Unit 7 - Week 5

Course outline

How does an NPTEL online course work?

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Week 5

- Lecture 24: Process capability analysis: Key Concepts
- Lecture 25: Process capability analysis: Measures and Indices
- Lecture 26: Process capability analysis: Minitab Application
- Lecture 27: Non-normal process capability analysis
- **Quiz : Assignment 5**
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Assignment Detailed Solution

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Assignment 5

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-03-04, 23:59 IST.

1) Which limits are determined by the needs of the customer? *1 point*

a. Tolerance limits
b. Control limits
c. Specification limits
d. None of the above

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
c.

2) A pharmaceutical company producing vitamin capsules desires a proportion of calcium content between 40 and 55 ppm. A random sample of 20 capsules chosen from the output yields, a sample mean calcium content of 44 ppm with a standard deviation of 3 ppm. Find the natural tolerance limits of the process. *1 point*

a. 40 and 55
b. 35 and 53
c. 41 and 47
d. None of the above

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
b.

3) In question number 2 if the process is in control at the present values of its parameters, what proportion of the output will be nonconforming, assuming a normal distribution of the characteristic? *1 point*

a. 0.09814
b. 0.08919
c. 0.09188
d. 0.01896

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
c.

4) For question number 2, find the $C_p$index. Which comment will be true on the ability of the process to meet specifications? *1 point*

a. The $C_p$index is 0.6111.
b. All of the output from the process will not meet specifications.
c. Total proportion of nonconforming product is 0.0124.
d. The process uses up 120% of the specification range.

☐ a.
☐ b.
☐ c.
☐ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
b.
c.
d.

Common Data Questions (From QUESTON 5 to QUESTION 8)

The diameter of a forged part has specifications of 120 ± 5mm. A sample of 25 parts chosen from the process gives a sample mean of 122 mm with a sample standard deviation of 2 mm.

5) What will be the value of $\boldsymbol{C_{pk}}$index for the process? *1 point*

a. 0.5
b. 1.167
c. 1.5
d. 1.67

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
a.

6) What is the proportion of nonconforming parts assuming normality? *1 point*

a. 0
b. 0.067
c. 0.089
d. 1

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
b.

7) If the target value is 120mm, what is the value of C_{pm}? *1 point*

a. 0.828
b. 0.555
c. 0.353
d. 0.589

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
d.

8) If the target value is 120mm, what is the value of C_{pmk}? *1 point*

a. 0.828
b. 0.555
c. 0.354
d. 0.589

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
c.

9) The emergency service unit in a hospital has a goal of 3.5 minutes for the waiting time of patients before being treated. A random sample of 20 patients is chosen and the sample average waiting time is found to be 2.3 minutes with a sample standard deviation of 0.5 minutes. Find an appropriate process capability index. What is the proportion of patients who will wait longer than 3.5 minutes? *1 point*

a. 0.0082
b. 0.0164
c. 0.0024
d. 0.0138

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
a.

10) In an assembly there are four components. Suppose that the mean lengths of the four components and their respective tolerances are as shown in the following table: *1 point*

Component	Mean Length (cm)	Tolerance (cm)
A	2	2 ±0.3
B	5	5±0.2
C	6	6±0.2
D	7	7±0.1

Assuming a normal distribution for the individual component dimensions, find the natural tolerance limits for the assembly length. The design specifications for assembly length are 20 ±0.3 cm.

a. 19.574 and 20.426
b. 19.682 and 20.239
c. 19.428 and 20.586
d. 19.563 and 20.489

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
a.

11) The size of the hole before the assembly is always larger than the size of the shaft is a which type of fit? *1 point*

a. Transition fit
b. Clearance fit
c. Interference fit
d. None of these

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
b.

12) What will be the sample size for two-sided nonparametric tolerance limits? They should contain 95% of the population with a probability of 0.99. The quality characteristic is the concentration of potassium in a chemical compound in parts per million. *1 point*

a. 100
b. 110
c. 120
d. 130

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
d.

13) In which case the process is not capable. *1 point*

a. Process spread less than specification spread
b. Process spread greater than specification spread
c. Process spread equals to specification spread
d. None of these

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
b.

14) What will be the sample size for a one-sided upper nonparametric tolerance limit? It should contain 98% of the distribution with a probability of 0.95. The quality characteristic is the number of grams of fat in 10 kg of processed poultry. *1 point*

a. 175
b. 168
c. 149
d. 126

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
c.

15) The waiting time in minutes before being served in a local post office is observed for 50 randomly chosen customers: *1 point*

2.1	0.5	3.6	1.4	2.0	1.9	2.4	2.7	2.1	1.8
0.8	0.4	4.2	3.5	2.5	4.6	3.8	1.5	4.5	3.9
4.8	2.8	1.9	1.2	3.2	5.5	2.5	3.8	5.0	4.6
1.6	2.5	2.4	1.9	2.0	2.1	2.8	1.6	3.8	4.2
3.5	5.2	3.1	1.6	1.5	3.5	5.2	4.8	3.9	2.6

Test for normality using $\alpha = 0.05$. Estimate the mean and standard deviation of the waiting times. If the goal of the post office is for the waiting time not to exceed 4 minutes, find the capability indices CPU and C_{pk} and comment on these values. Assume normality. Based upon your calculation choose the correct statements from options below.

a. The sample mean waiting time is found to be 2.906 minutes with a standard deviation of 1.327 minutes.
b. p value is less than α so we reject the null hypothesis.
c. Since CPU is greater than 1 no undesirable situation exists.
d. 20.61% of the customer will have to wait more than 4 minutes.

☐ a.
☐ b.
☐ c.
☐ d.

No, the answer is incorrect.
Score: 0
Accepted Answers:
a.
d.