

**King Saud University**  
**Department of Industrial Engineering**  
**IE-331 Statistical Quality Control**  
**Midterm Exam - Duration 75 min**

Monday 10<sup>th</sup> of May, 2010; 25<sup>th</sup> of Jumada Alawwal, 1431



Student Name :.....  
Student Number :.....  
Section :Dr.....

Question 1 ...../5  
Question 2 ...../8  
Question 3 ...../7  
Total ...../20

**Question 1 (5 points)**

Select the correct answer

- 1) The Dimming Cycle for quality improvement consists of four steps; Plan, Do, Check and..
  - a. Sort
  - b. Act
  - c. Remove
  - d. Reverse
- 2) The probability of the product or service failing within a specified period of time is called
  - a. Repeatability
  - b. Reliability
  - c. Productivity
  - d. Durability
- 3) The difference between the control limits and the specification limits is:
  - a. Control limits represents the spread in the data while the specification limits defined by the engineer, designer or the customer
  - b. Specification limits represents the spread in the data while the Control limits defined by the engineer, designer or the customer
  - c. Control limits always larger than the specification limits
  - d. Control should be smaller than the specification limits

- 4) One of the following descriptive statistics can NOT be used to represent the spread in the data
- Mean
  - Standard Deviation
  - Range
  - Variance
- 5) Given a normal distribution with a mean of 24.3 and a standard deviation of 2.4, what is the probability of obtaining a value between 19.5 and 26.7?
- 0.1815
  - 0.0228
  - 0.8185
  - 0.8413
- 6) What is the probability of a fuel pump running until 10000 working hours if the mean time between failures of 8500 working hours per failure assuming exponential distribution is representing the reliability of the pump?
- 37.24 %
  - 30.83 %
  - 28.65 %
  - 24.35 %
- 7) A technique for problem solving in which all potential problem or sources of variation are ranked according to their contribution
- Pareto Analysis
  - Scatter diagram
  - Control Chart
  - Cause and Effect Diagram
- 8) The control chart that should be used to monitor the defects in samples when the samples are equal in size:
- c – chart
  - np - chart
  - p - chart
  - Individual chart
- 9) The control chart that should be used to monitor the defectives in samples when the samples are not equal in size:
- c – chart
  - p - chart
  - np - chart
  - Individual chart
- 10) The life of a printer head is normally distributed with mean 750 days and standard deviation 10 days. What is the probability that a random sample of 9 printer heads will have an average life of less than 760 days?
- 99.96 %
  - 99.86 %
  - 99.46 %
  - 99.26 %

## Question 2 (7 points)

A shaft manufacturer is using a steel rod and turns it down to the correct shaft diameter. The quality inspector picked up 15 samples, each containing 4 steel rods. As per process standard, each rod should measure 15 mm inches in diameter. The diameter of each rod in the sample was measured. The results were tabulated as in the following.

Sample No.	$X_1$	$X_2$	$X_3$	$X_4$
1	15.4	14.2	14.1	13.8
2	15.3	14.2	14.1	14.8
3	15.5	15.0	17.0	14.5
4	15.7	15.1	15.8	15.1
5	14.7	16.8	14.1	15.0
6	14.3	15.8	13.2	14.5
7	14.3	15.8	14.2	13.9
8	14.4	15.3	15.7	13.7
9	14.2	16.0	14.4	15.1
10	14.2	14.9	16.2	14.8
11	15.4	15.6	15.0	15.1
12	15.9	16.1	15.3	15.8
13	16.2	16.0	16.5	15.9
14	17.7	16.4	16.1	16.2
15	17.2	17.1	17.3	16.8

- Plot the X-Bar control chart. (4 points)
- Is the process in control? (2 points)
- Based on the results from (b) what should the quality engineer do? (1 point)



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### Question 3 (8 points)

A farm (farm - A) provides dairy products plant with milk. The milk should have minimum and maximum protein levels to be accepted. The milk from (farm-A) has an average of 3.20 percent protein per bottle and standard deviation of 0.15 percent. The protein level in the milk is normally distributed.

- a. For each bottle of milk the upper specification of protein is 3.5 percent and the lower specification is 3.0 percent, what is the probability that the milk from (farm - A) will meet the specification limits? (4 points)
- b. Another farm (farm - B) can provide the milk with an average protein of 3.24 percent and variance  $\sigma^2$  of 0.01 percent. The percentage is also normally distributed in (farm - B). In a shipment of 50000 bottle units, how many bottles from (farm – B) would have low protein percentage? (3 points)
- c. If the cost of out-of-specification bottle of milk to the dairy products plant is 4 SR, how much the plant will save per day when it switches form (farm – A) to (farm- B) assuming the plant consumes 50000 bottle each day? (1 point)