Continuing Education Course #297
What Every Engineer Should Know about
Statistical Process/Quality Control I

1. The cost of writing instructions and operation procedures for inspection and testing should be charged to
- a. prevention costs.
- b. appraisal costs.
- c. internal failure costs.
- d. external failure costs.

2. If prevention costs are increased to pay for engineering design work in quality/process control, and this results in a **reduction in the number of nonconforming products**, this yields a reduction in
- a. appraisal costs.
- b. operating costs.
- c. quality costs.
- d. failure costs
- e. manufacturing costs

3. The "quality function" of a company is best described as
- a. the degree to which the company product conforms to a design or specification.
- b. that collection of activities through which "fitness for use" is achieved.
- c. the degree to which a class or category of product possesses satisfaction for people generally.
- d. all of the above.

4. Which of the following **is true** of the Supplier Quality Audit function and Quality improvement plans
- a. The supplier should have an internal process for the routine audit of product and process quality.
- b. The supplier should perform internal quality audits scheduled on a regular basis to set a benchmark for continuous improvement of the quality system.
- c. The Supplier Quality Improvement Plan should represent the Supplier's planned quality initiatives for improving overall service level to customers.
- d. The results of the internal audits should be distributed to the appropriate personnel and action plan developed, tracked and documented for all areas that are in deficit.
- e. All of the above

5. Which of the following does not generate product-quality characteristics?
- a. Designer
- b. Inspector
- c. Machinist
- d. The Equipment Engineer

6. A company's Process/Quality Control Program is considered to be
- a. A collection of quality control procedures and guidelines
- b. A step by step list of all quality control check points.

○ c. A summary of a company’s process/quality control policies.
○ d. A system of activities to provide quality of products and service.

7. When planning a total quality system, one key objective is to provide a means of guaranteeing "the maintenance of product integrity. "Which of the following quality system provisions is designed to **MOST** directly provide such a guarantee?
○ a. Drawing and print control
○ b. Calibration and maintenance of test equipment
○ c. Identification and segregation of nonconforming material
○ d. Specification change control.

8. The primary reason for evaluating and maintaining surveillance over a supplier's quality program is to
○ a. Perform product inspection at source.
○ b. Eliminate incoming inspection cost.
○ c. Motivate suppliers to improve quality.
○ d. Make sure the supplier's quality program is functioning effectively.

9. Products should be subjected to test which are designed to
○ a. Demonstrate extra performance.
○ b. Demonstrate basic function at minimum testing cost.
○ c. Approximate the conditions to be experienced in customer's application.
○ d. Assure performance under severe environmental conditions.

10. Failure costs include costs due to
○ a. quality control engineering
○ b. inspection set-up for tests
○ c. certification of special-process suppliers.
○ d. supplier analysis of non-conforming hardware

11. The basic objective of a quality cost program is to
○ a. Identify the source of quality failures.
○ b. Interface with the accounting department.
○ c. Improve the profit of your company
○ d. Identify quality control department costs.

12. To be effective, the Quality Audit function should ideally be
○ a. an independent organizational segment in the Quality /Process Control function.
○ b. an independent organizational segment in the production control function.
○ c. an independent organizational segment in manufacturing operations function.
○ d. all of the above.

13. The true cost of quality
○ a. The quality cost system, once established, should be less dynamic to have any impact on the achievement of the organization’ goals
○ b. Should be as high as high as 90 percent of the sales revenue
○ c. Should be no more than 10 to 15 percent of operations cost.
○ d. None of the above

14. What of the following Gurus propose a 14-Step or 14-Point system that focus on management commitment and/or management obligations

- a. Juran and Deming
- b. Crosby and Deming
- c. Crosby and Juran
- d. Deming and Okogbaa

15. A careful analysis of the approaches by the three Guru's shows six specific areas of agreement on their views about Quality. These are:
- a. Management Commitment, Strategic Planning, Training, Measurement
- b. Leadership, Vendor Compliance, Rainbow charts
- c. Identification & Elimination of Error, Culture of Continuous Improvement
- d. a and c
- e. None of the above

16. Which of the Gurus emphasizes the "trilogy"
- a. Deming
- b. Juran
- c. Cosby
- d. All of the above

17. The "Four absolutes of Quality." Which Guru specifically discusses this notion as part of their TQM philosophy.
- a. Deming
- b. Juran
- c. Cosby
- d. All of the above

