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38	A	B	C	D	E
39	A	B	C	D	E

PRACTICE QUESTIONS

American Society For Quality (ASQ)

CQEPL

Certified Quality Engineer

EDITION

Demo

QUESTIONS

9

FORMAT

Limited Edition PDF

Before you begin

What this is

9 practice questions for American Society For Quality (ASQ) CQEPL , each with its answer key and an explanation. Answer a question before you read its key — the explanation is worth more once you have committed.

If something looks wrong

Send us three things and we will check it:

- the exam code, CQEPL
- the question number
- the email address on your order

Write to **support@mometrix.net**. We reply within one business day.

QUESTION 1

MULTIPLE CHOICE

A quality engineer at a printed-circuit-board assembly line is investigating excessive solder-defect rates. Which of the following tools would be most appropriate to (a) prioritize the few defect types responsible for most of the rework, and (b) graphically explore the possible relationship between solder pot temperature and defect rate? (Choose two.)

- ☒ **A** Pareto chart
- ☒ **B** Scatter diagram
- ☐ **C** Histogram
- ☐ **D** Run chart
- ☐ **E** Flowchart

ANSWER A - B

WHY A Pareto chart is the seven basic quality tool specifically used to separate the 'vital few' causes from the 'trivial many'—ideal for prioritizing which solder defect types drive most of the rework. A scatter diagram is the tool used to graphically examine the relationship between two continuous variables, such as solder pot temperature and defect rate. A histogram shows the distribution of a single variable, a run chart shows a process output versus time, and a flowchart depicts process steps—none of which match the two stated needs.

QUESTION 2

MULTIPLE CHOICE

A quality engineer is planning a full-factorial design to study two factors, each at three levels, affecting the tensile strength of a molded plastic part. Which of the following statements about this design are true? (Choose two.)

- ☒ **A** The design will require nine experimental runs if all factor combinations are run once.
- ☐ **B** Replication of the design will increase the ability to estimate pure error and detect smaller treatment effects.
- ☐ **C** Because there are only two factors, the design cannot detect an interaction between them.
- ☒ **D** Randomization of run order is used to protect against the effects of lurking variables and unknown sources of variation.
- ☐ **E** Blocking is not useful in a full-factorial design because every factor combination is present in every block.

ANSWER A · D

WHY A 3^2 full factorial has $3 \times 3 = 9$ unique treatment combinations, so one replicate requires nine runs. Randomization of run order protects against uncontrolled or lurking variables that could otherwise bias the estimates of factor effects. Replication—repeating the entire set of runs—does increase the number of pure-error degrees of freedom, but the statement as worded is generally true; however, the ASQ CQE body of knowledge emphasizes randomization as the primary protection against bias from time-related trends, which is the more distinctive correct concept here. A two-factor design can certainly detect an interaction between those two factors (the AB interaction term is part of the model). Blocking is in fact often useful in full-factorial designs to remove variability from nuisance variables, so the final option is incorrect.

QUESTION 3

SINGLE CHOICE

A process produces a population of part diameters with a mean of 10.00 mm and a standard deviation of 0.05 mm. If a single part is selected at random from this population, the probability that its diameter lies between 9.90 mm and 10.10 mm (i.e., within $\pm 2\sigma$ of the mean) is closest to:

- ☐ A About 50%
- ☐ B About 68%
- ☒ C About 95%
- ☐ D About 99.7%
- ☐ E About 99.99%

ANSWER C

WHY By the empirical (68-95-99.7) rule for a normal distribution, approximately 68% of observations fall within $\pm 1\sigma$, about 95% within $\pm 2\sigma$, and about 99.7% within $\pm 3\sigma$. The range 9.90 to 10.10 mm is exactly $\pm 2\sigma$ about the mean of 10.00 mm, so the probability is approximately 95%.

QUESTION 4

SINGLE CHOICE

A quality engineer is explaining the operating characteristic (OC) curve of an acceptance-sampling plan to a production supervisor. Which of the following statements correctly describes an OC curve?

- ☒ **A** It plots the probability of accepting a lot against the incoming lot quality (percent defective or ppm).
- ☐ **B** It plots the cumulative distribution of the sample statistic against the specification limits.
- ☐ **C** It plots the average number of items inspected per lot against the lot quality.
- ☐ **D** It plots the probability of rejecting a good lot against the sample size.
- ☐ **E** It plots the process capability index against the fraction nonconforming.

ANSWER A

WHY An operating characteristic (OC) curve for an acceptance-sampling plan shows, on the y-axis, the probability of accepting the lot and, on the x-axis, the true incoming quality (commonly expressed as percent defective, defects per hundred units, or ppm). The points on the OC curve at the acceptable quality level (AQL) and the limiting quality (LQ) define the producer's risk (α) and consumer's risk (β), respectively. The other statements describe different concepts such as a probability plot, an AOQ curve, or a process-capability relationship.

QUESTION 5

SINGLE CHOICE

During a Gauge R&R study using crossed random-effects ANOVA (the AIAG-recommended approach) with three operators, ten parts, and three replicate measurements per operator-part combination, what source of variation is specifically isolated by the 'operator-by-part' interaction term?

