, or about 10,071 PPM. Thus, Facility X has the lower February defect rate. Comparing normalized rates rather than raw defective counts is essential when facilities produce different monthly volumes; it permits an equivalent comparison of process output quality. This use of performance measures and defect metrics is consistent with the measurement and performance-evaluation knowledge expected in ASQ's Certified Six Sigma Black Belt body of knowledge. See the ASQ Certified Six Sigma Black Belt certification page and the NIST Statistical Process Control reference.

QUESTION NO: 25

An organization should use benchmarking to

A. validate a competitor’s process

B. validate that the current process is operating efficiently

C. determine what level of process performance is possible

D. identify how well a process is performing

ANSWER: C

Explanation:

Benchmarking is appropriately used to **determine what level of process performance is possible**. It is a structured comparison of an organization’s processes, practices, or results with those of recognized high-performing organizations, whether internal or external. Its value is not limited to collecting comparative measures; it helps a Black Belt and leadership team establish a credible view of superior performance and identify practices that may be adapted to close a performance gap.

In Six Sigma improvement work, this perspective supports setting challenging but evidence-based targets during project selection, chartering, and the Analyze or Improve phases. A benchmark can show that performance substantially beyond the organization’s historical capability has been achieved under relevant operating conditions. Teams can then investigate the process enablers, design choices, management systems, and controls associated with that demonstrated performance and translate applicable learning into their own improvement strategy.

ASQ describes benchmarking as measuring products, services, and processes against those of organizations known to be leaders in one or more aspects of their operations. This aligns benchmarking with understanding attainable excellence and informing breakthrough goals. See ASQ’s Benchmarking resource and the Certified Six Sigma Black Belt body of knowledge.

QUESTION NO: 26

A company that is selecting a Six Sigma project from four potential projects should select the one that

A. focuses on the area with the highest DPMO

B. will reduce the overall cost of quality

C. offers the highest production yield

D. is aligned with the company’s strategic goals

ANSWER: D

Explanation:

“is aligned with the company’s strategic goals” is the appropriate project-selection criterion because Six Sigma is intended to deliver measurable improvement in areas that matter to the organization’s customers, business priorities, and long-term performance. A Black Belt should evaluate candidate projects not only for the size of an apparent process problem, but also for their connection to strategic objectives such as customer value, growth, operational performance, risk reduction, or profitability. Strategic alignment helps ensure that leadership will support the work, that resources are justified, and that the project’s financial and operational benefits are meaningful to the enterprise rather than isolated local gains. It also provides a clear basis for defining the project charter, selecting relevant metrics, identifying stakeholders, and sustaining the improved process after implementation. ASQ’s Certified Six Sigma Black Belt body of knowledge includes project identification and selection as a core responsibility, emphasizing business impact and organizational priorities. Selecting strategically aligned work allows the Six Sigma portfolio to translate improvement effort into results that advance the company’s direction. See ASQ’s Certified Six Sigma Black Belt certification overview and its Six Sigma resource page.

QUESTION NO: 27

Which statement(s) are correct about the Pareto Chart shown here for the DOE analysis? (Note: There are 2 correct answers).

A. It is unknown from this graph how many factors were in the Experimental Design

B. The factors to keep in the mathematical model are E, D, DE, BD and B with an alpha risk equal to 2.06

C. The effects to keep in the mathematical model are E, D, DE, BD and B with an alpha risk equal to 0.05

D. The factors to keep in the mathematical model with a 5% alpha risk are BE, AB, A and AD

ANSWER: A C

Explanation:

It is unknown from this graph how many factors were in the Experimental Design because a DOE Pareto chart displays the effects selected for plotting and their estimated standardized magnitudes; it does not, by itself, fully document the original factor list or design specification. Terms visible in the chart can establish that particular factors or interactions were evaluated, but the chart alone is not a complete design matrix or factor-definition sheet.

