

Certified Six Sigma Green Belt

STUDY GUIDE | EXAM 4

100 multiple-choice practice questions

Includes answer key and concise rationales

Practice material for study use. It is not affiliated with or endorsed by any certification body.

Instructions

Choose the best answer for each question. For a realistic practice session, complete all questions before reviewing the answer key. Topics cover DMAIC, Lean, measurement systems, statistical process control, capability, hypothesis testing, regression, DOE, risk, and control.

1. Which statement best describes the purpose of a project charter?

- A. Authorize the project and define its business case, scope, and team
- B. List every solution the team will implement
- C. Replace the control plan after project close
- D. Document only financial benefits

2. A CTQ is best defined as:

- A. A cost-accounting measure
- B. A customer requirement translated into measurable performance needs
- C. Any output of a process
- D. A team meeting agenda

3. Which item is usually outside a well-written problem statement?

- A. Magnitude of the gap
- B. Where and when the issue occurs
- C. The presumed root cause
- D. The affected customer or process

4. A SIPOC is most useful during which phase?

- A. Define
- B. Measure
- C. Analyze
- D. Control

5. In a RACI matrix, the person who ultimately owns a decision is:

- A. Responsible
- B. Accountable
- C. Consulted
- D. Informed

6. A process has 240 opportunities for defects and 6 defects. Its DPO is:

- A. 0.0025
- B. 0.025
- C. 2.5
- D. 25

7. A unit has 3 defect opportunities. If 500 units contain 15 defects, DPMO is:

- A. 1,000
- B. 10,000
- C. 30,000
- D. 90,000

8. Which measure is most appropriate for tracking the proportion of invoices with an error?

- A. Xbar chart
- B. p chart
- C. c chart
- D. Individuals chart

9. Which measure of central tendency is least affected by extreme values?

- A. Mean
- B. Median
- C. Range
- D. Standard deviation

10. A histogram is primarily used to:

- A. Display the distribution of continuous data
- B. Show task dependencies
- C. Assign team roles
- D. Test an attribute gage

11. The operational definition of "on time" should specify:

- A. A subjective judgment by the supervisor
- B. Exactly how, when, and by whom the result is measured
- C. Only the target value
- D. Only the customer name

12. Repeatability refers to variation when:

- A. Different appraisers measure the same item
- B. The same appraiser measures the same item repeatedly
- C. The process shifts over months
- D. Specifications change

13. Reproducibility refers to variation due to:

- A. Different appraisers
- B. Different parts only
- C. A changing specification
- D. A process mean shift

14. A measurement system that cannot distinguish among parts is likely to have:

- A. Too many distinct categories
- B. Poor discrimination
- C. Perfect bias
- D. No repeatability error

15. A data-collection plan should include all EXCEPT:

- A. Definitions and sampling rules
- B. Data owner and collection method
- C. A guaranteed root cause
- D. Timing and storage location

16. A run chart differs from a control chart because a run chart:

- A. Always has specification limits
- B. Does not use calculated control limits
- C. Can only display attribute data
- D. Cannot reveal nonrandom patterns

17. Common-cause variation is:

- A. Variation from a specific identifiable event
- B. Inherent variation of a stable system
- C. Always caused by operator error
- D. Variation beyond specifications

18. A point beyond an upper control limit suggests:

- A. A special cause may be present
- B. The process meets customer requirements
- C. The gage is accurate
- D. The mean equals the target

19. Specification limits are set by:

- A. Customer, design, or business requirements
- B. The control-chart calculation
- C. The last sample mean
- D. The facilitator

20. Cp evaluates:

- A. Potential capability based on spread
- B. Actual centering and spread
- C. Customer satisfaction only
- D. Measurement bias

21. Cpk decreases when:

- A. The process mean moves away from the nearest specification limit
- B. The process becomes perfectly centered
- C. The specification width increases
- D. Variation is eliminated