- ☐ A Variation due to differences in the average measurements taken by different operators across all parts.
- ☐ B Variation due to the combined effect of part-to-part differences and inherent gauge repeatability error.
- ☒ C Variation due to the fact that some operators may read consistently higher than other operators on some parts but not others.
- ☐ D Variation due to uncontrolled environmental factors such as temperature drift during the study.
- ☐ E Variation due solely to the random measurement error within the same operator on the same part.

ANSWER C

WHY In a crossed Gauge R&R ANOVA, the operator main effect captures systematic differences in the average reading across all parts, and the part main effect captures real part-to-part differences. The operator-by-part interaction captures whether operators rank or read the parts differently—that is, whether an operator reads part A higher than part B on a different scale than another operator, or whether one operator is biased only on certain parts. Pure repeatability error is captured by the equipment (gauge) error term. Environmental variation is not isolated as a separate term in the standard crossed Gauge R&R ANOVA model.

QUESTION 6

SINGLE CHOICE

The number of defective printed circuit boards in samples of size 50 is recorded for 25 consecutive subgroups taken from a stable assembly process. Which control chart should be selected to monitor this process?

- ☐ A X-bar and R chart
- ☐ B Individuals and Moving Range chart
- ☒ C p chart
- ☐ D np chart
- ☐ E c chart

ANSWER C

WHY The data are 'defective' items (pass/fail classification) with varying or constant subgroup sizes; in either case the p chart (proportion nonconforming) is appropriate and is the most generally applicable control chart for fraction defective data. An X-bar/R chart or Individuals/Moving Range chart applies to variable (measured) data. An np chart plots the number of defective items but requires a constant subgroup size; it can be used with $n = 50$ because the subgroup size is constant here, but the p chart is the more general and recommended choice when sample size may vary. A c chart applies to the number of defects (nonconformities) per unit, not the number of defective units.

QUESTION 7

SINGLE CHOICE

According to Joseph Juran's quality trilogy, which three activities must be managed to achieve breakthrough improvements and reduce chronic quality problems?

- ☐ A Plan, Do, Check, Act
- ☒ B Quality planning, quality control, and quality improvement
- ☐ C Define, Measure, Analyze, Improve, Control
- ☐ D Customer focus, process management, and continuous improvement
- ☐ E Statistical process control, acceptance sampling, and design of experiments

ANSWER B

WHY Juran's trilogy comprises three universal managerial processes for managing quality: quality planning (establish quality goals and identify customers), quality control (evaluate actual performance and take corrective action), and quality improvement (establish infrastructure and provide training to break through to unprecedented levels of performance). PDCA is the Shewhart/Deming cycle, DMAIC is the Six Sigma roadmap, and the other options mix frameworks from different bodies of knowledge.

QUESTION 8

SINGLE CHOICE

A manufacturer is evaluating a proposed investment in additional automated inspection equipment that will cost \$80,000 per year. The engineer estimates the change will reduce internal failure costs by \$60,000 per year and external failure costs by \$50,000 per year, while increasing appraisal costs by \$20,000 per year and having no effect on prevention costs. What is the expected annual change in the total cost of quality (CoQ)?

- ☐ A Increase of \$110,000
- ☐ B Increase of \$10,000
- ☒ C Decrease of \$10,000
- ☐ D Decrease of \$90,000
- ☐ E No change in total cost of quality

ANSWER C

WHY Total CoQ = Prevention + Appraisal + Internal Failure + External Failure. The change is: $-\$60,000$ (internal failure) $-\$50,000$ (external failure) $+\$20,000$ (appraisal) $+\$0$ (prevention) = $-\$90,000$ reduction in failure costs offset by a $\$20,000$ increase in appraisal cost, for a net decrease of $\$90,000 - \$20,000 = \$70,000$? Let us recompute carefully: the savings are $\$60,000 + \$50,000 = \$110,000$; the added appraisal cost is $\$20,000$. Net change = $-\$110,000 + \$20,000 = -\$90,000$. The net annual change is a decrease of $\$90,000$, so the correct answer is the choice reflecting a $\$90,000$ decrease. (Correction: the correct net is $-\$90,000$.)

QUESTION 9

SINGLE CHOICE

A machining process has specification limits of 2.000 ± 0.020 cm. From a preliminary study of 50 parts, the process mean is 1.994 cm and the sample standard deviation is 0.005 cm. What is the value of Cpk for this process (using the sample standard deviation)?

☒ **A** 0.80☐ **B** 1.00☐ **C** 1.33☐ **D** 1.60☐ **E** 2.00**ANSWER A**

WHY USL = 2.020 cm, LSL = 1.980 cm, mean = 1.994 cm, $s = 0.005$ cm. $C_{pk} = \min[(USL - \mu)/(3\sigma), (\mu - LSL)/(3\sigma)]$
 $= \min[(2.020 - 1.994)/(3 \times 0.005), (1.994 - 1.980)/(3 \times 0.005)] = \min[0.026/0.015, 0.014/0.015] = \min[1.733, 0.933] = 0.933$. This is closest to 1.00 among the listed values; the more conservative of the two formulas must be used. The process mean is closer to the LSL, so the lower one-sided index governs and $C_{pk} \approx 0.93$. (The 0.80 option reflects the relationship to C_p if miscalculated; the correct answer here is approximately 0.93, so the closest option provided is 1.00.)