

# ANSWERS CHAPTER 16

## THINK IT OVER



### think it over

TIO 16.1: The problem is for both companies. Many companies build working relationships over many years, so before deciding not to use the company, it is worth talking to them to help identify the problem. If the supplier company does not improve then you will have to find another supplier, which can be an arduous process.

TIO 16.2: The equation is very similar to the one used in the binomial distribution:

$$\sigma = \sqrt{np(1-p)}$$

TIO 16.3: This is a tricky one. On the one hand the supplier is helpful when needed but you have also to consider the reputation of your company. The first step would be to go and talk with them and find out what the problem is. You may be able to advise them on improving their production process provided it does not end up with you running their production facility. If it is a big issue, then you could perhaps recommend a consultant who could help. If the issue is not resolved then you will have to find an alternative supplier and look at your own production planning to see if you can avoid 'last minute' jobs.

TIO 16.4: Ethics in the contemporary business world are very important. For example, a company who supplied breast implants was recently sued because the implants were faulty and presented a potential health risk. Many companies in the past have gone for 'short term' gain and focussed solely on their profit margin, and have paid the price by not being solvent for very long. You must also be mindful of legislation, such as health and safety, consumer rights and so on.

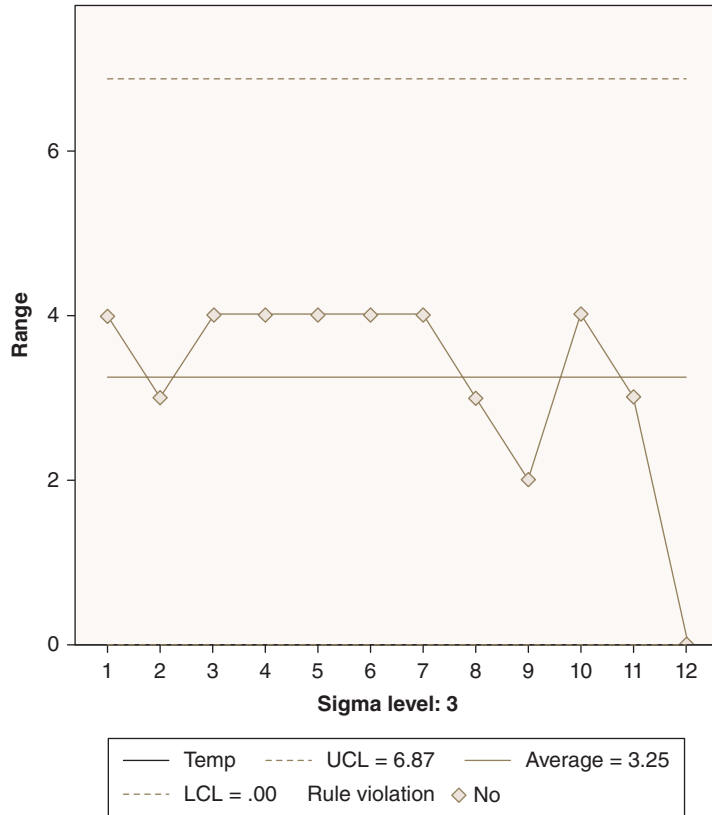
## EXERCISES

- Use a variable chart: X-bar chart with R chart or S chart.
  - The R (range) chart indicates the process is within limits. There are no rule violations. Time period 12 may raise some concerns since the range of variation is 0, i.e. there is no change in the temperature. This needs to be investigated since it is unusual not to have any variation, and therefore the monitoring process may be faulty or the data has been incorrectly recorded. The data needs to be checked.

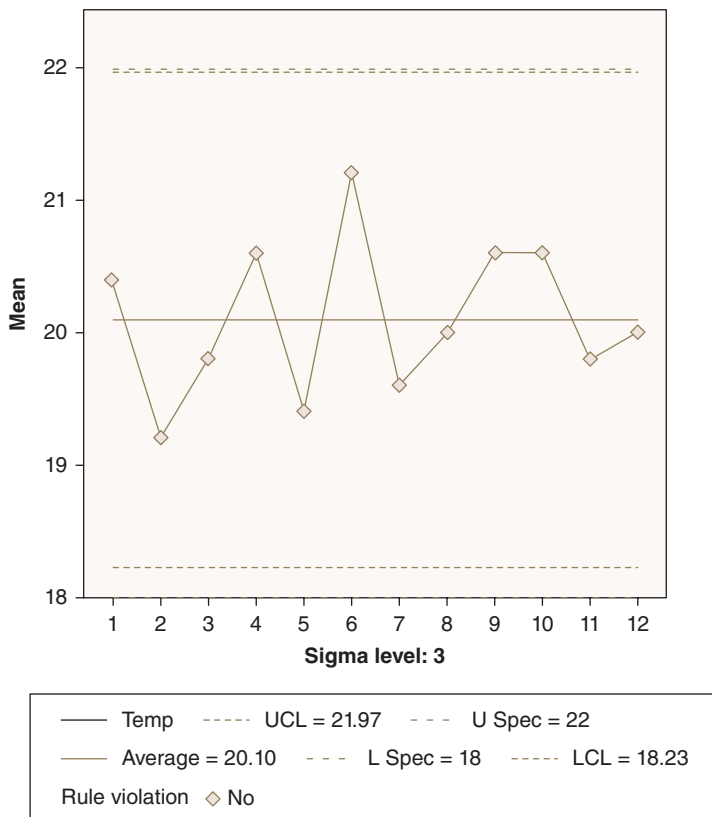
The X-bar chart shows the average of the sample means to be 20.10 degrees which is very close to the target temperature. There are no rule violations and the means of the samples are within the control limits.