22. A process has USL 110, LSL 90, mean 102, sigma 2. Cpk is:

- A. 0.67
- B. 1.00
- C. 1.33
- D. 1.67

23. When data are strongly nonnormal, a good first response is to:

- A. Ignore the shape and use normal capability automatically
- B. Investigate the distribution and use an appropriate transformation or nonnormal method
- C. Delete all observations above the mean
- D. Widen specifications

24. Which graph is best for prioritizing categories contributing to a problem?

- A. Pareto chart
- B. Scatter plot
- C. Box plot
- D. Gantt chart

25. A scatter plot is primarily used to explore:

- A. A possible relationship between two variables
- B. Process ownership
- C. Project timing
- D. Customer segments only

26. Correlation alone proves that:

- A. One variable causes the other
- B. The relationship is linear
- C. Nothing about causation
- D. The sample is representative

27. A cause-and-effect diagram is commonly called a:

- A. Fishbone diagram
- B. Pugh matrix
- C. Run chart
- D. Box-and-whisker plot

28. The 5 Whys technique is intended to:

- A. Generate a random sample
- B. Move from symptom toward underlying cause
- C. Calculate Cpk
- D. Set control limits

29. A failure mode and effects analysis (FMEA) is most useful for:

- A. Anticipating and prioritizing risks before failure occurs
- B. Confirming a hypothesis with a t test
- C. Plotting a distribution
- D. Writing a project charter

30. In traditional FMEA, the RPN is calculated as:

- A. Severity + Occurrence + Detection
- B. Severity x Occurrence x Detection
- C. Severity / Occurrence
- D. Occurrence - Detection

31. A high severity rating should receive attention even if:

- A. The RPN is not the highest
- B. The team has a charter
- C. The process is stable
- D. The data are continuous

32. The null hypothesis usually represents:

- A. No difference or no effect
- B. The preferred solution
- C. A guaranteed improvement
- D. The customer specification

33. A Type I error occurs when the team:

- A. Rejects a true null hypothesis
- B. Fails to reject a false null hypothesis
- C. Uses a small sample
- D. Finds a practical effect

34. A Type II error occurs when the team:

- A. Rejects a true null hypothesis
- B. Fails to reject a false null hypothesis
- C. Uses a p chart
- D. Uses a paired design

35. If $p = 0.03$ and $\alpha = 0.05$, the appropriate decision is to:

- A. Reject the null hypothesis
- B. Accept the null hypothesis as true
- C. Increase the sample without review
- D. Conclude the effect is large

36. Statistical significance does not necessarily mean:

- A. The result is practically important
- B. The p-value is below alpha
- C. A comparison was made
- D. A sample was used

37. A paired t test is appropriate when comparing:

- A. Two measurements from the same units before and after a change
- B. Two unrelated defect counts
- C. Three independent group means
- D. Two proportions from unrelated samples

38. ANOVA is typically used to compare:

- A. Means of three or more groups
- B. Two defect proportions
- C. One median to a target
- D. Two variances only

39. After a significant ANOVA result, the team often uses:

- A. Post-hoc comparisons
- B. A SIPOC only
- C. A c chart
- D. A control plan only

40. A chi-square test of independence is used for:

- A. Association between categorical variables
- B. Difference between two continuous means
- C. Process capability
- D. Regression slope only

41. A confidence interval provides:

- A. A plausible range for a population parameter
- B. Proof that the process is capable
- C. A control limit
- D. A list of root causes

42. Increasing sample size generally makes a confidence interval:

- A. Narrower, all else equal
- B. Wider, all else equal
- C. Equal to specifications
- D. Invalid

43. A regression slope of -2 means that, on average:

- A. Y decreases by 2 for each one-unit increase in X
- B. X decreases by 2 for each one-unit increase in Y
- C. The relationship is non-significant
- D. The intercept is -2

44. R-squared in regression represents:

- A. The fraction of response variation explained by the fitted model
- B. The probability the model is correct
- C. The slope sign
- D. The process sigma

45. A residual plot is used to check:

- A. Model assumptions and unexplained patterns
- B. Only the project schedule
- C. Only sample size
- D. Only customer requirements

46. Multicollinearity in regression means:

- A. Predictors are strongly related to each other
- B. Residuals are all zero
- C. The response is categorical
- D. The sample is random

