Introduction to Statistics and Data Science using *eStat*

Chapter 7 Testing Hypothesis for Single Population

7.5 Application of Testing Hypothesis: Sample Inspection

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7.5 Application of Testing Hypothesis: Sample Inspection

- Sample inspection refers to predicting the quality of the entire lot of products by selecting only a few samples because it is impossible or difficult to inspect the entire lot of products.
- The conclusion obtained from the sample inspection is to determine whether the lot is 'acceptable' as satisfactory quality or 'rejected'. Therefore, It is also called an acceptance sampling.
- Acceptance sampling by variable
- Acceptance sampling by attribute

7.5.1 Acceptance Sampling by Variable

- There is a case that only a minimum specification limit, L, of the quality characteristic value exists to determine whether the product is defective,
- A case that only a maximum specification limit, R, exists,
- A case that both L and R exist.

7.5.1 Acceptance Sampling by Variable

Example 7.5.1	**(Case of lower specification limit L)** Assume that the tension of the wire string produced by a steel company is normally distributed based on past experience and the variance is 30, that is, the standard deviation is $\sigma = \sqrt{30} = 5.48$. If the wire tension of one roll is less than 87, it cannot be used for the desired work and is judged as a defective product. That is, the lower specification limit is L = 87. Inspecting an entire lot containing many rolls of wire rope is impossible because the products can be destroyed. Therefore, a sample of rolls is selected from the lot, and if the defective rate of the sample is estimated to be 1%, the lot is accepted, and if the defective rate is estimated to be 5%, the lot is rejected. What should be the sample size and decision criteria? However, note that the decision criteria should satisfy the producer risk probability of rejecting a good lot, α = 1%, and the consumer risk probability of rejecting a bad lot, β = 10%.

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Example 7.5.1 Answer

- Assume that the quality characteristic value is the random variable X which follows a normal distribution with the mean of μ_0 for an accepted lot and the variance of σ^2 is 30. Since the lower specification limit is L = 87, the probability that the characteristic value is less than 87 is 1% can be represented as P(X < 87) = 0.01. Using the standardization of the normal random variable X, Z, it can also be written as follows.

$$P(Z < \frac{87-\mu_0}{\sqrt{30}}) = 0.01$$

Therefore, according to the standard normal distribution table, $(87-\mu_0)/\sqrt{30}$ should be −2.33. That is, $\mu_0 = 87 + 2.33\sqrt{30} = 99.7684$ which is the population mean of an accepted lot.

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- In a similar way, the characteristic values of a rejected lot follows a normal distribution with the mean of μ_1 and the variance of 30. The probability that the characteristic value is less than 87 is 5% can be represented as P(X < 87) = 0.05. Using the standardization of the normal random variable X, it can also be written as follows.

$$P(Z < \frac{87-\mu_1}{\sqrt{30}}) = 0.05$$

Therefore, $(87-\mu_1)/\sqrt{30}$ should be −1.645 and μ_1= 96.0146 which is the population mean of a rejected lot.

H_0: μ= 99.7684 H_1: μ= 96.0146

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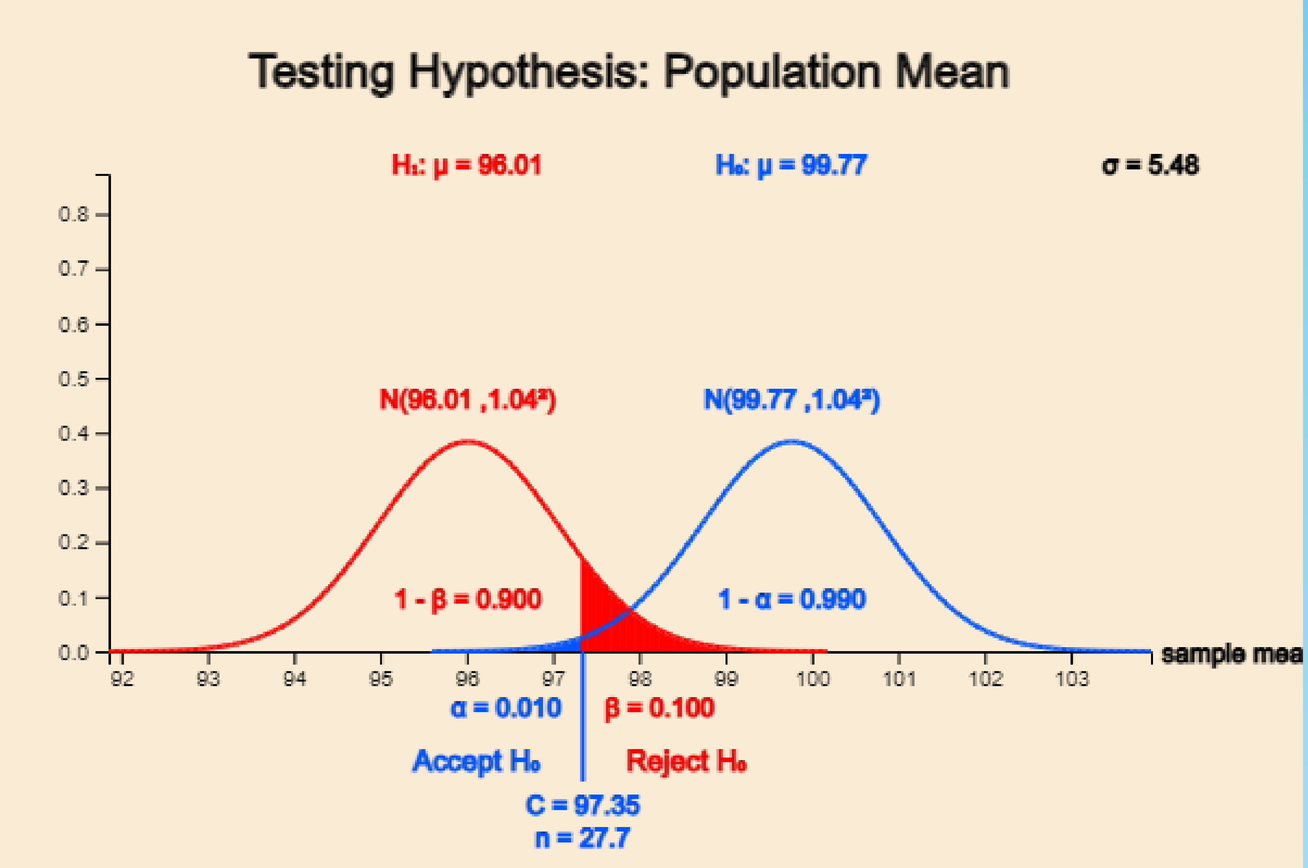

'If the sample mean $\bar{x}$ < 97.3457, then reject the lot, else accept the lot.'

Thank you