CSSBB Six Sigma Black Belt

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Practice Questions

Try all 30 first, then check the answer key at the back.

1. What is the benefit of pairing an X■ chart with an R-chart?

A. Since there is typically space available on the strip chart recorder paper, it is logical to pair the X■ chart with the R-chart
B. The R-chart is used to ensure that the X■ remains on track
C. The X■ chart should be considered in relation to the standard deviation of the subgroups
D. It helps assess the stability of the process (X■) and identify its variation (R)

2. Sarah is collecting data on a new brand of snack chip. One issue with producing the snack chip is its delicate structure, which tends to cause it to break in half during transportation from the dryer to the consumer package. The factory has implemented an automated sorting machine to remove broken chips before packaging. Sarah has developed a program that converts this data into a control chart, which displays the percentage of defective chips in the entire snack chip population. What type of chart has Sarah developed?

A. c-chart
B. p-chart
C. X■ and R chart
D. XmR chart

3. Which of the following categories is not considered a standard Cost of Quality (CoQ) category?

A. External failure costs
B. Prevention costs
C. Design costs
D. Appraisal costs

4. Henderson determines that a sample size of 138 is required to determine, with 95% confidence ($\alpha = 0.05$), the maximum proportion of defective 50 mm copper piping in the population. What is the calculated proportion (p■)?

A. 1
B. 0.10
C. 10
D. 0.001

5. What fundamental characteristic does a prediction interval possess?

A. It is determined by the chi-square distribution
B. It is determined by proportional predictions
C. It is determined by individual observations
D. It is determined by the average of observations

6. Tom, a production Vice President, notices a surge in warranty payouts. This is likely to be indicative of which type of waste?

A. Overproduction
B. Overprocessing
C. Motion
D. Defects

7. Coach Johnson's statistical expert, Roy, is preparing a One-Way ANOVA analysis to determine if there has been an improvement in average sprint speed among three groups of twenty sprinters. Each group has undergone a different training regimen over the past three months. Roy has collected all the necessary data. What does Roy need to confirm before conducting the analysis?

A. That all the runners met Coach Johnson's specified minimum speed limit
B. That the null hypothesis of Anderson-Darling test cannot be rejected
C. That all the sprinters were in good health during the sprint tests
D. The Z-value found in his statistical tables

8. Which of the following is not a fundamental component of an effective team communication strategy?

A. Who will authorize the message
B. The nature of the message content
C. The approach used to transmit the information
D. Who will be responsible for delivering the message

9. In which of Tuckman's stages of group development do team members become acquainted with each other's preferences and aversions?

A. Norming
B. Performing
C. Forming
D. Storming

10. Ethan has been asked to develop a training requirement analysis for a new logistics position. Ethan reviews the tasks he will need to perform to enable the training requirement analysis to be completed. Which type of analysis is Ethan not likely to choose?

A. Skills analysis
B. Personnel analysis
C. Job analysis
D. Task analysis

11. When is the optimal moment to present a team reward?

A. During the acknowledgment stage
B. Upon concluding the control phase of the project
C. After the project successfully obtains final stage gate approval
D. After the project attains final financial validation

12. Which stage of Tuckman's group development model do team members belong to when they think in terms of a shared purpose?

A. Norming
B. Storming
C. Forming
D. Performing

13. Sarah, a team leader, notices that Alex, her top development resource, has been consistently late to scrum meetings over the past week. What does Sarah need to do here?

A. Encourage other team members to mock Alex for his tardiness in meetings to motivate him
B. Treat Alex to lunch to motivate him
C. Utilize the Six R's to comprehend Alex's current situation and provide motivation
D. Privately caution Alex about his punctuality in meetings to motivate him

14. Team member Sarah just invented a clever spreadsheet tool filled with time-saving macros for team use. What leadership style is appropriate for her?

A. Delegating
B. Directing
C. Coaching
D. Supporting

15. Alex has collected and sorted data from his machine bolt quality testing project and now needs to determine if the distribution of the data follows a normal distribution. Which test below is the most suitable for this purpose?

A. Scatter diagram
B. Box plot
C. Frequency distribution
D. Normal probability plot

16. Which of the following statistical techniques is inferential and not descriptive? - Frequency distribution - Correlation analysis - Quartile analysis - One sample hypothesis test

A. Correlation analysis
B. Quartile analysis
C. One sample hypothesis test
D. Frequency distribution

17. John has conducted a full factorial design on temperature versus machine belt rpm and has identified two sets of optimum operating conditions where the settings have small variation from each other. He now wants to see how those two sets behave under varying thickness of lubricating oils, which has long been suspected of producing quality defects in the past. What type of experimental design is ideal in these circumstances?

