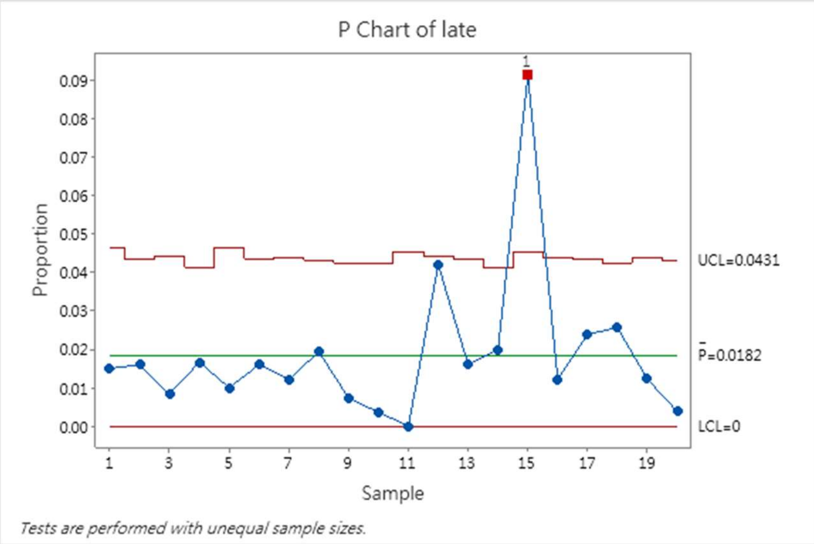
7.4

The commercial loan operation of a financial institution has a standard for processing new loan applications in 24 hours. Table 7E.2 shows the number of applications processed each day for the last 20 days and the number of applications that required more than 24 hours to complete.

Day	number	late
1	200	3
2	250	4
3	240	2
4	300	5
5	200	2
6	250	4
7	246	3
8	258	5
9	275	2
10	274	1
11	219	0
12	238	10
13	250	4
14	302	6
15	219	20
16	246	3
17	251	6
18	273	7
19	245	3
20	260	1
	4996	91

$\overline{p} = D_i / n_i =$ 0.0182

(a) Set up the fraction nonconforming control chart for this process. Use the variable-width control limit approach. Plot the preliminary data in Table 7E.2 on the chart. Is the process in statistical control?



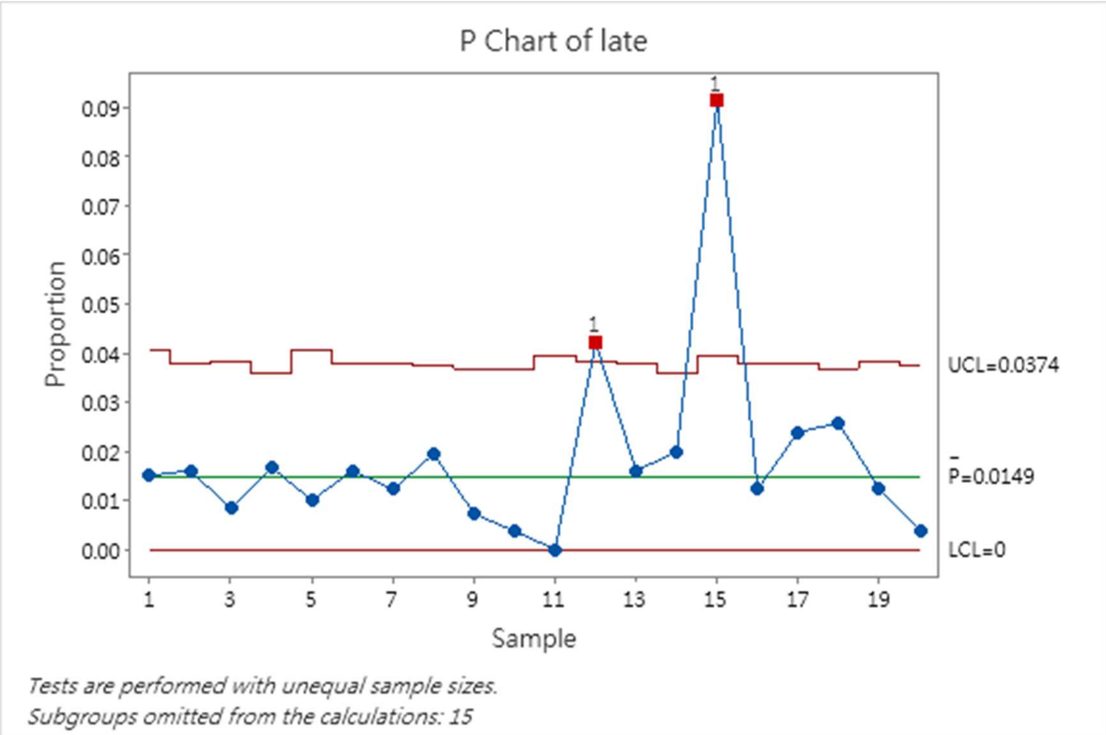
Test Results for P Chart of late

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 15

the process is not in statistical control

(b) Assume that assignable causes can be found for any out-of-control points on this chart. What center line should be used for process monitoring in the next period, and how should the control limits be calculated?

