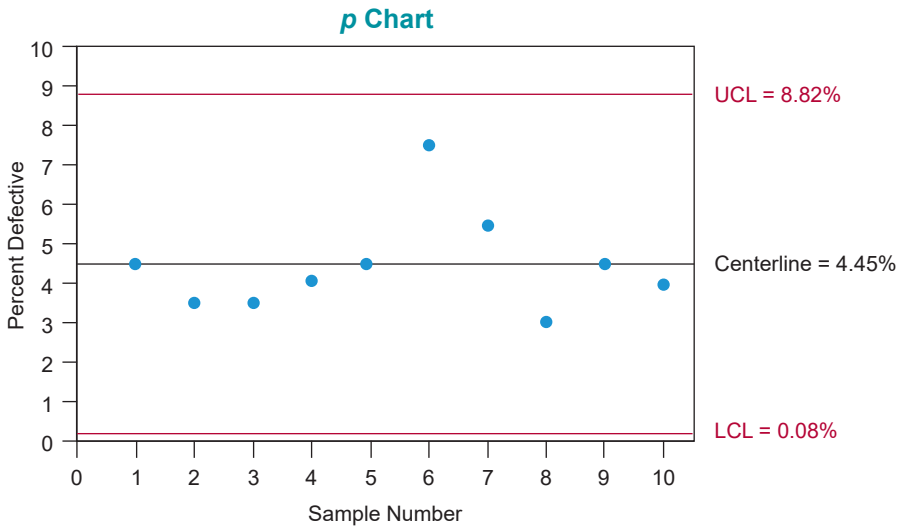

Figure 18.4.2

From the p chart, we can see that for this data, when the standard percent defective is unknown, all of the samples fall within the control limits.

18.4 Exercises

Basic Concepts

1. Explain the difference between control charts for attributes and control charts for variables.
2. What is a p chart?
3. How are the upper and lower control limits calculated for a p chart when the process proportion is known?
4. Is the allowable variation for a process involving a p chart larger, smaller, or the same as the allowable variation for a process involving a mean chart or range chart? Explain.
5. Suppose the LCL for a process is computed to be -0.07. What value should be used for the LCL in the p chart? Explain.
6. How does the procedure for constructing a p chart change if the process proportion is not known?
7. What is $\bar{p}$? What other hypothesis testing procedure uses the concept of $\bar{p}$? Are these measures the same? Explain.
8. When examining a p chart, how do you determine if samples are out of control?

Exercises

9. In a paper products plant, 100 product samples are taken each hour and tested for being either acceptable or defective. In the past, 1% defective was considered normal. Find the upper and lower control limits for a 3σ p chart.
10. To monitor the production of sheet metal screws by a particular machine in a large manufacturing company, a sample of 100 screws is examined each hour for three shifts of eight hours each. Each screw is inspected and designated as conforming or nonconforming according to specifications. Historically, the proportion of nonconforming screws has been 5%. Use the following results of one day's sampling to construct a 3σ p chart. Which samples, if any, are out of control?

Nonconforming Screws					
Sample Number	Number Defective	Sample Number	Number Defective	Sample Number	Number Defective
1	4	9	10	17	9
2	7	10	5	18	11
3	9	11	5	19	14
4	10	12	4	20	5
5	8	13	12	21	6
6	6	14	6	22	12
7	5	15	7	23	15
8	1	16	13	24	5

11. A production process involves the manufacture of rubber gaskets for windows. When these gaskets are inspected, they are classified as conforming or nonconforming based on a number of different characteristics, such as thickness, consistency, overall size, and so on. To monitor the percentage of nonconforming gaskets being produced, a sample of 25 gaskets is inspected each hour. Management predetermines the acceptable fraction of nonconforming gaskets as 10%.

a. Determine the UCL, LCL, and centerline.

b. Use the following table to plot the samples on your control chart.

Nonconforming Gaskets			
Sample Number	Percent Defective	Sample Number	Percent Defective
1	16	13	12
2	16	14	8
3	16	15	8
4	12	16	12
5	8	17	8
6	8	18	12
7	4	19	12
8	0	20	4
9	8	21	8
10	4	22	12
11	4	23	16
12	4	24	4

c. Are any samples out of control? If so, identify which ones.

12. The academic dean decides to sample 200 students each semester to study the drop rate at his institution. The numbers of drops for the last eight semesters are shown in the following table. Find the upper and lower control limits and construct a *p* chart. Indicate which semesters, if any, are out of control.

Number of Drops			
Semester Number	Number of Drops	Semester Number	Number of Drops
1	10	5	8
2	12	6	6
3	14	7	13
4	9	8	15

13. The Thompson Company makes voltage protectors at its Midland, Georgia plant. During each shift, 10 protectors are tested until failure, with some rated defective and others rated non-defective. The numbers of defective protectors for the last 20 shifts are given in the following table. Find the upper and lower control limits and construct a *p* chart. Indicate which shifts, if any, are out of control.

Defective Voltage Protectors			
Sample Number	Number Defective	Sample Number	Number Defective
1	1	11	1
2	1	12	1
3	0	13	1
4	2	14	2
5	3	15	0
6	1	16	0
7	0	17	2
8	2	18	1
9	3	19	1
10	0	20	1