



IE 331 Statistical Quality Control

Final Exam

Time Allowed: 1 pm to 4 pm (Three hours)

Date: 7/7/1431 (19/6/2010) (Saturday)

Max Marks 40



Name:

Student Id:

Note: Solve all questions

Question1: Write down the right choice (Marks 1 x 10)

1. A quality-control manager randomly selects 90 bottles of vinegar that were filled on June 19 to assess the calibration of the filling machine. What is the sample in the study?
 - a) The 90 bottles of vinegar in the plant on June 19.
 - b) Bottles of vinegar produced in the plant on June 19.
 - c) The 90 bottles of vinegar produced in the plant in September.
 - d) Bottles of vinegar produced in the plant.

2. Which type of variation occurs when a process is in control?
 - a) assignable
 - b) attribute
 - c) random
 - d) normal

3. What type of control chart would be used to monitor the number of defects in the output of a process for making rope?
 - a) x-bar chart
 - b) c chart
 - c) Pie chart
 - d) R chart

4. Variance is
 - a) Square root of standard deviation
 - b) Reciprocal of standard deviation
 - c) Two times standard deviation
 - d) Square of standard deviation

Question1: Continue....

5. Poisson distribution is associated with
 - a) Discrete probability
 - b) Continuous probability
 - c) Normal probability
 - d) Above all

6. A capable process should have C_p
 - a) Minimum 0.5
 - b) Minimum 1
 - c) Maximum 0.5
 - d) Maximum 1

7. If bad lot is accepted, there will be risk to
 - a) Producer
 - b) Technical
 - c) Consumer
 - d) Above all

8. What does the word KAIZAN means
 - a) Continuous Sampling
 - b) Continuous Improvement
 - c) Continuous Inspection
 - d) Continuous Rejection

9. In six sigma DMAIC is the short form for
 - a) Define Measure Avoid Inspect and Check
 - b) Define Measure Act Inspect and Control
 - c) Define Measure Analyze Inspect and Control
 - d) Design Measure Analyze Inspect and Check

10. In R and R studies, the objective is to test gauge
 - a) Responsiveness and Rejection rate
 - b) Resistance and Reaction
 - c) Response and Reply
 - d) Repeatability and Reproducibility

Question 2: (7 Points)

A production manager at a tire manufacturing plant has inspected the number of defective tires in twenty random samples with twenty observations each. Following are the number of defective tires found in each sample:

Sample Number	Number of Defective Tires	Number of Observations Sampled	Sample Number	Number of Defective Tires	Number of Observations Sampled
1	3	20	11	3	20
2	2	20	12	2	20
3	1	20	13	2	20
4	2	20	14	1	20
5	1	20	15	1	20
6	3	20	16	2	20
7	3	20	17	4	20
8	2	20	18	3	20
9	1	20	19	1	20
10	2	20	20	1	20

- Construct the P- chart with the above information and write comment on the constructed Chart? (5 Points)
- What do you say about the control chart pattern? (2 Points)

Question 3: (8 Points)

Three bottling machines at Al-Maria Juice Production Line are being evaluated for their capability. To do this quality manager runs the control chart for three bottling machines (A, B and C) for a period of one month.

From control chart data the standard deviation for machine 'A' is observed to be 0.05, for machine 'B' as 0.10 and for 'C' as 0.20. The average content of each juice bottle is found to be 15.9, while the specifications limits are set between 15.8 and 16.2 ounces. Help the manager to identify which of the machines are capable of producing within specifications.

Question 4 (Marks 8)

A camshaft manufacturer has an acceptance sampling plan that consists of inspecting 30 parts in 1000 batch and rejecting the batch if three or more nonconforming items are found.

- Construct the operating characteristic curve and find the probability of accepting a batch containing 6% nonconforming. (use Poisson distribution) (4 Points)
- The manufacturer requires a plan with a probability of not more than 0.04 of rejecting a batch containing 6% nonconforming. If the sample size remains 30, what should the maximum number of nonconforming camshafts for rejecting the batch if the manufacturer's risk is to be met? (2 Points)
- How much is the difference in average outgoing quality between the acceptance sampling plan in part (a) and part (b) at 6% nonconforming? (2 Points)

Question 5 (Marks 7)

A sample of ball bearings have observed measurements of the outer diameter that show a mean of 2.500 inch and standard deviation of 0.0135 inch. These results are for the observed values. A separate error-of-measurement study indicates a precision of 0.002 in (1σ) and bias error +0.008 in. The outer diameter of the bearing has specification of 2.500 ± 0.01 in.

Use $\sigma^2_{\text{total}} = \sigma^2_{\text{product}} + (\sigma^2_{\text{bias}} + \sigma^2_{\text{precision}})$

- What percentage of population has true dimension outside the specification? (4 points)
- What is the difference between precision and accuracy ; explain by an example (3 points)