# AQS 110 - Module 3 Exam – Fall 2015 (50 pts)

1. Upper (UCL) and lower control (LCL) limits on X-bar and R chars are set where?

    a. *Plus and minus three standard deviations from the mean (x-bar)*

    b. Wherever the customer calls for them to be set

    c. Anywhere, as long as there are 3S between the two limits

    d. UCLs and LCL s are not used on x-bar/R charts.

2. Which of the following statements describes attribute data

    a. Number of gallons of chemical used in a process.

    b. Diameter of a hole.

    c. Miles per gallon fuel economy.

    d. *Number of employees wearing green shirts.*

3. Random selection of a sample:

    a. Assures that the sample average will equal the population average.

    b. *Theoretically means that each item in the lot has an equal chance to be selected.*

    c. Means that a table of random numbers was used to dictate the selection.

    d. Is a meaningless theoretical requirement.

4. Define

    a. process performance (2 pts)

       *how well is the process running, is it stable*

    b. process capability   (2 pts)

       *does the process manufacture product within specification consistently*

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5. Describe how each of the following quality tools are used for analysis (8 pts)

   a. Flow chart

   *Demonstrates the steps and provides location for where data was taken*

   b. Check Sheet

   *Original data, can be used to verify transcription errors*

   c. Control Charts

   *Used to monitor a process, demonstrate stability/capability*
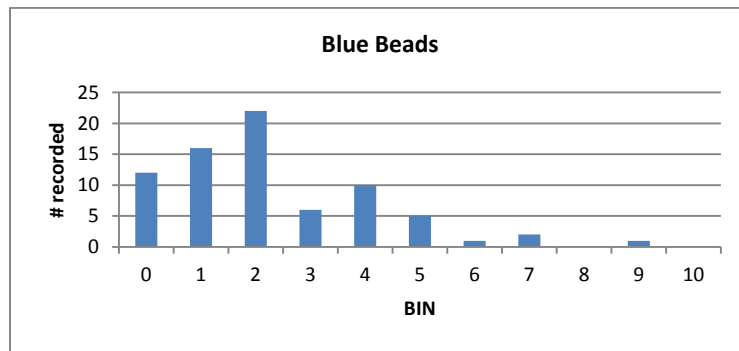
   d. Histogram

   *Picture of data that can show dispersion, shape, central tendency*

6. The graph below is an example of

   a. Normal distribution

   b. Tailing

   c. Bimodal

**Blue Beads**

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BIN

7. Which of the following statements is true regarding the data below? (4 pts)

   3, 4, 7, 7, 7, 8, 8, 11, 12, 13, 13     *mode = 7,  median = 8,  mean = 8.5*

   a. The mean is greater than the mode  (mean > mode)

   b. The median is less than the mode  (median < mode)

   c. The mean is less than the median  (mean < mode)

   d. The median and mode are the same  (median = mode)

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8. Reference standards are used when calibrating equipment both internally and externally.    T    F

9. Weight of a paint can is an example of data that is quantitative and continuous.    T    F

10. The mean, median and mode are all equal when the distribution is normal    T    F

11. Descriptive statistics are used to draw conclusions about a population.    T    F    *inferential statistics*

12. Using statistical process control (SPC) reduces prevention costs.    T    F    *cost of software increases prevention*

13. A Certificate of Conformance contains actual results.    T    F    *Certificate of Analysis*

14. Match the following (4 pts)

   a.   Accuracy, Precision          _ C _   descriptive *(qualitative data)*, numerical *(quantitative data)*

   b.   Attribute, Variable           _ D _   in control *(process stability)*, meets specification *(process capability)*

   c.   Qualitative, Quantitative   _ A _   on target *(accurate)*, repeatable *(precise)*

   d.   Stability, Capability         _ B _   p-chart *(attribute data)*,  x-bar/R chart *(variable data)*

15. Why is a scatter diagram useful when looking at test results?  Provide an example.  (2 pts)

   *Can demonstrate relationships between variables (i.e. cyclic results)*

16. Describe the difference between specification limits and control limits.  (2 pts)

   *Specification limits determined by customer*

   *Control limits established by manufacturer based on process data*

17. List two of the five options for dispositioning non-conforming product.  Who decides?  (4 pts)

   *Scrap, Rework, Reprocess, Downgrade, Release per Customer Agreement*

   *Material Review Board (Quality / Manufacturing;  Purchasing, Customer, Marketing)*

18. A product has a specification range of 35 – 65 lbs, the mean of the process is 54 lbs and the standard deviation is 4 lbs.  Calculate the $C_{pk}$.    (8 pts)
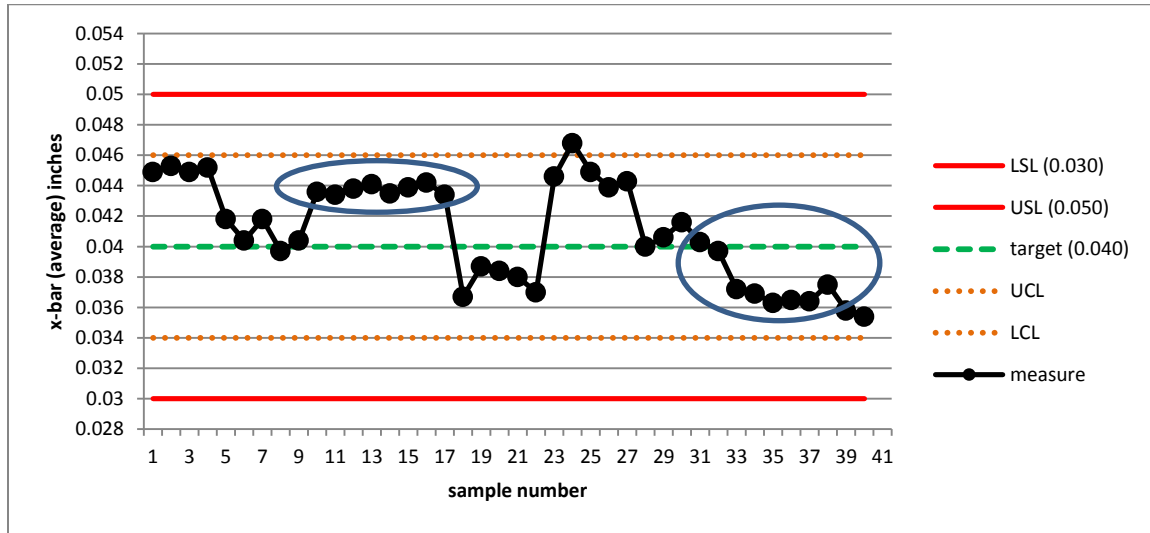
   Would this process meet Customer expectations?  No   Why or why not?  Process not capable at USL $C_{pk}$ < 1.00

$$C_p = \frac{USL - \text{xbar}}{3\sigma} \quad \frac{65 - 54}{3\ (4)} = 0.92 \quad or \quad C_p = \frac{\text{xbar} - LSL}{3\sigma} \quad \frac{54 - 35}{3\ (4)} = 1.58$$

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19. For each of the SPC charts below does the process remain in control? (4 pts)

a. in control (why)    out of control (why)    *7 points above target,   7 points downward trend*



b. in control (why)    out of control (why)

*In control because all values below UCL/above LCL*
*BUT, very little variation*