Quality control

LECTURER 3

Quality Characteristics

Quality characteristics divided into two parts

- **Measurable Characteristics The characteristics that can be quantified (measurable) also called structural characteristics such as (length, weight, temperature, size, etc).**
- **Immeasurable Characteristics The characteristics that can not be measured in units of measurement also called sensory characteristics such as (color, taste, smell, etc).**

Control Charts Errors

Type one Error: (out of control / in control)
Type Two Error: (in control / out of control

Actual Condition of Process	Conclusion Based on Control Chart	
	Process In Control	**Process Not In Control**
In Control	Correct	Type I Error
Out of Control	Type II Error	Correct

- **Process is OUT of control if: One or multiple points outside the control limits**
- **Process is IN control if: The sample points fall between the control limit**

Types of control charts

- There are many types of control charts. The control charts that you or your team decides to use should be determined by the type of data that you have.
- Variable Control Charts
- Attribute Control Charts

1- Variable Control Charts

- **Variable quality Control Charts These charts are used in the process of controlling and monitoring the quality of products. If the characteristics of the produced product is measurable**.

Type of Variable Quality Control Chart

a. Individual values – Chart.
b. Average – Chart.
c. Range - Chart .
d. Standard Deviation- Chart

Individual Values - Chart

- This chart is used to control the quality of the product. The target line for this chart represents the over all average ($T = \bar{x}$) for all observations of the same process . The (upper and lower) control limits are put at (±3σ) from the target line, as shown by the following formulas:

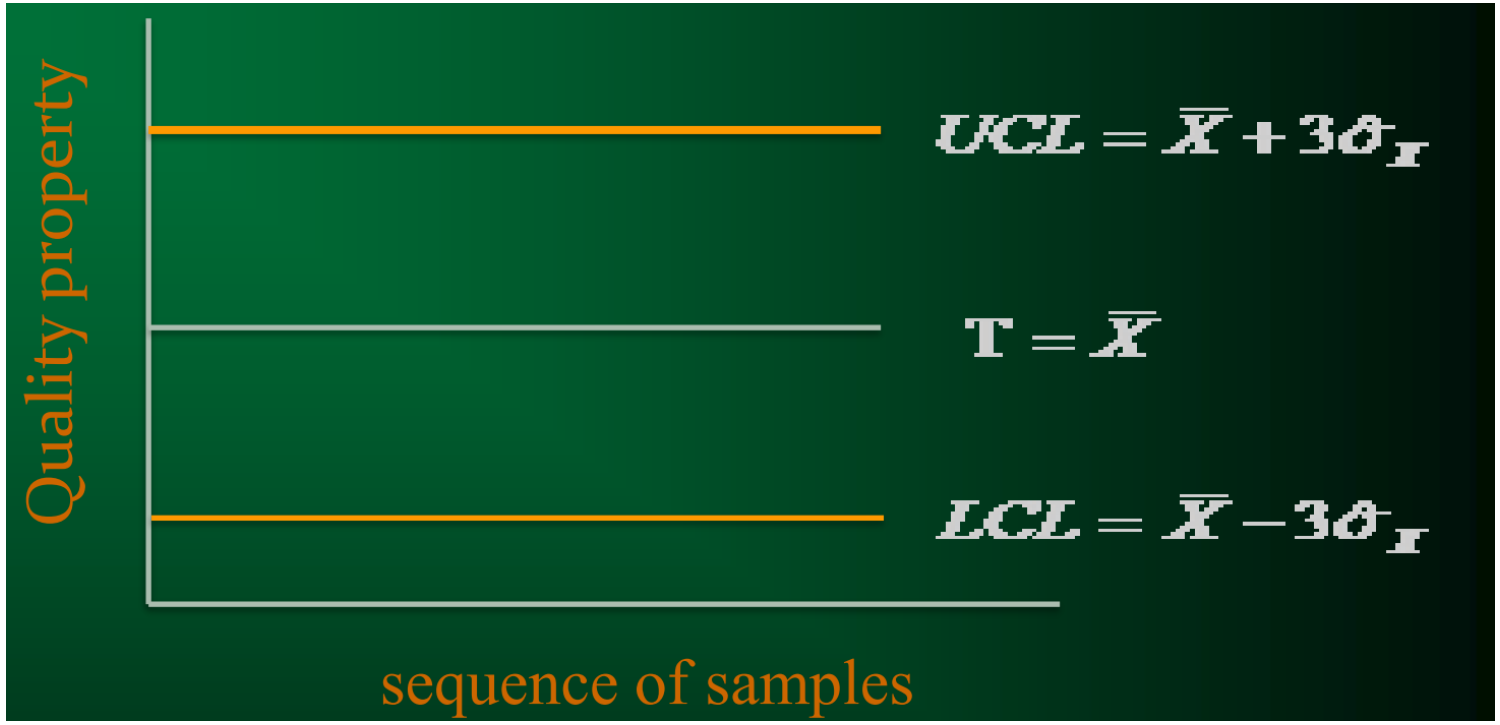
$$UCL = \bar{x} + 3\hat{\sigma}_x$$
$$LCL = \bar{x} - 3\hat{\sigma}_x$$

where

$(\hat{\sigma}_x)$ represents the standard division for all observations and calculated by the following formula:

$$\hat{\sigma}_x = \sqrt{\frac{\sum_{i=1}^{n} x_i^2 - n\,\bar{x}^2}{(n-1)}}$$

(individual values-chart)