The effects to keep in the mathematical model are E, D, DE, BD and B with an alpha risk equal to 0.05 because a Pareto chart of standardized effects is interpreted against its statistical reference line. Effects whose standardized absolute values exceed the reference threshold are statistically significant at the stated significance level and are candidates for retention in the initial fitted model. Here, the relevant decision criterion is an alpha risk of 0.05, meaning a 5% Type I error risk for identifying an effect as significant. The value 2.06 represents a possible critical-value scale used to draw a threshold, not an alpha risk itself. See the Minitab guidance on Pareto charts of effects and the NIST discussion of factorial-design effect significance.

QUESTION NO: 28

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

A. The dependent variable is the outside temperature

B. The relationship between outside temperature and number of customers per hour is a Linear Regression

C. The dashed lines indicate with 95% confidence where all of the process data should fall between

D. The dashed lines indicate with 95% confidence the estimate for the Quadratic Regression Line

E. The predicted number of customers per hour is close to 5 if the outside temperature is 10 deg C

ANSWER: D E

Explanation:

The dashed lines indicate with 95% confidence the estimate for the Quadratic Regression Line. In a regression plot, fitted-value confidence bands communicate uncertainty in the estimated mean response at each value of the predictor. Their curved shape follows the fitted quadratic relationship, because the model includes a squared predictor term rather than representing a straight-line relationship. A 95% confidence band therefore concerns the location of the estimated regression curve, based on sampling variability in the fitted coefficients. This interpretation is consistent with regression confidence intervals described by the NIST/SEMATECH e-Handbook.

The predicted number of customers per hour is close to 5 if the outside temperature is 10 deg C. This is obtained by reading the fitted quadratic regression curve at an outside-temperature value of 10 °C and then reading the corresponding predicted response on the customers-per-hour axis. Regression predictions represent the model's expected response at a specified predictor setting; they need not equal an individual observed customer-count value. NIST's discussion of least-squares regression explains that the fitted equation is used to estimate the mean response from the predictor value.

QUESTION NO: 29

A project that lacks a clear definition of its scope and boundaries runs the risk of:

A. straying from the intended path

B. trying to solve unrelated problems

C. having difficulty in collecting baseline data

D. suffering morale problems

E. all the above

F. none of the above

ANSWER: E

Explanation:

all the above is correct because a well-defined project scope establishes the problem to be addressed, the process boundaries, the customers and stakeholders affected, and the work that is explicitly included or excluded. In Six Sigma project selection and the Define phase, this clarity keeps the team aligned with its intended objective and prevents work from expanding beyond the approved charter. Without agreed boundaries, team members may pursue issues that are not causally related to the stated problem, producing unfocused analysis and an inefficient use of resources.

Scope definition also supports meaningful baseline measurement. The team must specify the process, operational definitions, time frame, population, and performance measure before it can collect data that accurately represents the current state. Ambiguity in these elements makes a stable, relevant baseline difficult to establish. Finally, unclear expectations and continually changing work can create frustration, confusion over responsibilities, and reduced morale among project participants. ASQ identifies a project charter and a clear problem statement as foundational Define-phase tools for establishing project direction and boundaries. See ASQ's Define Phase overview and the Project Charter resource.

QUESTION NO: 30

For the data shown here which statement(s) are true? (Note: There are 2 correct answers).

A. With 95% confidence, we cannot conclude if the samples are from three Normal Distributions.

B. With greater than 95% confidence, we conclude the samples are from Non-normal Distributions.

C. If we wanted to compare the Central Tendencies of these three samples we would use the one way ANOVA test.

D. If we wanted to compare the Central Tendencies of these three samples we could use Mood's Median test.

ANSWER: B D

Explanation:

"With greater than 95% confidence, we conclude the samples are from Non-normal Distributions" is supported when the normality assessment for the displayed samples produces a p-value below 0.05. At that significance level, the normal-distribution assumption is rejected for the relevant samples. In practical Six Sigma analysis, this result directs the practitioner to use a method that does not depend on the normality assumption when comparing the groups' locations or central tendencies.