A. Randomized block design
B. Completely randomized design
C. Balanced design
D. Fractional factorial design

18. When does the sequence of runs become a significant design principle in Design of Experiments (DOE)?

A. To determine the appropriate response variable
B. To minimize the impact of noise factors
C. To determine the required number of runs
D. To determine the independent variables of the experiment

19. A documented and consistent process is a form of which Lean element?

A. Standard work
B. Pull system
C. 5S
D. Kaizen

20. Maria is trying to determine how the factors she discovered in the Analyze phase of her project can highlight their impact on project Y. Which element of DOE is Maria working on?

A. Experimental error
B. Experimental run
C. Experimental design
D. Design space

21. In the development of a new submarine hull made of sonar-absorbing material, Jackson created a cylindrical tube using a classified absorptive substance for further examination. What kind of assessment is Jackson conducting with this test?

A. Deterministic simulation
B. Probabilistic simulation
C. Pilot runs
D. Prototype

22. Consider the following experimental design: Three species of adult grasshopper are treated with three different types of insecticides at three different concentration levels commonly used in agriculture to examine mortality rates. Ethan conducts the experiment and observes from the main effects graph that there is minimal mortality in all species except at the highest concentration of any insecticide. What can be inferred from this data?

A. Ethan did not conduct an adequate number of repetitions in the design
B. The design was not fully randomized
C. The grasshopper species are developing resistance to the insecticides
D. Incorrect concentration levels of the insecticides were selected

23. The Internet of Things (IoT) provides manufacturers and service organizations with the ability to continuously monitor device performance in real-time. Which DFX methodology enables this objective when troubleshooting a device?

A. Design for Maintainability (DFM)
B. Design to Cost (DTC)
C. Design for Producibility (DFP)
D. Design for Test (DFT)

24. An architect is deciding how to build a residential home fascia using bricks, cinder blocks, and cement board. According to the design requirements, the total variation when these materials are stacked on top of each other should not exceed +/- 3 mm. What is this type of tolerance called?

A. Q variation
B. Noise variation
C. Conventional tolerance
D. Statistical tolerance

25. A critical integrated circuit assembly line operation requires line workers to have a Department of Defense master craftsman certification on through-hole welding techniques. This certification is costly to obtain, with training only available once a year in Mechanicsburg, VA. Which DFX methodology should be utilized to address this situation?

A. Design for Maintainability (DFM)
B. Design to Cost (DTC)
C. Design for Test (DFT)
D. Design for Producibility (DFP)

26. Why would creating a product that consistently falls in the middle between the lower and higher specification limits be extremely challenging?

A. Attempting to eliminate noise does not provide added value
B. The cost of reducing noise increases exponentially, limiting the advantages
C. Customers do not expect perfection
D. It is impossible to detect perfection in customer processes

27. Cause and effect diagrams are a valuable tool for which type of project scoping method?

A. Functional method
B. Dimensional method
C. Financial method
D. Collaboration method

28. Which method is not a legacy of Kaoru Ishikawa?

A. Quality circle
B. Cause and effect diagram
C. Quality first methodology
D. Kanban

29. In what situations should Lean Six Sigma be applied for ongoing improvement?

A. Only when the project receives approval from top management
B. Only when there is a potential cost savings of $500,000 or more
C. Only when there are enough resources available to assemble a project team to carry out the necessary work
D. Anywhere there is variation and waste present

30. Which of the following is not a Six Sigma tool?

A. Process mapping
B. Kanban
C. Statistical process control
D. Control chart

Answer Key & Explanations

1. D — It helps assess the stability of the process (X■) and identify its variation (R)
In summary, an X■ chart is utilized to monitor the average or mean of the process and track its changes over time. On the other hand, an R-chart is employed to illustrate process variation by using subgroup ranges. It is important to note that the R-chart does not keep the X■ on track; its purpose is solely to display variation within the subgroups. To graph the standard deviation of the subgroups, an s-chart is utilized

2. B — p-chart
This particular chart represents attribute data in the form of a percentage of the total snack chip population. X■ and R and XmR charts are used for continuous data analysis. A c-chart is employed to monitor expected occurrences based on a Poisson distribution, assuming a constant sample size