47. A designed experiment differs from observational data because it:

- A. Deliberately changes factor settings
- B. Never uses replication
- C. Cannot include noise
- D. Always has one factor

48. In DOE, a factor is:

- A. An input deliberately studied
- B. The response being measured
- C. A random error only
- D. A specification limit

49. In DOE, the response is:

- A. The measured output of interest
- B. A team role
- C. A blocking variable only
- D. A randomization rule

50. Replication in an experiment helps estimate:

- A. Experimental error
- B. Only the grand mean
- C. Customer requirements
- D. Project cost

51. Randomization in DOE primarily protects against:

- A. Bias from time-related or nuisance effects
- B. The need for analysis
- C. All measurement error
- D. The need for replication

52. Blocking is used to:

- A. Account for a known nuisance source of variation
- B. Eliminate all variation
- C. Increase the number of response variables
- D. Replace randomization

53. An interaction exists when:

- A. The effect of one factor depends on the level of another
- B. A factor has no effect
- C. The response is categorical
- D. A measurement system is biased

54. A 2³ full factorial design has how many treatment combinations?

- A. 6
- B. 8
- C. 9
- D. 16

55. A fractional factorial design is especially useful when:

- A. Many factors must be screened with limited runs
- B. Only one factor exists
- C. No randomization is possible
- D. The response cannot be measured

56. The best first step before piloting an improvement is to:

- A. Define success measures, risks, and a test plan
- B. Roll out globally without controls
- C. Discard baseline data
- D. Close the project

57. A Pugh matrix helps a team:

- A. Compare solution alternatives against criteria
- B. Calculate a p-value
- C. Create a control chart
- D. Measure gage bias

58. A cost-benefit analysis should include:

- A. Implementation, operating, and expected benefit impacts
- B. Only purchase price
- C. Only labor savings
- D. Only intangible benefits

59. Mistake-proofing is also known as:

- A. Poka-yoke
- B. Kaizen event
- C. Stratification
- D. Benchmarking

60. Which is the strongest mistake-proofing approach?

- A. Prevent the error from occurring
- B. Post a reminder sign
- C. Ask for more attention
- D. Inspect after shipment

61. Standard work is most valuable because it:

- A. Makes the best-known method visible and repeatable
- B. Eliminates all need for training
- C. Replaces process metrics
- D. Guarantees capability

62. A control plan should identify:

- A. What to monitor, how often, ownership, and reaction steps
- B. Only the project sponsor
- C. Only a final financial result
- D. Every historical data point

63. A reaction plan specifies:

- A. What to do when a metric signals a problem
- B. How to calculate the mean
- C. Who wrote the charter
- D. Which supplier is preferred

64. Visual management is intended to:

- A. Make status and abnormal conditions easy to see
- B. Hide variation from operators
- C. Replace all data collection
- D. Eliminate customer contact

65. A balanced scorecard concept encourages:

- A. Using a mix of financial and nonfinancial measures
- B. Using only cost measures
- C. Avoiding customer measures
- D. Tracking only project duration

66. The primary customer of a process output is:

- A. The recipient who uses the output
- B. Always the project sponsor
- C. Always the operator
- D. Only an external buyer

67. Voice of the customer data can be collected through:

- A. Surveys, interviews, complaints, and observation
- B. Only financial statements
- C. Only control charts
- D. Only DOE

68. Kano analysis is used to distinguish:

- A. Basic, performance, and excitement requirements
- B. Common and special causes
- C. Continuous and discrete data
- D. Internal and external failures

69. A stakeholder analysis helps the team:

- A. Plan engagement based on influence and interest
- B. Calculate DPMO
- C. Set specification limits
- D. Estimate sigma directly

70. A champion generally:

- A. Removes barriers and provides organizational support
- B. Collects every data point personally
- C. Owns every process step
- D. Performs all statistical tests

71. A Green Belt should escalate an issue when:

- A. It exceeds the team authority or threatens scope, timing, or benefits
- B. Any team member asks a question
- C. A run chart has no points
- D. A meeting ends early