18. The Plan-Do-Check-Act (PDCA) cycle is very popular not just in Quality work but in Engineering design as well. Which of the Gurus is credited with this idea as part of their TQM philosophy?
- a. Deming
- b. Juran
- c. Crosby
- d. All of the above

19. A process is checked by inspection of random sample of four shafts after a polishing operation, and X chart and R charts are maintained. A person making a spot check picks out two shafts, measures them accurately, and plots the value of each on the X chart. Both points fall just outside the control limits. He advises the department foreman to stop the process. This decision indicates that:
- a. the process average level is out of control.
- b. both the average level and dispersion are out of control.
- c. the average level is out of control but not the dispersion.
- d. the person is not using the chart correctly.

20. The primary use of a control chart is to
- a. Detect assignable causes of variation in the process.
- b. Detect nonconforming product.
- c. Measure the performance of all quality characteristics of a process.
- d. Detect the presence of random variation in the process.

21. A null hypothesis assumes that a process is producing no more than the maximum allowable rate of nonconforming items. The Type II error is to conclude that the process
- a. is producing too many nonconforming when actually it is not.
- b. is not producing too many nonconforming when it actually is.

○ c. is not producing too many nonconforming when it is not.
○ d. is producing too many nonconforming when it is.

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23. The spread of individual observations from a normal process capability distribution may be expressed numerically as:
○ a. $6R/d_2$
○ b. $2A_2R$
○ c. R/d_2
○ d. D_4R

24. When used together for variables data, which of the following pair of quantities is the most useful in comparing control charts?
○ a. AQL, p'
○ b. p, n
○ c. X, R
○ d. R, σ

Questions 25-30
The Specification Limits are 85±5 units for a process. In an analysis for control chart, data was taken over 20 days. Sampling was done once a day and the sample size taken each day was 5, i.e., n=5. The mean for each day was computed and after 20 days, the following data was obtained: $\sum \overline{X} = 1680, \sum R = 35$

25. Compute the Central line (CL_x), the Upper Control Limit (UCL_x) and Lower Control Limit (LCL_x) of the X-bar ($\overline{X}$ chart)
○ a. CL_x = 84.00, UCL_x = 86.349, LCL_x = 81.657
○ b. CL_x = 336.00, UCL_x = 338.330, LCL_x = 336.670
○ c. CL_x = 84.00, UCL_x = 85.010, LCL_x = 82.990
○ d. None of the above

26. Compute the Central line (CL_R) and the Upper Control Limit (UCL_R) and Lower Control Limit (LCL_R) of the R chart.
○ a. CL_R = 1.75, UCL_R =8.607, LCL_R = 0.00
○ b. CL_R = 1.75, UCL_R =3.700, LCL_R = 0.00
○ c. CL_R = 1.45, UCL_R =4.071, LCL_R = 0.00
○ d. CL_R = 7.00, UCL_R =14.798, LCL_R = 0.00

27. For the next lot taken on day 21 with n=5, with the following results: $\overline{X} = 86.5, R = 3.65$. Is the process in control?
○ a. The process is not in control.
○ b. The process is in control.
○ c. The points are not within limits, but the process is in control.
○ d. The points are within limits, but the process is in control

28. On day 22, another lot was taken with n=5 and with the following results: $\overline{X} = 83.0, R = 3.60$. Is the process in control?

- a. The process is not in control.
- b. The process is in control.
- c. The points are not within limits, but the process is in control.
- d. The points are within limits, but the process is in control

29. If on day 23 the process is under control and n=5, Use $\frac{\overline{R}}{d_2^*}$ to estimate σ, the process standard deviation

- a. σ = 1.752
- b. σ = 2.025
- c. σ = 0.752
- d. None of the above.

30. Using the estimate of σ, compute the capability indices, namely: $C_{pl}, C_{pu},$ and C_{pk}

- a. $C_{pl} = 1.773, C_{pu} = 2.660,$ and $C_{pk} = 1.773$
- b. $C_{pl} = 1.773, C_{pu} = 1.773,$ and $C_{pk} = 1.773$
- c. $C_{pl} = 2.660, C_{pu} = 2.660,$ and $C_{pk} = 2.660$
- d. None of the above