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 UCLr = 1.14, LCLr=0, UCLx=6.56, LCLx=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 +-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 = Minimum of [{upper specification-$\bar{\bar{x}}$/3s} , {$\bar{\bar{x}}$-lower specification/3s}]
Cpk = 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 +- 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:
Cpk = Minimum of [{upper specification-$\bar{\bar{x}}$/3s}, {$\bar{\bar{x}}$-lower specification/3s}]
Cpk = Minimum of [{8} , {4}] = 4
Process is capable because Cpk>1