72. Project scope creep is best controlled by:

- A. Clear boundaries and a formal change process
- B. Adding every requested idea immediately
- C. Avoiding stakeholder communication
- D. Removing the charter

73. A project milestone is:

- A. A significant checkpoint or deliverable date
- B. Any data point on a chart
- C. A control limit
- D. A process input

74. The critical path in a project network is:

- A. The sequence with the longest total duration
- B. The cheapest sequence
- C. Every parallel task
- D. The first task started

75. Risk mitigation means:

- A. Taking action to reduce likelihood or impact
- B. Ignoring low-probability events
- C. Transferring every risk
- D. Documenting benefits only

76. A process map is most helpful for:

- A. Understanding workflow, handoffs, and rework loops
- B. Estimating only financial value
- C. Replacing data analysis
- D. Assigning control limits

77. Value-added work is work that:

- A. Transforms the product or service in a way the customer values
- B. Consumes the most labor
- C. Occurs after an inspection
- D. Is required by tradition

78. Which is an example of the waste of waiting?

- A. An operator idle because upstream information is missing
- B. Producing a feature the customer wants
- C. Correctly assembling a product
- D. Updating a control chart

79. A pull system means work is:

- A. Initiated by downstream demand
- B. Released solely by a forecast
- C. Always produced in large batches
- D. Never scheduled

80. Cycle time is:

- A. Elapsed time to complete one unit or process cycle
- B. Total annual demand
- C. The time between audits only
- D. A defect opportunity

81. Takt time is calculated as:

- A. Available production time / customer demand
- B. Customer demand / available production time
- C. Defects / opportunities
- D. USL - LSL

82. Little's Law relates:

- A. WIP, throughput rate, and flow time
- B. Mean, median, and mode
- C. Cp, Cpk, and Ppk
- D. Severity, occurrence, and detection

83. A queue usually grows when:

- A. Arrival rate exceeds effective service capacity
- B. Service capacity exceeds arrivals
- C. Variation is zero
- D. WIP is eliminated

84. Stratification means:

- A. Separating data into meaningful categories
- B. Averaging all data together
- C. Deleting unusual values
- D. Changing specifications

85. A box plot is especially useful for comparing:

- A. Distributions across groups
- B. Task dependencies
- C. RACI roles
- D. Supplier contracts

86. A check sheet is designed to:

- A. Collect data consistently at the point of occurrence
- B. Predict a regression slope
- C. Calculate capability automatically
- D. Replace a process map

87. When an outlier is found, the best initial action is to:

- A. Investigate its validity and cause before removing it
- B. Delete it automatically
- C. Replace it with the mean
- D. Ignore all data from that period

88. A sampling frame is:

- A. The list or mechanism from which a sample is drawn
- B. A control chart centerline
- C. A project charter section
- D. A visual board

89. Selection bias occurs when:

- A. The sample systematically differs from the target population
- B. The p-value is small
- C. The process is stable
- D. A factor is randomized

90. A process is statistically stable but incapable when:

- A. It is predictable but does not consistently meet specifications
- B. It has many special causes
- C. It has no data
- D. It is perfectly centered

91. Pp differs from Cp because Pp:

- A. Uses overall process variation rather than within-subgroup variation
- B. Always exceeds Cp
- C. Uses only specification limits
- D. Ignores data

92. If the process mean is exactly centered and Cpk = 1.50, Cp is:

- A. Less than 1.50
- B. Equal to 1.50
- C. Always 0
- D. Cannot be calculated

93. An Xbar-R chart is typically used for:

- A. Continuous data collected in rational subgroups of small size
- B. Proportions defective
- C. Counts of rare events with varying opportunity
- D. Single observations only

94. An individuals-moving range chart is appropriate when:

- A. Only one observation is available per time period
- B. There are 20 parts in every subgroup
- C. The data are categories
- D. The response is a count of defects

95. A c chart assumes:

- A. A constant area of opportunity for counted defects
- B. Varying sample sizes for proportions
- C. Continuous measurements
- D. No possible defects

