

# Quality Engineering Statistics: Quiz A

## 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 three general types of quality cost are:
  - a.** Overhead, Operating, Profit
  - b.** Failure, Appraisal, Prevention
  - c.** Costs of doing business, good quality costs, bad quality costs
  - d.** Internal Failure, External Failure, Appraisal
  - e.** I don't have a clue
- 2.** Warantee return cost 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.** When a successful quality improvement program is first implemented:
  - a.** Internal failure costs go down
  - b.** External failure costs go down
  - c.** Prevention costs go down
  - d.** Appriasal costs go down
  - e.** I don't have a clue
- 4.** Examples of variable and attribute data are:
  - a.** Temperature and paint chips, respectively.
  - b.** Paint chips and temperature, respectively.
  - c.** Temperature and true position, respectively.
  - d.** Unusable parts and paint chips, respectively.
  - e.** I don't have a clue.
- 5.** The three characteristics that we look for with a histogram are:
  - a.** Location, variation, and shape
  - b.** Central tendency, dispersion, and skewness
  - c.** Mean, standard deviation, and variance
  - d.** Bimodal, mean, and skewness
  - e.** I don't have a clue
- 6.** The statistics that we could use to measure variation are:
  - a.** Mean, median, mode
  - b.** Standard deviation, variance, skew
  - c.** Standard deviation, variance, range, and IQR
  - d.** Standard deviation, range, and midrange
  - e.** I don't have a clue
- 7.** The median 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 range of the data set  $\{8, 10, 11, 9, 12, 10, 10\}$  is:
- a.** 8
  - b.** 4
  - c.** 10
  - d.** 7
  - e.** I don't have a clue
- 9.** What minimum fraction of a population falls within two standard deviations of the mean?
- a.**  $1/2$
  - b.**  $3/4$
  - c.**  $1/4$
  - d.** 0.954
  - e.** I don't have a clue
- 10.** A customer can order a unit with three different options: A, B, and C. There are two possible choices for option A, three choices for option B, and two choices for option C. How many different configurations of a finished unit does the customer have to select from?
- a.** 3
  - b.** 12
  - c.** 7
  - d.** None of the above
  - e.** I don't have a clue
- 11.** Two cards are drawn randomly from a deck. The probability of getting a pair of kings is:
- a.**  $(\frac{1}{52})^2$
  - b.**  $(\frac{4}{52})^2$
  - c.**  $(\frac{4}{52})(\frac{3}{52})$
  - d.**  $(\frac{4}{52})(\frac{3}{51})$
  - 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% of the parts. 1% of the parts have both types of defect. What is the overall defect rate for this type of part?
- a.** 7%
  - b.** 6%
  - c.** 5%
  - d.** 4%
  - e.** I don't have a clue
- 13.** The material and labor cost for a part is \$10 and finished good parts are sold for \$80. Only 90% of the parts that are started are good parts. The remaining parts must be sold as scrap for \$5 each. What is the expected net earnings per part for each part started?
- a.** \$62.50
  - b.** \$82.50
  - c.** \$80
  - d.** None of the above
  - 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 none of the bad parts is:
- $\left(\frac{2}{10}\right)\left(\frac{1}{9}\right) = \frac{2}{90}$
  - $\left(\frac{8}{10}\right)\left(\frac{7}{10}\right) = \frac{56}{100}$
  - $\left(\frac{8}{10}\right)\left(\frac{7}{9}\right) = \frac{56}{90}$
  - $2\left(\frac{2}{10}\right)\left(\frac{1}{9}\right) = \frac{4}{90}$
  - I don't have a clue
- 15.** A sampling plan to estimate the defect rate of a process uses  $n = 4$  parts and the total number of defects found on those parts in inspection is  $c$ . The probability distribution that determines the probability of accepting a lot with defect rate  $\lambda = 1.2$  is:
- Hypergeometric
  - Binomial
  - Poisson
  - Normal
  - I don't have a clue
- 16.** Approximations between probability distribution like the hypergeometric, binomial, Poisson, and normal distributions are used:
- Only when certain conditions are met.
  - Only when the true and approximating distribution have about the same shape.
  - To simplify probability calculations.
  - All of the above.
  - I don't have a clue.
- 17.** When an  $np$  or  $c$  chart goes out of control on the low side of the chart:
- Shut the process down until you've identified the problem.
  - Find out what caused the change and eliminate it forever from the process.
  - Recalculate the control limits.
  - Find out what caused the change and make it a permanent part of the process.
  - I don't have a clue.
- 18.** A control chart for defectives is kept with  $n = 50$  and  $UCL/LCL = 6/0$ . A sample is drawn and found to contain  $D = 6$  defective parts. The correct action is to:
- Take action because the process is out of control.
  - Take no action because the process is in control.
  - Make whatever adjustments are necessary because although the process is still in control, it will soon go out of control.
  - None of the above.
  - I don't have a clue.
- 19.** When an operator makes changes to an important process variable that are not called for by the control chart:
- The process may run tighter because of the operator's increased attention.
  - The process may not show any change if the operator's actions are appropriate.
  - The process may show increased variability because of the operator's unnecessary actions.
  - All of the above.
  - I don't have a clue.

