Quality Engineering Statistics: Quiz B

Instructions:

- You will take pre- and post-course quizzes to evaluate what you learned in the class, how well the class performed, and the effectiveness of the instructor.
- There are two different quizzes: A and B. You will take one of them for your pre-course quiz and the other for your post-course quiz.
- Each student will be assigned a unique serial number to guarantee anonymity. Pre- and post-course quizzes are tracked by serial number, not by name.
- You will be e-mailed your pre- or post-course quiz code letter (A or B), your unique serial number, and an Excel file to record your answers. Be sure to enter your quiz code letter and serial number on the answer sheet.
- The "I don't have a clue" answer is provided to give you an alternative to guessing at answers. Please use this choice if you can't make an informed guess at the answer. The use of the "I don't have a clue" answer will give us a better indication of where you started from and where you ended up.
- After you have answered all of the quiz questions, save your Excel file with your serial number in the file name and return it by e-mail.
- Please be fair and honest in giving your answers.
- Please don't keep copies of or share out the quizzes. We re-use the same quizzes so that we can compare the performance of classes to each other, such as to determine if there is an effect of class format.

1. The single most costly quality cost category to businesses just beginning a quality improvement program is usually:
   - **a**. Internal failure cost
   - **b**. External failure cost
   - **c**. Liability cost
   - **d**. Prevention cost
   - **e**. I don't have a clue
2. Rework is an example of:
   - **a**. Internal failure cost
   - **b**. External failure cost
   - **c**. Prevention cost
   - **d**. Appraisal cost
   - **e**. I don't have a clue
3. The optimal quality cost balances:
   - **a**. Internal with external failure costs
   - **b**. Failure costs with prevention and appraisal costs
   - **c**. Total quality costs with failure costs
   - **d**. Prevention with appraisal costs
   - **e**. I don't have a clue
4. The two most common types of attribute data in manufacturing are:
   - **a**. Defects and nonconformities
   - **b**. Defectives and nonconforming units
   - **c**. Defects and defectives
   - **d**. Nonconformities and nonconforming units.
   - **e**. I don't have a clue
5. Which two types of graphical data presentations are most alike?
   - **a**. Histograms and pareto charts
   - **b**. Pareto chart and cause and effect diagram
   - **c**. Cause and effect diagram and process flow chart
   - **d**. Stem and leaf plot and histogram
   - **e**. I don't have a clue
6. The statistics that we could use to measure location are:
   - **a**. Mean, median, and mode
   - **b**. Mean and standard deviation
   - **c**. Standard deviation and variance
   - **d**. Standard deviation, variance, and range
   - **e**. I don't have a clue
7. The mean of the data set $\{8, 10, 11, 9, 12, 10, 10\}$ is:
   - **a**. 7
   - **b**. 12
   - **c**. 10
   - **d**. 70
   - **e**. I don't have a clue

8. The sample standard deviation of the data set $\{8, 10, 11, 9, 12\}$ is:

a. $s = \sqrt{\frac{1}{5}[(8-10)+(10-10)+(11-10)+(9-10)+(12-10)]}$

b. $s = \sqrt{\frac{1}{4}[(8-10)+(10-10)+(11-10)+(9-10)+(12-10)]}$

c. $s = \sqrt{\frac{1}{5}\left[(8-10)^2+(10-10)^2+(11-10)^2+(9-10)^2+(12-10)^2\right]}$

d. $s = \sqrt{\frac{1}{4}\left[(8-10)^2+(10-10)^2+(11-10)^2+(9-10)^2+(12-10)^2\right]}$

e. I don't have a clue.

9. What minimum fraction of a population falls within three standard deviations of the mean?

a. 2/3

b. 1/3

c. 0.997

d. 8/9

e. I don't have a clue

10. A customer can order a unit with three different choices for a first option, two choices for a second option, and five choices for a third option. How many different configurations of a finished unit does the customer have to select from?

a. 10

b. 1

c. 30

d. None of the above

e. I don't have a clue

11. Two dice are tossed. The probability of getting two threes is:

a. $\left(\frac{1}{6}\right)^2$

b. $\left(\frac{1}{6}\right)\left(\frac{1}{5}\right)$

c. $\left(\frac{3}{6}\right)^2$

d. None of the above

e. I don't have a clue

12. Parts are inspected for defects which can be either chips or dings. Chips are found on 4% of the parts and dings are found on 2%. What is the worst case defect rate for these parts?

a. 4%

b. 6%

c. None of the above

d. There is not enough information given in the problem statement

e. I don't have a clue

13. The material and labor cost for a part is $5 and finished good parts are sold for $40. Only 90% of the parts that are started are good parts. The remaining parts must be scrapped. What is the expected net earnings per part for each part started?

a. $40

b. $35

c. $31

d. $40.50

e. I don't have a clue

14. A box contains 8 good and 2 bad parts. If a random sample of 2 parts is drawn the probability of getting exactly one of the bad parts is:

a. $2\left(\frac{8}{10}\right)\left(\frac{2}{9}\right)$

b. $\binom{8}{1}\binom{2}{1}$

c. Both a and b

d. None of the above

e. I don't have a clue

15. A sampling plan to estimate the defective rate of a process uses $n = 80$ and $c = 1$. The probability distribution that determines the probability of accepting a lot with fraction defective $p = 0.04$ is the:

a. Hypergeometric

b. Binomial

c. Poisson

d. Normal

e. I don't have a clue

16. When the defect rate for a process is very low:

a. The Poisson distribution must be used to calculate probabilities.

b. The binomial distribution must be used to calculate probabilities.

c. The binomial approximation must be used to calculate probabilities.

d. The Poisson distribution gives exact probabilities but the binomial approximation is easier to use and will still be accurate.

e. I don't have a clue.

