

High Cost of Low Quality

Microsoft announced that it would spend \$1.15 billion to repair Xbox

360 game machine consoles. Industry analysts estimate

that about one-third of all units were defective and in need of repair. Many users reported that the machine shut down after three flashing red lights appeared on the console.

The Federal Drug Administration recently reached an agreement whereby a pharmaceutical company, the Schering-Plough Corporation, would pay a record \$500 million for failure to correct problems in manufacturing drugs. According to a *New York Times* article by Melody Petersen, "Some of the problems relate to the lack of controls that would identify faulty medicines, while others stem from outdated equipment. They involve some 200 medicines, including Claritin, the allergy medicine that is Schering's top-selling product."



Solution

The centerline for the control chart is located by the value of \bar{p} :

$$\begin{aligned}\bar{p} &= \frac{\text{total number of defective quarters from all samples combined}}{\text{total number of quarters sampled}} \\ &= \frac{8 + 7 + 12 + \cdots + 24}{20 \cdot 10,000} = \frac{252}{200,000} = 0.00126\end{aligned}$$

Because $\bar{p} = 0.00126$, it follows that $\bar{q} = 1 - \bar{p} = 0.99874$. Using $\bar{p} = 0.00126$, $\bar{q} = 0.99874$, and $n = 10,000$, we find the positions of the centerline and the control limits as follows:

Centerline: $\bar{p} = 0.00126$

Upper control limit:

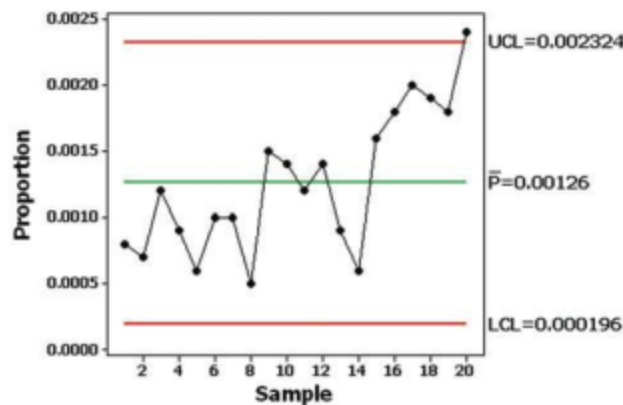
$$\bar{p} + 3\sqrt{\frac{\bar{p}\bar{q}}{n}} = 0.00126 + 3\sqrt{\frac{(0.00126)(0.99874)}{10,000}} = 0.002324$$

Lower control limit:

$$\bar{p} - 3\sqrt{\frac{\bar{p}\bar{q}}{n}} = 0.00126 - 3\sqrt{\frac{(0.00126)(0.99874)}{10,000}} = 0.000196$$

Having found the values for the centerline and the control limits, we can proceed to plot the proportions of defective quarters. The Minitab control chart for p is shown in the accompanying display.

CONTROL CHART FOR p : DEFECTIVE QUARTERS



Interpretation

We can interpret the control chart for p by considering the three out-of-control criteria listed in Section 14-2. Using those criteria, we conclude that this process is out of statistical control for these reasons: The Run of 8 Rule is violated because there are 8 consecutive points lying below the centerline, and there is a point lying beyond the upper and lower control limits. This is based on a new process that is being tested, and the control chart indicates that this process requires corrective action so that it is brought within statistical control.