Manufacturing Process HW: Widget Production

Simone Cherry-Delisle

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- **Defect Rate:** 3% of produced widgets are identified as defective.
- **Variability:** Standard deviation of widget dimensions: 0.05 units.
- **Production Rate:** 1,000 widgets produced per hour.
- **Quality Control Inspections:** Random sampling of 50 widgets every hour for quality inspection.

Defect Analysis

Calculate the number of defective widgets expected in a production run of 10,000 units. How might this impact overall product quality?

Solution. Assume that the occurrence of defective widgets X may be described as an i.i.d. sequence of Bernoulli trials, each with probability 0.03 of defect; that is, assume $X \sim Bin\left(n, p = 0.03\right)$. Then

$$E\left(X\right) = np = \left(10000\right)\left(0.03\right) = 300. \tag{1}$$

Trend Analysis

Over three consecutive hours, the defect rates observed are 2%, 3.5%, and 1.5%. Analyze the trend and propose potential reasons for variations. How might process adjustments be made to improve consistency?

Solution. See print-out of the file widget_production.ipynb.