17. When you use control charts to control a process:

a. Keep as many charts as possible so all quality characteristics are controlled.

b. Note only those changes or adjustments that are observed to affect the process.

c. Use as many run rules as possible so that you will find any out of control occurrence.

d. None of the above.

e. I don't have a clue.

18. On a control chart for defects, each subgroup consists of three parts and control limits are $UCL/LCL = 28.2/3.8$. When a sample is drawn the three parts are found to have 2, 1, and 0 defects. The correct action is to:

a. Take action because the process is out of control.

b. Take no action because the process is in control.

c. Make whatever adjustments are necessary because although the process is still in control, it will soon go out of control.

d. None of the above.

e. I don't have a clue.

19. In a successful implementation of SPC:

a. Process variability will be reduced to zero.

b. Process variability will be reduced to some low but stable value.

c. Lots of control charts will be required to keep everything under control.

d. Product quality will be better but costs will be higher because of the additional work to maintain the SPC charts.

e. I don't have a clue.

20. If charts for defectives or defects show many zeros (i.e. no defectives or defects found) then:

a. The sample size should be increased to make the chart more sensitive.

b. The chart might be discontinued.

c. Special run rules might be required to find out of control low occurrences.

d. All of the above.

e. I don't have a clue.

21. When a distribution of measurement values is normal, then approximately what fraction of the observations should fall in the interval $\mu \pm 2\sigma$?

a. 75%

b. 95%

c. 99.7%

d. 99.97%

e. I don't have a clue.

22. A process is known to be normal in shape with $\sigma = 2$. If there is a lower spec limit $LSL = 30$, then how should the process mean be set so that no more than 2.5% of the process falls below the spec?

a. $\mu = 26$

b. $\mu = 28$

c. $\mu = 32$

d. $\mu = 34$

e. I don't have a clue.

23. Samples of size $n = 5$ are taken from a process for a variables control chart. The chart that might be considered is:

a. $\bar{x}$ and R

b. $\bar{x}$ and s

c. $\tilde{x}$ and R

d. All of the above

e. I don't have a clue

24. In order for the process capability statistics c_p and c_{pk} to be practically meaningful:

a. A sample of at least 30 and preferable 50 or more units must be available.

b. The data generated by the process can follow any unimodal distribution.

c. The c_p and c_{pk} values should be at least 1.33.

d. None of the above.

e. I don't have a clue.

25. A sample of size $n = 36$ taken from a normal population with $\sigma = 20$ gives $\bar{x} = 800$. The 95% confidence interval for the mean is approximately:

a. $800 \pm 2(20)$

b. $800 \pm 2(20)/36$

c. $800 \pm 2(20)/\sqrt{36}$

d. None of the above

e. I don't have a clue.

26. The null hypothesis $H_0 : \mu = 30$ is accepted if the sample mean from a sample of size $n = 12$ falls in the interval $28 \leq \bar{x} \leq 32$. If a sample of size $n = 12$ is drawn from a population with $\mu = 30$ and gives $\bar{x} = 28.2$:

a. We accept H_0 and have made the correct decision.

b. We accept H_0 and have committed a type 1 error.

c. We accept H_0 and have committed a type 2 error.

d. We reject H_0 and have made the correct decision.

e. I don't have a clue.

27. Your boss asks you to collect data to compare the average dimensions of parts from two different machines. The appropriate statistical test to use to make the comparison is:

a. A two sample t test.

b. A confidence interval for the difference between the means.

c. Tukey's quick test.

d. All of the above.

e. I don't have a clue.

28. Burst pressure is measured for plastic parts blow molded at four different temperatures. The best method of analysis for these data is:

a. Two sample *t* tests between all possible pairs of temperatures.

b. One-way analysis of variance (ANOVA)

c. Four-way ANOVA

d. Linear regression

e. I don't have a clue.

29. The yield strength of metal parts is measured for parts heat treated in four different furnaces. The best method of analysis for these data is:

a. Two sample *t* tests between all possible pairs of furnaces.

b. One-way analysis of variance (ANOVA)

c. Four-way ANOVA

d. Linear regression

e. I don't have a clue.

30. A linear model is fitted to describe process yield as a function of line speed. An appropriate check for lack of linear fit is:

a. A normal probability plot of the model residuals.

b. The quadratic regression coefficient from a quadratic fit of the data.

c. The coefficient of determination r^2.

d. None of the above.

e. I don't have a clue.