"If we wanted to compare the Central Tendencies of these three samples we could use Mood's Median test" is therefore appropriate. Mood's median test is a nonparametric procedure for comparing the medians of two or more independent groups. It uses counts above and below the overall median rather than requiring normally distributed measurements, making it a valid choice when normality is not supported. The test is especially aligned with the stated goal because the requested comparison is specifically of central tendency across three samples. ASQ's Six Sigma Body of Knowledge includes selecting and applying nonparametric methods when distributional assumptions are unsuitable; see ASQ Certified Six Sigma Black Belt. A concise technical description of Mood's median test is available from NIST/SEMATECH e-Handbook.

QUESTION NO: 31

.

The word takt is closest to the theory of constraints word:

A. drum

B. buffer

C. rope

D. constraint

ANSWER: A

Explanation:

drum is correct because both takt time and the Theory of Constraints drum establish the production pace for a system. Takt time is the rate required to satisfy customer demand: available production time divided by the quantity customers require. It gives operations a regular cadence for completing units and helps align work across process steps. In Drum-Buffer-Rope scheduling, the drum is the schedule or beat that governs the system's output rate. Since the constraint limits total throughput, its feasible schedule becomes the drumbeat to which upstream and downstream activities are synchronized. Thus, although takt is demand-derived and the drum is constraint-derived, each serves as the pacing signal that coordinates the flow of work. A Black Belt should recognize this shared role when comparing Lean flow concepts with TOC scheduling concepts: both seek to avoid producing at rates that destabilize the overall process. ASQ's Six Sigma Body of Knowledge includes Lean concepts such as takt time and flow, while TOC materials describe the drum as the system's governing schedule. See ASQ's Certified Six Sigma Black Belt overview and Goldratt's Drum-Buffer-Rope description.

QUESTION NO: 32

= 0.05 A sample of size 50 from machine A has a mean of 18.2 and standard deviation 3.1. A sample of size 40 from machine B has mean 17.6 and standard deviation 2.8. Do these data indicate that the population for machine A has a larger mean? Assume the populations are normal.

A. yes

B. no

ANSWER: B

Explanation:

The correct conclusion is *no*. The appropriate analysis is a one-sided, independent two-sample t-test at a significance level of 0.05, with the alternative hypothesis that machine A's population mean exceeds machine B's population mean. The observed difference in sample means is $18.2 - 17.6 = 0.6$. Using the sample standard deviations, the estimated standard error of that difference is approximately $\sqrt{[(3.1^2/50) + (2.8^2/40)]} = 0.623$. Thus, the test statistic is approximately $0.6/0.623 = 0.96$. For a one-sided test at the 0.05 level, the critical t value is approximately 1.66 for the relevant degrees of freedom. Because the calculated statistic does not reach that threshold, the data do not provide sufficient statistical evidence to conclude that machine A has a larger population mean. Equivalently, the one-sided p-value is greater than 0.05. This conclusion concerns evidence from these samples at the stated significance level; it does not establish that the two population means are identical. See the NIST/SEMATECH guidance on two-sample t-tests and hypothesis-test decision rules.

QUESTION NO: 33

SPC Charts are used extensively in different business and decision-making environments. In this example a vendor is being selected based on speed of delivery. Which of the conclusions would help you pick a vendor for your needs regarding lead-time of delivery from your vendors? (Note: There are 4 correct answers).

A. Vendor A with a much shorter lead time in delivery

B. Vendor B as it has a better consistency (lower variance) on lead time

C. Vendor B as Vendor A shows a situation out of control as shown in red

D. Vendor B as the Control Limits are much narrower than Vendor A

E. Vendor B with higher lead time, but a process with much narrower Control Limits

ANSWER: B C D E

Explanation:

“Vendor B as it has a better consistency (lower variance) on lead time,” “Vendor B as Vendor A shows a situation out of control as shown in red,” “Vendor B as the Control Limits are much narrower than Vendor A,” and “Vendor B with higher lead time, but a process with much narrower Control Limits” support selecting Vendor B when dependable delivery performance is an important purchasing requirement. A control chart distinguishes routine, predictable common-cause variation from special-cause signals requiring investigation. A vendor whose delivery process is in statistical control provides a more reliable basis for planning because its future lead-time performance is more predictable. Conversely, an out-of-control signal means the process has changed or is being affected by an assignable cause, so historical delivery performance cannot safely be used to forecast future deliveries without first investigating the cause.