96. A u chart is used to monitor:

- A. Defects per unit when opportunity varies
- B. Fraction defective only
- C. Individual measurements
- D. Subgroup means

97. The purpose of rational subgrouping is to:

- A. Make within-subgroup variation reflect short-term common causes
- B. Guarantee normality
- C. Eliminate the need for a control chart
- D. Maximize subgroup size

98. A leading indicator is:

- A. A measure that signals future performance or risk
- B. A final outcome only
- C. Always a financial measure
- D. A specification limit

99. A lagging indicator is:

- A. A measure of results already achieved
- B. A predictor only
- C. A randomization method
- D. A measurement-system study

100. To sustain a new process, training should be paired with:

- A. Standard work, ownership, and verification
- B. A one-time announcement only
- C. Removal of all metrics
- D. An untested solution

Answer Key and Rationales

1. A

A charter formally launches the work and aligns sponsors, scope, objectives, roles, and expected value.

2. B

Critical-to-quality requirements connect voice of the customer to measurable specifications.

3. C

State the observed problem, not an unverified cause or solution.

4. A

SIPOC gives a high-level view of suppliers, inputs, process, outputs, and customers early in the project.

5. B

Accountable means final ownership; there should normally be one accountable owner per decision.

6. B

$DPO = \text{defects} / \text{opportunities} = 6 / 240 = 0.025$.

7. B

$DPMO = 15 / (500 \times 3) \times 1,000,000 = 10,000$.

8. B

A p chart monitors the fraction nonconforming when the subgroup size may vary.

9. B

The median is resistant to outliers.

10. A

Histograms reveal shape, center, spread, gaps, and possible multiple populations.

11. B

Operational definitions create consistent, repeatable measurement.

12. B

Repeatability is equipment variation under the same conditions.

13. A

Reproducibility is the appraiser-to-appraiser component.

14. B

Poor discrimination means meaningful part-to-part differences are obscured.

15. C

The plan defines reliable data collection; root cause comes later.

16. B

Run charts show data over time but generally omit statistical control limits.

17. B

Common causes are the routine sources built into the system.

18. A

A point beyond a control limit is a classic signal of special-cause variation.

19. A

Specifications define acceptable output; control limits describe process behavior.

20. A

Cp compares process spread to specification width without considering centering.

21. A

Cpk accounts for both spread and how close the mean is to a specification edge.

22. C

$Cpk = \min((110-102)/(3 \times 2), (102-90)/(3 \times 2)) = \min(1.33, 2.00) = 1.33$.

23. B

Capability analysis must match the data distribution and process context.

24. A

Pareto charts rank categories so effort can focus on the vital few.

25. A

Scatter plots show direction, form, strength, and outliers in a two-variable relationship.

26. C

Correlation quantifies association; it does not establish cause and effect.

27. A

The fishbone organizes potential causes into categories for structured brainstorming.

28. B

Repeated questioning tests the causal chain behind a problem.

29. A

FMEA proactively identifies failure modes, effects, causes, and controls.

30. B

RPN multiplies the three rating dimensions; use it alongside severity and business judgment.

31. A

Severe potential harm may demand action independent of a composite score.

32. A

Hypothesis tests begin with a baseline claim of no effect or difference.

33. A

Type I error is a false positive, controlled by alpha.

34. B

Type II error is a false negative; power equals 1 minus beta.

35. A

Because p is below alpha, the data are statistically inconsistent with the null hypothesis.

36. A

Effect size, cost, risk, and customer value determine practical importance.

37. A

Pairing uses within-unit differences and controls for unit-to-unit variation.

38. A

ANOVA tests whether at least one group mean differs among multiple groups.

39. A

Post-hoc tests help identify which group means differ.

40. A

It compares observed and expected counts in contingency tables.

41. A

The interval quantifies estimation uncertainty under the model assumptions.

42. A

Standard error decreases as sample size increases.

43. A

The slope describes the predicted change in response per unit change in predictor.

44. A

R-squared summarizes explained variation, not causation or model validity by itself.