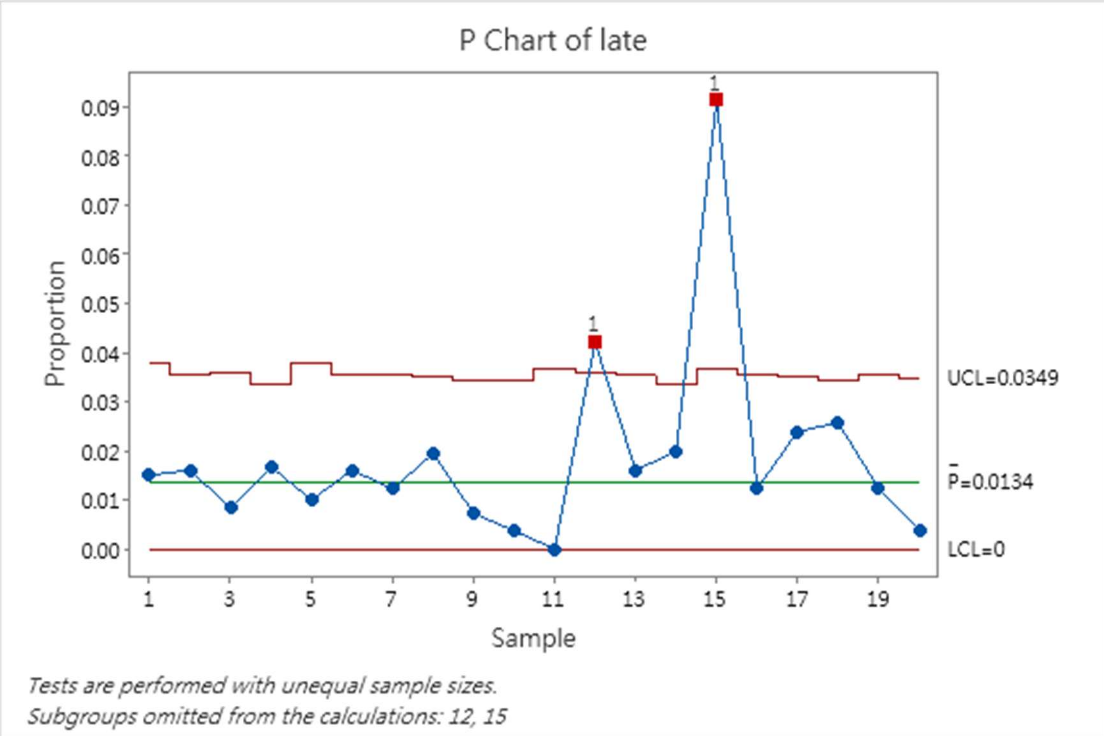


Test Results for P Chart of late

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 12, 15

Remove 12 and 15, do it again



Test Results for P Chart of late

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 12, 15

Use UCL = 0.0349, CL = 0.0134, LCL = 0 to monitor the process

7.5

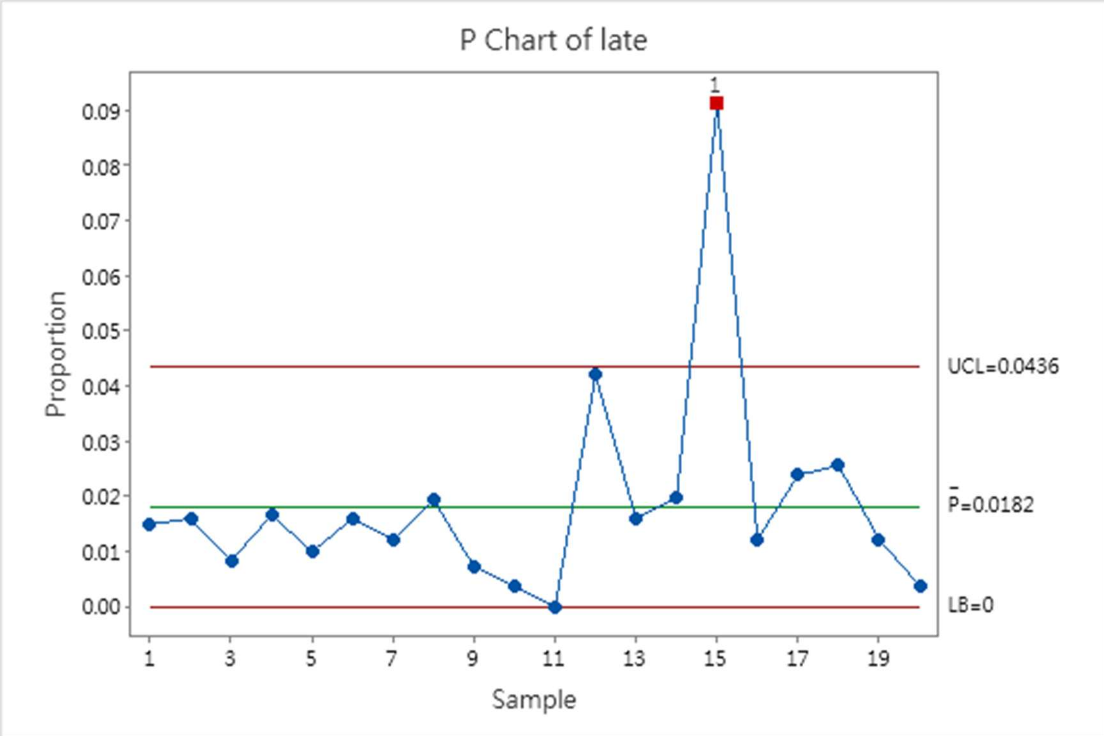
Reconsider the loan application data in Table 7E.2. Set up the fraction nonconforming control chart for this process. Use the average sample size control limit approach. Plot the preliminary data in Table 7E.2 on the chart. Is the process in statistical control? Compare this control chart to the one based on variable-width control limits in Exercise 7.4

$\bar{n}$ = 4996/20 = 249.8 → 250

control limits = $\bar{p} \pm 3\sqrt{(\bar{p}(1-\bar{p})/\bar{n})}$

UCL = 0.0182 + 0.0254 = 0.0436

LCL = 0.0182 – 0.0254 < 0 → LCL = 0