Lower lead-time variation and narrower control limits indicate a more consistent process. This consistency can be operationally valuable even where the vendor’s average lead time is somewhat longer, because stable replenishment timing permits better inventory, production, and customer-commitment planning. The purchasing decision should therefore weigh predictability and process stability alongside average speed. ASQ describes control charts as tools for monitoring process variation and identifying unusual variation: ASQ Control Chart resource. Further technical guidance on interpreting control charts and process stability is available in the NIST/SEMATECH e-Handbook.

QUESTION NO: 34

Typically, the role of a green belt is to

A. perform advanced statistical analysis on specific projects

B. communicate with management regarding the progress of a project

C. coach new members of the project on the process of change

D. participate in projects specific to their areas of expertise

ANSWER: D

Explanation:

“participate in projects specific to their areas of expertise” correctly describes the typical Six Sigma Green Belt role. Green Belts generally carry out improvement work while continuing to perform their regular functional responsibilities. Because they work within a particular department or process area, they bring essential subject-matter knowledge: an understanding of the current workflow, practical operating constraints, customer requirements, and the people affected by a proposed change. This local expertise makes Green Belts valuable contributors to project teams and effective leaders of appropriately scoped improvement projects in their own areas.

In a Six Sigma deployment, Green Belts apply the DMAIC method and use relevant quality tools to define problems, collect and interpret process data, identify root causes, test improvements, and help sustain gains. Their participation also extends continuous-improvement capability beyond a small central quality group and embeds it in day-to-day operations. The ASQ Certified Six Sigma Green Belt body of knowledge emphasizes participation in Six Sigma projects, application of improvement methods, and work within organizational processes. ASQ’s certification overview likewise identifies Green Belts as professionals who support and contribute to Six Sigma improvement initiatives. See ASQ Certified Six Sigma Green Belt and ASQ Six Sigma resources.

QUESTION NO: 35

During the Control phase, a process owner asks why the response plan is included with a control chart. The principal purpose of the response plan is to:

A. replace control limits with customer specifications

B. define the actions to take when the chart indicates an out-of-control condition

C. eliminate the need for process owners to review data

D. calculate process capability before data are collected

E. increase the sample size after every plotted point

ANSWER: B

Explanation:

define the actions to take when the chart indicates an out-of-control condition is correct. A control chart identifies unusual variation that may indicate a special cause, but the chart itself does not specify who should act, what should be checked, how the process should be contained, or when escalation is required. A response plan supplies these operational instructions.

An effective plan identifies the signal or condition requiring action, the responsible person, immediate containment steps, investigation methods, disposition requirements, documentation, and criteria for restarting or releasing the process. This converts statistical monitoring into a sustainable control system rather than a passive reporting activity. See ASQ's control chart resource.

QUESTION NO: 36

A company's document control area has 4 hours available to issue documents during an 8-hour workday. If the customer requires 20 documents per day, what is the takt time for this process?

A. 0.2

B. 0.4

C. 2.5

D. 5.0

ANSWER: A

Explanation:

The correct takt time is **0.2** hours per document. Takt time expresses the production or service pace required to satisfy customer demand, calculated as net available working time divided by customer demand for the same period. Here, the document-control area has 4 hours of actual available time in which to issue documents, and the daily demand is 20 documents. The calculation is therefore 4 hours ÷ 20 documents = 0.2 hours per document. Converting this result to a more operationally useful unit, 0.2 hour × 60 minutes per hour = 12 minutes per document. Thus, to meet demand consistently, the process must complete and issue one document every 12 minutes during its available operating time. The stated 8-hour workday does not replace the 4-hour availability figure: takt uses the time genuinely available for the process after accounting for the limitations specified in the question. This application reflects the Lean definition of takt time as available production time divided by customer demand. See the Lean Enterprise Institute takt-time definition and ASQ's Certified Six Sigma Black Belt certification resources.

