Section 5.4: Statistical Process Control

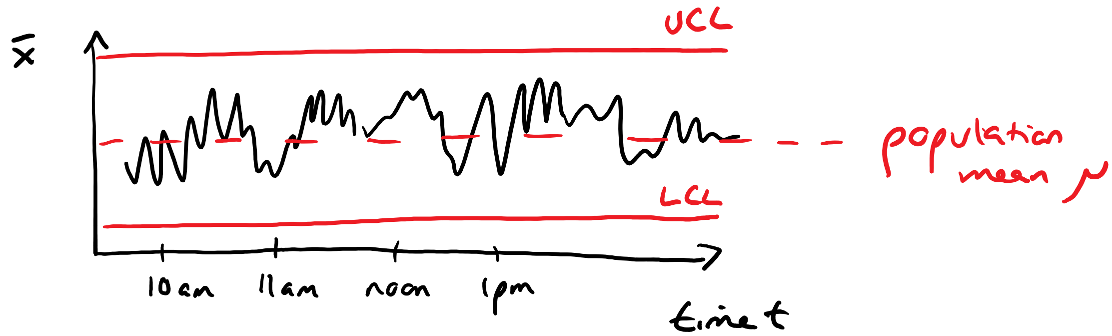
Tuesday, February 27, 2018 3:48 PM

idea: making identical objects on an assembly line

for quality control purposes, every now and again, choose n objects and measure x, some characteristic, for each object

assume x is a continuous variable

then calculate $\bar{x}$ for the sample and plot as a function of time



UCL = upper control limit
LCL = lower control limit

so, what should the graph look like?

$\bar{x}$ should vary about the (unknown) population mean μ

and almost all $\bar{x}$ will fall within

$\mu \pm 3 \underbrace{SE}_{\text{standard error}}$

$\mu \pm 3 \dfrac{\sigma}{\sqrt{n}}$ ← note: we don't actually know μ, but can estimate it over time from samples

how?

calculate $\bar{\bar{x}}$ – the mean of the sample means

s – standard deviation of all observations

then

upper control limit $UCL = \bar{\bar{x}} + \dfrac{3s}{\sqrt{n}}$ ← ess

lower $LCL = \bar{\bar{x}} - \dfrac{3s}{\sqrt{n}}$

so, put limits on chart, and if $\bar{x}$ deviates out beyond these limits, there's likely a problem

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sample proportion – same idea

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example: A producer of brass rivets randomly samples 500 rivets every hour and calculates the proportion of defectives. The mean sample proportion calculated from 10 000 samples was 0.025

a) Calculate the UCL and LCL limits for a control chart.

b) What does it mean if the next ten samples are above the UCL line?

a) $$\bar{\hat{p}} \pm 3SE = \bar{\hat{p}} \pm 3\sqrt{\frac{pq}{n}}$$

$$= 0.025 \pm 3\sqrt{\frac{(0.025)(0.975)}{500}}$$

$$= 0.025 \pm 0.021$$

so UCL = 0.046

LCL = 0.004

b) if 10 samples are above the UCL, this is statistically extremely unlikely to happen by chance - so there's likely a problem that you should look into