Test Results for P Chart of late

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 15

Similar to 7.4, sample 15 out of control

7.8

The number of nonconforming switches in samples of size 150 are shown in Table 7E.4. Construct a fraction nonconforming control chart for these data. Does the process appear to be in control? If not, assume that assignable causes can be found for all points outside the control limits and calculate the revised control limits.

TABLE 7E.4

Number of Nonconforming Switches for Exercise 7.10

Sample Number	Number of Nonconforming Switches	Sample Number	Number of Nonconforming Switches
1	8	11	6
2	1	12	0
3	3	13	4
4	0	14	0
5	2	15	3
6	4	16	1
7	0	17	15
8	1	18	2
9	10	19	3
10	6	20	0

n = 150

m = 20

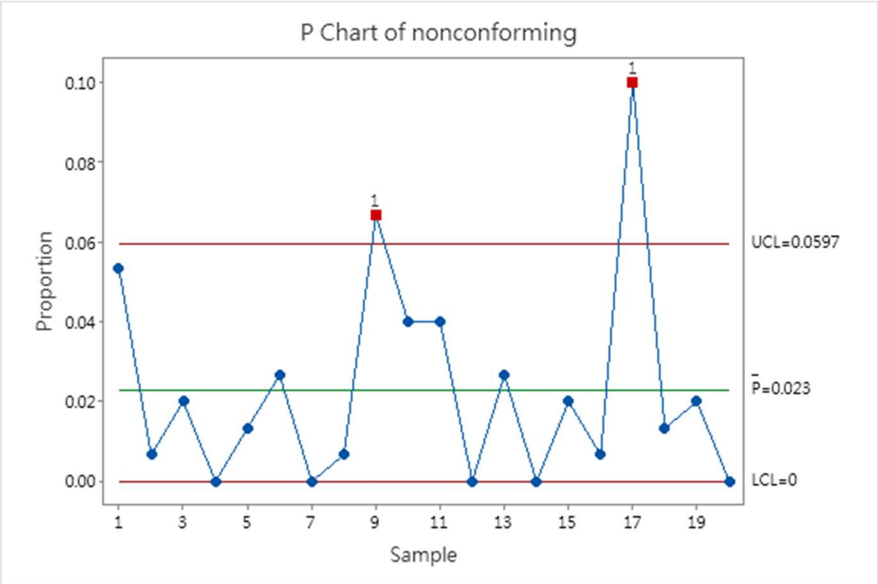
Di = 69

$\overline{p}$ = Di / mn = 69 / (20 * 150) = 0.023

control limits = $\overline{p} \pm 3 \sqrt{(\overline{p}(1-\overline{p})/\overline{n})}$