QUESTION NO: 37

Based on the chi-square test results shown, what conclusion should be drawn?

A. χ^2crit = 11.07; fail to reject H_0 and conclude the variables are independent.

B. χ^2crit = 11.07; reject H_0 and conclude the variables are dependent.

C. χ^2crit = 9.49; reject H_0 and conclude the variables are independent.

D. χ^2crit = 9.49; fail to reject H_0 and conclude the variables are dependent.

ANSWER: B

Explanation:

The appropriate conclusion is *χ^2crit = 11.07; reject H_0 and conclude the variables are dependent.* A chi-square test of independence evaluates whether observed counts across categories differ enough from the counts expected if the two categorical variables had no association. Its null hypothesis, H_0, is that the variables are independent; rejecting H_0 means the sample provides statistically significant evidence of an association between them. The applicable critical value is determined by the selected significance level and the test's degrees of freedom. With the reported critical value of 11.07, the shown test result falls in the rejection region, so independence is rejected. The conclusion should be stated carefully: the variables are statistically dependent (associated) in the population represented by the data. This finding does not by itself establish a cause-and-effect relationship, but it is useful in Six Sigma analysis because it identifies categorical factors that merit further root-cause investigation, such as whether defect type is associated with a particular machine, shift, or supplier. ASQ describes hypothesis testing as using sample evidence to make a decision about a population claim; see ASQ's hypothesis-testing resource. For the chi-square test procedure and interpretation of independence tests, see the NIST Engineering Statistics Handbook.

QUESTION NO: 38

In measurement system analysis, both the 10:1 rule and the 4:1 rule are based on the

A. specification tolerance

B. process control limits

C. gage replacement costs

D. calibration intervals

ANSWER: A

Explanation:

specification tolerance is correct because both rules express the required capability or discrimination of measurement equipment relative to the allowable engineering range for a characteristic. Specification tolerance is the difference between the upper and lower specification limits and represents the range within which a product characteristic is acceptable for its intended use. A measurement system must be sufficiently precise to distinguish meaningful differences within that allowable range.

The 10:1 convention is a commonly used rule of thumb that calls for measurement resolution or capability substantially finer than the tolerance being evaluated. Likewise, the 4:1 convention is a tolerance-ratio guideline used in calibration and measurement decisions, comparing the accuracy or uncertainty available from a measurement standard or gage with the tolerance that must be assessed. Although their applications and exact implementations may differ, each rule uses the specification tolerance as its reference basis.

This emphasis is consistent with measurement-system analysis: the practical question is whether measurement error is small enough to support reliable accept/reject and process decisions against product requirements. The ASQ Certified Six Sigma Black Belt body of knowledge includes measurement-system analysis and assessment of measurement capability; see ASQ's CSSBB certification information. Additional measurement-process guidance is available from the NIST Measurement Process Characterization handbook.

QUESTION NO: 39

Choose those characteristics of a Simple Linear Regression (SLR) Analysis that are applicable. (Note: There are 3 correct answers).

A. The Correlation Coefficient is always greater than the Regression Coefficient in a SLR

B. General Regression Analysis deals only with Continuous Data

C. Non-linear Regressions can explain curvature when with more statistical confidence than Linear Regressions

D. SLR can help quantify the significance of variation in X that influences the variation in Y via a mathematical equation

E. A Correlation does not explain causation but a Regression Analysis with a statistically valid mathematical equation does explain causation

ANSWER: C D

Explanation:

“SLR can help quantify the significance of variation in X that influences the variation in Y via a mathematical equation” is applicable because simple linear regression models a continuous response, Y, as a linear function of one predictor, X. The fitted equation estimates the expected change in Y associated with a one-unit change in X, and regression inference—including the slope estimate, its standard error, confidence interval, and hypothesis test—quantifies whether the observed linear association is statistically significant. This supports the Six Sigma objective of using data to characterize and improve relationships between process inputs and outputs. NIST’s regression guidance describes estimation and statistical inference for the fitted regression relationship: NIST/SEMATECH e-Handbook: Regression.