(individual values-chart)

ex1:

15 random observation of cigarettes was taken and the percentage of nicotine was :

$x_i = 18, 16, 20, 19, 18, 19, 18, 18, 17, 17.3, 18.6, 20.3, 21, 19.7, 16.4$

Draw individual values- chart

solution

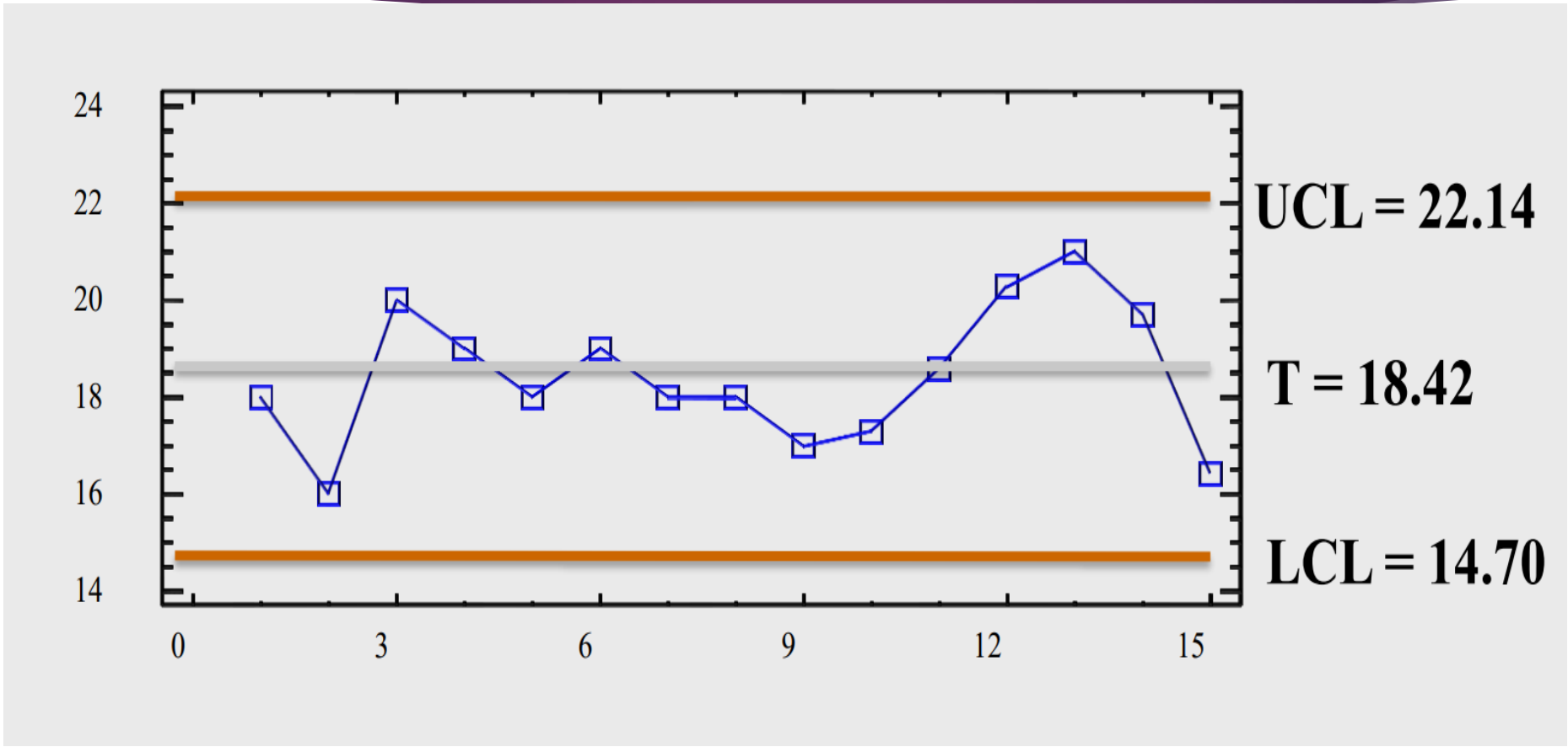
$$\bar{x} = T = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{18+16+20.....+19.7+16.4}{15} = 18.42$$

$$\hat{\sigma}_x = \sqrt{\frac{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2}{n-1}} = \sqrt{\frac{((18^2+16^2+...+16.4^2)-(15*18.42^2))}{14}}$$

$$= \sqrt{\frac{(5118.39-15*(18.42)^2)}{14}} = 1.44$$

$$LCL = \bar{x} - 3\hat{\sigma}_x = 18.42 - 3*1.44 = 14.70$$

$$UCL = \bar{x} + 3\hat{\sigma}_x = 18.42 + 3*1.44 = 22.14$$


24
22
20
18
16
14
0
3
6
9
12
15
UCL = 22.14
T = 18.42
LCL = 14.70