UCL = 0.023 + 0.0367 = 0.0597

LCL = 0.023 – 0.0367 < 0 $\rightarrow$ LCL = 0

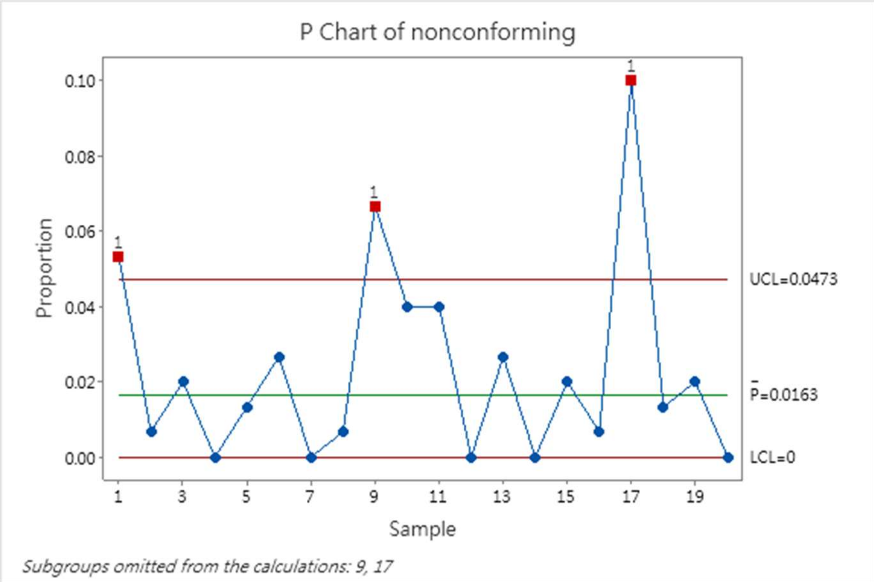


Test Results for P Chart of nonconforming

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 9, 17

Remove sample 9, 17, do it again

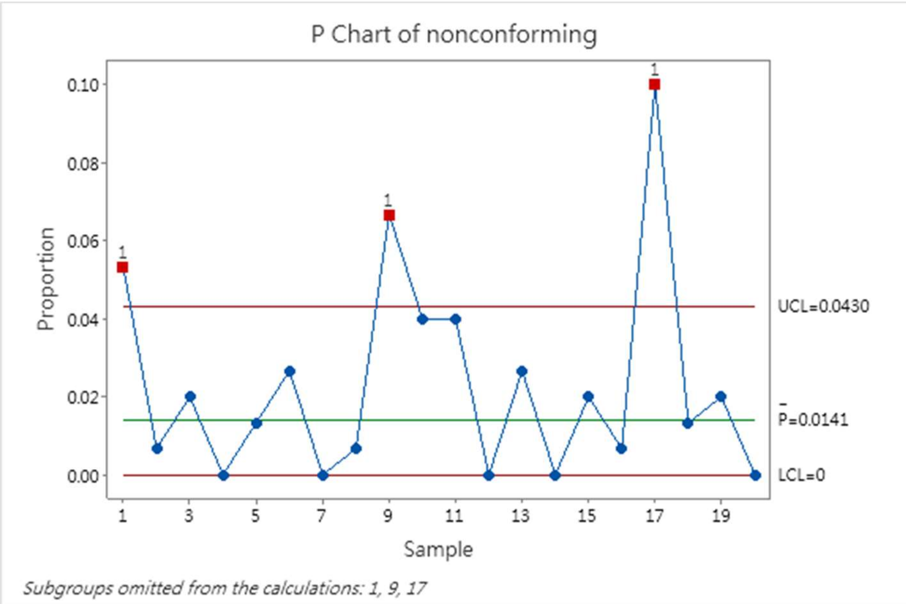


Test Results for P Chart of nonconforming

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 1, 9, 17

Remove sample 1, 9, 17, do it again



Test Results for P Chart of nonconforming

TEST 1. One point more than 3.00 standard deviations from center line.

Test Failed at points: 1, 9, 17

Use UCL = 0.043 CL = 0.0141 LCL = 0 to monitor the process