3. C — Design costs
The Cost of Quality (CoQ) categories consist of appraisal, prevention, internal failure, and external failure costs. - Appraisal costs involve measurement and inspection activities conducted during operations to assess compliance with quality requirements. - Prevention costs are planned and designed activities implemented before operations to ensure high-quality outcomes and prevent the occurrence of subpar products or services. - Internal Failure costs are incurred to rectify defects identified prior to the delivery of a product or service. - External Failure costs are incurred to address defects discovered by customers after they have received the product or service. Design costs, although significant, do not fall under the category of prevention costs and are considered separate from the standard CoQ categories

4. B — 0.10
To calculate the proportion (p■), we can use the equation n = (Zα/2/E)2 p■(1 - p■), where: α = 0.05 E = 0.05 p■ = ? n = 138 Referring to a standard normal distribution table, we find that α/2 (0.025) corresponds to Z = 1.96. Plugging in the values, we can solve for p■: 138 = ((1.96)/0.05))2 (p■(1-p■)). After solving the equation, we find that p■ = 0.10

5. C — It is determined by individual observations
The key feature of a prediction interval distinguishes it from a confidence interval, which relies on the average of a set of observations. A prediction interval is not dependent on chi-square or proportional predictions

6. D — Defects
Defects necessitate the need for reworking, reprocessing, or replacing originally-produced units, resulting in increased costs associated with warranty payouts. Overproduction refers to the act of producing more or earlier than what is required by demand. Overprocessing encompasses any production activity that does not add value to the customer. Motion refers to non-value added movements performed by people or equipment

7. B — That the null hypothesis of Anderson-Darling test cannot be rejected
It is crucial for Roy to perform a test for normality to ensure that the data he has collected follows a normal distribution. This is necessary in order to apply a parametric statistical analysis. If a sprinter was not in good health, their speed would be significantly affected and they would have already been identified as an outlier in

the sample. Calculating the Z-value is done after formulating the null and alternative hypotheses. Although Coach Johnson may have a minimum speed requirement for all his sprinters, that specific number is not relevant to this particular test

8. A — Who will authorize the message
A team communication strategy outlines the content to be conveyed, the method of communication, and the timing of the messages. It is essential to note that the team leader's approval of the messages is a given

9. C — Forming
When a team is just starting out, it is common for members to struggle with understanding one another. It takes time for them to adapt to each other's unique styles and personalities. Tuckman's stages of group development consist of forming, storming, norming, and performing. This model emphasizes that these phases are essential and unavoidable for a team to mature, face challenges, solve problems, plan tasks, and achieve results

10. B — Personnel analysis
In this scenario, Ethan is specifically focused on gathering information directly related to the new position. Therefore, he needs to conduct a job analysis, a task analysis, and a skills analysis. A personnel analysis may provide insights to an HR manager about the most qualified individuals within the organization, but this analysis would only be relevant after Ethan completes his training requirement analysis

11. A — During the acknowledgment stage
This crucial stage marks the team's recognition for their valuable contribution. It follows a series of important milestones such as completing the control phase, obtaining final stage gate approval, and securing final financial validation

12. A — Norming
During this stage, team members establish a collective identity and collaborate towards common objectives. Tuckman's model of group development comprises four stages: forming, storming, norming, and performing. According to this model, these phases are essential and inevitable for a team to evolve, confront challenges, address issues, generate solutions, plan tasks, and achieve outcomes

13. C — Utilize the Six R's to comprehend Alex's current situation and provide motivation
As an effective team leader, Sarah regularly applies the Six R's approach to foster motivation and excellence within her team. The Six R's represent: - Reinforce - Request for information - Recourse - Responsibility - Role - Repeat Warning Alex privately or publicly shaming him may elicit a highly negative reaction. Taking Alex out to lunch might be perceived as condoning his current behavior

14. A — Delegating
Sarah is evidently highly skilled and motivated. The directing leadership style is suitable for individuals with low ability but high commitment. The coaching leadership style is ideal for those with moderate ability but low commitment. The supporting leadership style is appropriate for individuals with medium ability and commitment

15. D — Normal probability plot
A normal probability plot is specifically designed to test the hypothesis that data follows a normal distribution. A scatter diagram is used to visually examine the relationship and patterns between two variables plotted against each other. A box plot only displays certain aspects such as the maximum and minimum values,

quartile range, etc., and cannot analyze normal distribution. A frequency distribution visually represents the frequency of data within specified bins and also cannot analyze normal distribution