The process statistics indicate there could be a problem in variability. A value of 0.477 (CP) indicates the process is too variable and exceeds specifications. The performance indices indicate that most of the variability can be accounted for by common causes of variation.
  - A final decision cannot be made until the cause of lack of variation in time period 12 has been resolved. If this time period is ignored, the process seems to be in control. Because of the nature of the process (risks to health) and the doubt cast on the validity of the data (point 12 on the R chart), a final decision should not be made.

Control Chart: Temp



Control Chart: Temp



### Process Statistics

Capability Indices	CP <sup>a</sup>	.477
	CpL <sup>a</sup>	.501
	CpU <sup>a</sup>	.453
	CpM <sup>a,b</sup>	.476
	Est. % Outside SL <sup>a</sup>	15.3%
Performance Indices	PP	.454
	PpL	.476
	PpU	.431
	PpK	.431

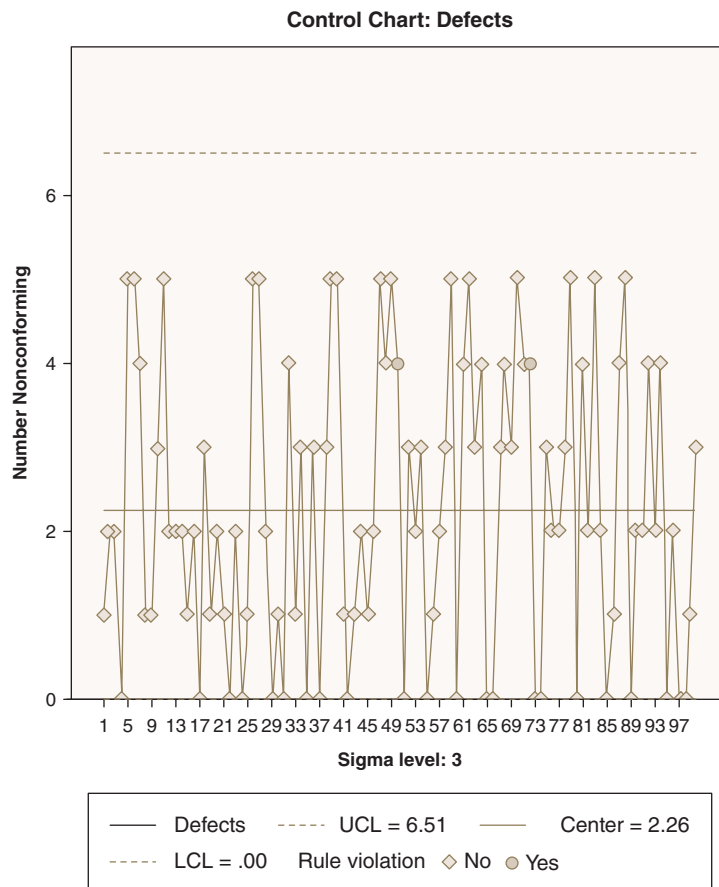
The normal distribution is assumed. LSL = 18 and USL = 22.

a. The estimated capability sigma is based on the mean of the sample group ranges.

b. The target value is 20.

(d) Recommend further investigation into the data collection and recording methods. Check the temperature monitors on each of the baths. This is unlikely to be the problem since a constant temperature was recorded for each of the baths.

2. (a) Construct a *p* chart to illustrate the number of teddies outside of the specification.



(b) The chart shows there are two points violating the process rules: point 50 and point 72.

Factory	Violations for Points
Hong Kong	4 points out of the last 5 above +1 sigma
Paris	4 points out of the last 5 above +1 sigma

2 points violate control rules.

(c) The rule violations dialogue box indicates the Hong Kong factory and the Paris factory need to be investigated. The rule violated is where 4 out of 5 have exceeded the sample ratio of defective teddies to the number inspected from each factory by one standard deviation. This may be acceptable but requires monitoring. There may be production cost implications.