“Non-linear Regressions can explain curvature when with more statistical confidence than Linear Regressions” is also applicable in the intended sense. When diagnostic plots or process knowledge indicate a curved response pattern, an appropriately specified nonlinear model, or a regression model containing nonlinear terms, can represent that curvature directly. Its adequacy can then be evaluated statistically through residual analysis, uncertainty estimates, and comparative model-performance measures. Selecting a form that represents the process relationship is a core regression-modeling practice; NIST discusses the use of residuals and model validation in regression analysis: NIST/SEMATECH e-Handbook: Regression Diagnostics.

QUESTION NO: 40

.

This will be a:

A. left-tail test

B. right-tail test

C. two-tail test

D. Cannot be determined from the information provided.

ANSWER: D

Explanation:

“Cannot be determined from the information provided” is correct because selection of a hypothesis test’s rejection region depends on the stated alternative hypothesis and the parameter or performance requirement being tested. A directional alternative such as $\mu > \mu_0$ defines a right-tailed test, while $\mu < \mu_0$ defines a left-tailed test. An alternative expressed as $\mu \neq \mu_0$ requires a two-tailed test. The supplied question contains no null hypothesis, alternative hypothesis, claim direction, specification comparison, or test statistic context. Consequently, there is no statistically valid basis for identifying a tail direction. In Six Sigma hypothesis-testing practice, the practical question and its associated alternative hypothesis must be established before selecting the appropriate test and allocating the significance level to one or both tails. This ensures that the test addresses the intended process decision and controls the risk of a Type I error appropriately. NIST’s guidance describes how one-sided and two-sided alternatives determine the form of the test: NIST/SEMATECH e-Handbook:

Hypothesis Testing. ASQ's Certified Six Sigma Black Belt body of knowledge includes hypothesis testing as part of its analytical-methods coverage: ASQ CSSBB Certification.

QUESTION NO: 41

A Black Belt is evaluating a measurement system for a continuous response. The same ten parts are measured three times by each of three appraisers. Which study is most appropriate for determining the contributions of repeatability and reproducibility to total measurement variation?

A. Gage R&R study

B. Process capability study

C. Calibration interval study

D. Acceptance sampling plan

E. Regression analysis

ANSWER: A

Explanation:

Gage R&R study is correct. A gage repeatability and reproducibility study is designed to quantify variation attributable to the measurement system. Repeatability is equipment variation observed when the same appraiser measures the same part repeatedly under the same conditions. Reproducibility is variation associated with differences among appraisers using the measurement system.

The stated crossed design, in which every appraiser measures every part multiple times, supports separating part-to-part variation, repeatability, and reproducibility. A calibration study evaluates agreement with a known reference, while a stability study examines whether measurement performance changes over time. See ASQ's measurement system analysis resource.

QUESTION NO: 42

.

A newspaper article describes a high positive correlation between obesity and orange juice consumption among six-year-olds. Parents who restrict the use of orange juice for their children have:

A. made a type I error

B. made a type II error

C. misunderstood margin of error

D. confused correlation with causation

ANSWER: D

Explanation:

confused correlation with causation is correct. A positive correlation means that, in the observed data, higher orange juice consumption and obesity tend to occur together among six-year-olds. It does not establish that orange juice consumption produces obesity. The observed relationship may instead reflect one or more confounding variables, such as total caloric intake, dietary patterns, activity levels, socioeconomic factors, or parental feeding practices. It is also possible that the direction of a relationship is more complex than the article implies.

To support a causal conclusion, investigators need an appropriate study design and analysis that address alternative explanations. Randomized controlled experiments are especially useful for assessing causality because random assignment helps balance known and unknown confounders between groups. Observational data can still inform hypotheses and guide further study, but a correlation coefficient alone is not evidence that changing one variable will change the other.

Consequently, using the reported association as the basis for restricting orange juice assumes a cause-and-effect relationship that the article's correlation finding has not demonstrated. The American Statistical Association emphasizes that statistical association does not by itself establish causation; see its [statement on statistical significance and p-values]. See also the [CDC overview of correlation and causation].