16. C — One sample hypothesis test
The one sample hypothesis test is an inferential statistical technique that focuses on making predictions or generalizations about a larger dataset based on a specific hypothesis. If the hypothesis is true, an inference is made regarding the nature of the larger dataset. Frequency distribution, correlation analysis, and quartile analysis are all descriptive statistical techniques that provide basic information about a specific population

17. A — Randomized block design
John has identified two blocks of relatively homogeneous operating conditions that produce acceptable quality in the final product. By assigning lubricating oil thickness changes as a special cause, he can isolate the effect this additional variable has on the blocks. He would not be able to accomplish this using a completely randomized design, which would not isolate the two operating conditions. A balanced design, where all treatment combinations have the same number of observations, or fractional factorial design, which limit the number of factors to be tested, would answer the question of how oil thickness affects the two identified operating conditions

18. B — To minimize the impact of noise factors
For instance, when there is a high probability of a time-based relationship that could introduce additional variability to the results, careful consideration should be given to the order in which the runs are conducted in order to minimize this time dependency. The number of runs is determined based on the number of levels and factors involved. The selection of independent and response variables is finalized during the analyze phase

19. A — Standard work
This practice accurately outlines the steps involved in a task to ensure consistency and reduce inefficiencies. A pull system is a method of fulfilling demand only when needed. 5S is a technique for organizing the workplace to enable visual control and lean production. Kaizen is an approach to continuously improving processes and procedures

20. C — Experimental design
This crucial aspect of DOE refers to the formal plan that outlines the specific details for conducting an experiment. Design space refers to the multidimensional region of possible treatment combinations. Experimental error represents the variation in the response variable that is attributed to the factors. An experimental run refers to a single instance of performing the experiment for a specific set of treatment combinations

21. D — Prototype
Prototypes serve as representations of existing products that are used to evaluate essential functionalities and features, such as a novel, classified sonar-absorbing material. Deterministic simulations typically employ software to validate a general design. Probabilistic simulations offer insights into the statistical variations of the tested process. Pilot runs typically involve brief trials on current production equipment to verify the final design parameters

22. C — The grasshopper species are developing resistance to the insecticides
This observation aligns with the widespread issue of pesticide overuse. We can assume that Ethan planned and executed the experiment effectively and skillfully. Therefore, we can rule out the possibility of pesticide concentration, replication, or randomization errors influencing the results

23. D — Design for Test (DFT)
By incorporating computer chips into devices to gather and store extensive performance data, manufacturers have unlocked a plethora of opportunities to enhance the consumer experience. Design for Maintainability (DFM), Design to Cost (DTC), and Design for Producibility (DFP) are all secondary considerations in this particular scenario

24. C — Conventional tolerance
When dimensioning is based on stacking, it is referred to as conventional tolerance. Statistical tolerance is determined by statistically-derived distributions. Q variation is a component of noise variation analysis. Noise variation occurs due to uncontrollable inputs

25. D — Design for Producibility (DFP)
Introducing more automation into the production system to handle the necessary welding could be a viable approach to decrease expenses and enhance quality. Design for Maintainability (DFM), Design to Cost (DTC), and Design for Test (DFT) are secondary considerations in this specific scenario

26. B — The cost of reducing noise increases exponentially, limiting the advantages
When conducting regression analysis, it is possible to identify various independent factors that have diminishing effects on the overall process. However, attempting to control every single component of noise can be prohibitively expensive for businesses. While customers may desire perfection, their definition of perfection often aligns with a product that meets the specified limits. Therefore, a product that falls within a tighter specification may not be desired. Achieving true perfection is possible with highly sensitive analytical instruments, but eliminating all sources of noise may not be necessary or beneficial

27. A — Functional method
This approach is based on identifying the cause and effect relationships between input and output variables, aiming to identify the key factors (represented as x) that lead to a specific outcome (represented as y). The dimensional method aims to define the project scope across various categories, while there is no specific method called the financial method or collaboration method

28. D — Kanban
This method was developed by Taiichi Ohno from the Toyota company

29. D — Anywhere there is variation and waste present
Factors like support from top management, project staffing, and financial gain are all part of the process of selecting a project. However, they do not solely determine which methodology to use

30. B — Kanban
Kanban is not a tool used in Six Sigma methodology. It is actually a Lean method. On the other hand, statistical process control, control chart, and process mapping are all tools that fall within the Six Sigma methodology

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