- 20.** When calculating new control limits for defectives or defects charts:
- All available observations must be included in the calculations.
  - Observations corresponding to known special causes can be omitted from the calculations.
  - Observations that fall outside of the original control limits can be omitted from the calculations.
  - It's not important to worry about special causes because the control chart limits will be recalculated regularly.
  - 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  $\mu \pm 3\sigma$ ?
- 75%
  - 95%
  - 99.7%
  - 99.97%
  - I don't have a clue.
- 22.** A process is known to be normal in shape with  $\mu = 30$  and  $\sigma = 2$ . What specification limits should be set if about 97.5% of the finished product must fall within the limits even when the mean of the process shifts by  $1\sigma$ ?
- $30 \pm 2$
  - $30 \pm 3$
  - $30 \pm 4$
  - $30 \pm 6$
  - I don't have a clue.
- 23.** Control limits for an IMR chart (individual and moving range) are to be calculated from a preliminary sample of 30 subgroups. How many observations are available to determine the individual and moving range control limits?
- 30 and 30
  - 29 and 29
  - 30 and 29
  - 29 and 30
  - I don't have a clue.
- 24.** A process with six sigma capability has:
- About 3.4 defects per million opportunities.
  - $c_{pk} \geq 2.0$
  - $USL/LSL = \mu \pm 6\sigma$
  - All of the above
  - I don't have a clue
- 25.** The 95% confidence interval for the mean of a process is  $P(47 < \mu < 53) = 0.95$  as determined from a sample of size  $n = 40$ . This means that:
- There is a 95% chance that the true unknown population mean is in the interval.
  - 95% of the observations taken from this population will fall in the interval.
  - 95% of the samples of size  $n = 40$  should fall in this interval.
  - There is a 95% chance that the sample mean falls inside this interval.
  - 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  $\mu = 29$  and gives  $\bar{x} = 28.2$ :
- We accept  $H_0$  and have made the correct decision.
  - We accept  $H_0$  and have committed a type 1 error.
  - We accept  $H_0$  and have committed a type 2 error.
  - We reject  $H_0$  and have made the correct decision.
  - I don't have a clue.
- 27.** Your boss asks you to collect data to compare the variation of parts from two different machines. The appropriate statistical test to use to make the comparison is:
- A two sample t test.
  - An F test.
  - A confidence interval for the difference between the two standard deviations.
  - None of the above.
  - I don't have a clue.
- 28.** Burst pressure is measured for plastic parts blow molded by four different operators. The best method of analysis for these data is:
- Two sample t tests between all possible pairs of operators.
  - One-way analysis of variance (ANOVA)
  - Four-way ANOVA
  - Linear regression
  - I don't have a clue.
- 29.** The yield strength of metal parts is measured at four different heat treat temperatures. The best method of analysis for these data is:
- Two sample t tests between all possible pairs of temperatures.
  - One-way analysis of variance (ANOVA)
  - Four-way ANOVA
  - Linear regression
  - I don't have a clue.
- 30.** Appropriate diagnostics for an ANOVA are:
- A normal plot of the residuals.
  - A plot of the residuals vs. the independent variable.
  - A plot of the residuals vs. the order of the observations.
  - All of the above.
  - I don't have a clue.