

## Week 13 Self-Assessment 8 Solutions

1. Which best describes Quality?

- a. How to make stuff
- b. The change in look from one item to another
- c. How consistent machines produce the same product
- d. Meeting or exceeding customers' expectations
- e. Fit for use

Answer: D

Explanation: According to the lecture slides on Page 2, Quality is defined as meeting or exceeding customers' expectations

2. Which is not a dimension of product quality?

- a. Value
- b. Conformance to Specifications
- c. Serviceability
- d. Performance
- e. Durability

Answer: A

Explanation: The 8 dimensions of product quality are Performance, Functionality, Durability, Reliability, Conformance to Specifications, Serviceability, Aesthetics, Perceived Quality

3. Statistical Process Control looks at variation as being of two types: Random and Assignable?

- a. True
- b. False

Answer: A

4. Which is not one of the four costs of quality?

- a. Internal Failure
- b. Appraisal
- c. External Failure
- d. Performance
- e. Prevention

Answer: D

Explanation: The four costs of quality are Appraisal Costs, Prevention Costs, Internal Failure Costs and External Failure costs

**Use the following for Questions 5-7. Assume 3 sigma limits:**

John Doe works at Precision Brakes, a supplier to Honda. A critical dimension is the rotor diameter. John has taken 10 rotors per day for the past 5 days and measured them. The data from his samples are given in the table below:

Day	Mean (mm)	Range (mm)
1	156.9	4.2
2	153.2	4.6
3	153.6	4.1
4	155.5	5.0
5	156.6	4.5

5. What are the upper and lower control limits for the R chart?

- a. UCLr = 9.48 mm, LCLr = 0.00 mm
- b. UCLr = 8.76 mm, LCLr = 1.32 mm
- c. UCLr = 5.84 mm, LCLr = 0.67 mm
- d. UCLr = 7.93 mm, LCLr = 1.00 mm

Answer: D

Explanation:

$$\bar{R} = 4.48$$

$$UCLr = D4 * \bar{R}$$

$$UCLr = 1.777 * 4.48$$

$$UCLr = 7.96096$$

$$LCLr = D3 * \bar{R}$$

$$LCLr = 0.223 * 4.48$$

$$LCLr = 0.99904$$

6. What are the upper and lower control limits for the x-bar chart?

- a. UCLx=156.54 mm, LCLx=153.78 mm
- b. UCLx=157.74 mm, LCLx=152.58 mm
- c. UCLx=158.94 mm, LCLx=151.38 mm
- d. UCLx=159.14 mm, LCLx=150.18 mm

Answer: A

Explanaiton:

$$\bar{\bar{x}} = 155.16$$

$$UCL\bar{x} = \bar{\bar{x}} + A2 * \bar{R}$$

$$UCL\bar{x} = 155.16 + .308 * 4.48$$

$$UCL\bar{x} = 156.53984$$

$$LCL\bar{x} = \bar{\bar{x}} - A2 * \bar{R}$$

$$LCL\bar{x} = 155.16 - .308 * 4.48$$

$$LCL\bar{x} = 153.78016$$

7. Is this process in control?

- a. Yes
- b. No. There are points above the R chart control limits
- c. No. There are points out of x-bar control limits
- d. No. There are points below the R chart control limits

Answer: C

Explanation: x-bar values of day 1,2,5 are out of x-bar control limits.

**Use the following for Questions 8-9:**

Whole Food Inc. uses SPC to ensure its protein bars have the proper weight. Based on an in control process using 3 sigma limits, the control limits were found to be  $UCL_r = 1.14$ ,  $LCL_r = 0$ ,  $UCL_x = 6.56$ ,  $LCL_x = 5.84$ . Over the last 5 days, the following additional samples have been taken:

	Weight			
Sample	Bar #1	Bar #2	Bar #3	Bar #4
1	6.3	6.0	5.9	5.8
2	6.0	6.0	6.3	5.8
3	6.3	5.1	6.1	5.9
4	6.3	6.6	6.2	5.9
5	6.5	6.0	6.5	6.9

8. Is this Process Still in Control?

- a. No. Sample 1 outside x chart control limits
- b. No. Sample 3 outside r chart control limits
- c. No. Sample 5 outside both control chart limits
- d. Yes

Answer: B

Explanation:

Sample	Mean	Range
1	6	0.5
2	6.025	0.5
3	5.85	1.2
4	6.25	0.4
5	6.475	0.9

Range of sample 3 is out of r chart control limits

9. A similar extra-large product has a manufacturing process that creates snack bars with a process mean of 18 ounces and standard deviation of 2.5 ounces. According to Cpk is this process capable of meeting an 17.5 ounce  $\pm 2.5$  requirement?

- a. Yes, Cpk is 2.67
- b. Yes, Cpk is 4
- c. No, Cpk is .267
- d. No, CpK is .4

Answer: C

Explanation:

$Cpk = \text{Minimum of } [\frac{\text{upper specification} - \bar{x}}{3s}, \frac{\bar{x} - \text{lower specification}}{3s}]$

$Cpk = \text{Minimum of } [0.26666, 0.4] = 0.267$

Process is not capable because  $Cpk < 1$

10. Mustek makes DRAM memory chips. The process yields products with an average life of 1,800 hours with a standard deviation of 100 hours. The requirement from IBM, Dell and others is 2,400 hours  $\pm 1,800$  hours. Using Cpk is this process capable of meeting the requirement from IBM, Dell and others?

- a. Yes, Cpk is 8
- b. No, Cpk is .8
- c. Yes, Cpk is 4
- d. No, Cpk is .4

Answer: C

Explanation:

$C_{pk} = \text{Minimum of } [\{\text{upper specification} - \bar{\bar{x}}/3s\}, \{\bar{\bar{x}} - \text{lower specification}/3s\}]$

$C_{pk} = \text{Minimum of } [\{8\}, \{4\}] = 4$

Process is capable because  $C_{pk} > 1$