45. A

Residuals can reveal nonlinearity, unequal variance, dependence, and outliers.

46. A

Collinear predictors can make individual coefficients unstable and hard to interpret.

47. A

DOE manipulates factors to support stronger causal inferences.

48. A

Factors are controllable or observable inputs whose effects are studied.

49. A

The response captures the outcome affected by factors.

50. A

Repeated runs at the same treatment combinations provide an estimate of random error.

51. A

Random order helps distribute lurking influences across treatments.

52. A

Blocks group similar experimental units so treatment effects are estimated more clearly.

53. A

Interactions mean main effects cannot be interpreted in isolation.

54. B

Two levels for each of three factors gives $2 \times 2 \times 2 = 8$ combinations.

55. A

Fractional designs trade some effect resolution for experimental efficiency.

56. A

A pilot should be planned, measurable, bounded, and reversible when possible.

57. A

It structures solution selection using weighted or relative criteria.

58. A

A balanced analysis captures one-time and ongoing costs as well as expected benefits and risks.

59. A

Poka-yoke prevents errors or makes them immediately detectable.

60. A

Prevention removes the opportunity for error; detection and reminders are weaker.

61. A

Standard work reduces variation and supports training, auditing, and improvement.

62. A

A control plan sustains gains by defining monitoring and the response to out-of-control conditions.

63. A

It translates signals into timely, owned corrective action.

64. A

Visual cues support rapid recognition and response at the point of work.

65. A

Balanced metrics avoid optimizing one dimension at the expense of customers, process, or people.

66. A

Customers may be internal or external; they are defined by their use of the output.

67. A

Different VOC methods reveal stated needs, behavior, and pain points.

68. A

Kano helps interpret how different features affect satisfaction.

69. A

It identifies who is affected and how to manage communication and support.

70. A

Champions sponsor improvement efforts and help secure resources and alignment.

71. A

Escalation is appropriate for material risks, decisions, or barriers beyond the project team.

72. A

Explicit in-scope/out-of-scope limits and change control preserve focus.

73. A

Milestones mark meaningful progress and decision points.

74. A

Delay on a critical-path activity delays the project unless time is recovered elsewhere.

75. A

Mitigation is one response strategy; avoidance, transfer, and acceptance are others.

76. A

Maps make process flow and hidden complexity visible.

77. A

Value-added work meets customer needs; necessary non-value-added work should be minimized.

78. A

Waiting is delay caused by unavailable people, materials, information, or equipment.

79. A

Pull links production or service activity to actual consumption needs.

80. A

Cycle time measures how long the work takes from start to finish for the defined unit.

81. A

Takt sets the pace required to meet demand.

82. A

In stable systems, $WIP = \text{throughput rate} \times \text{flow time}$.

83. A

When work arrives faster than it can be completed, waiting accumulates.

84. A

Stratification can reveal patterns hidden in aggregate data.

85. A

Box plots compactly compare center, spread, skew, and outliers among groups.

86. A

Well-designed check sheets make collection simple, standardized, and auditable.

87. A

Outliers may be data errors or important special causes; either way they deserve investigation.

88. A

A sound sampling frame represents the population of interest.

89. A

Biased selection can make conclusions unrepresentative.

90. A

Stability concerns predictability; capability compares that predictable variation to customer requirements.

91. A

P_p is a long-term performance index; C_p estimates short-term potential capability.

92. B

With perfect centering, C_{pk} equals C_p .

93. A

Xbar-R charts monitor subgroup averages and ranges, often for subgroup sizes 2 through 10.

94. A

I-MR charts are designed for individual continuous observations.

95. A

Use c charts for counts with a constant inspection unit; use u charts when opportunity varies.

96. A

The u chart standardizes count data by the varying number of units or opportunities.

97. A

Subgroups should be formed so between-subgroup changes can reveal special causes.

98. A

Leading measures help teams act before lagging outcomes are realized.

99. A

Lagging metrics summarize outcomes such as defects, cost, or customer retention.

100. A

Training is stronger when the process, accountability, and feedback loop are embedded.