Chapter 9 Homework

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9.1

cusum Chart
for x
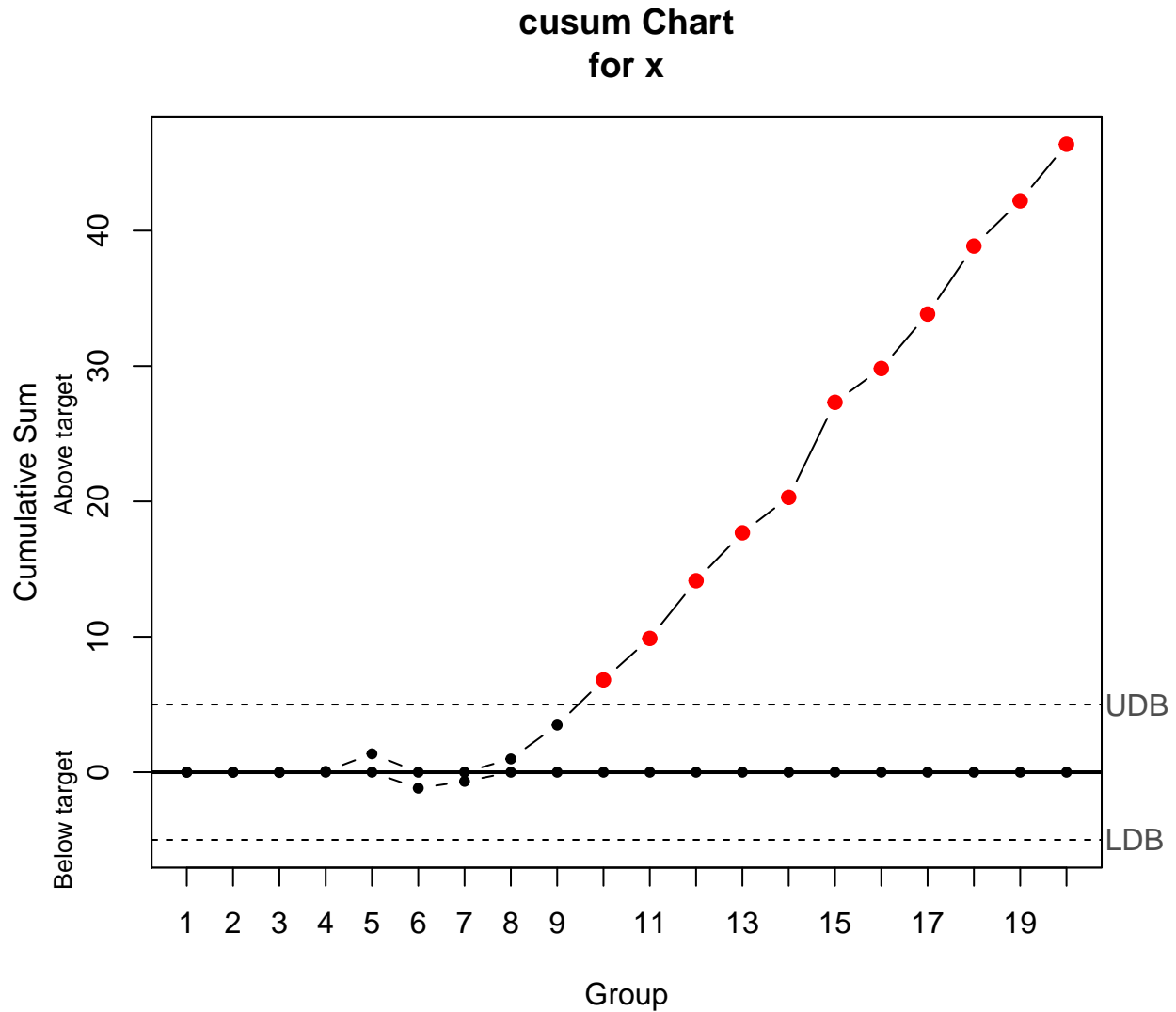
K is typically 0.5 times the shift that is desired to be detected. Since the desired detection is 1.0σ

$$\frac{1}{2}\sigma = 12.5$$

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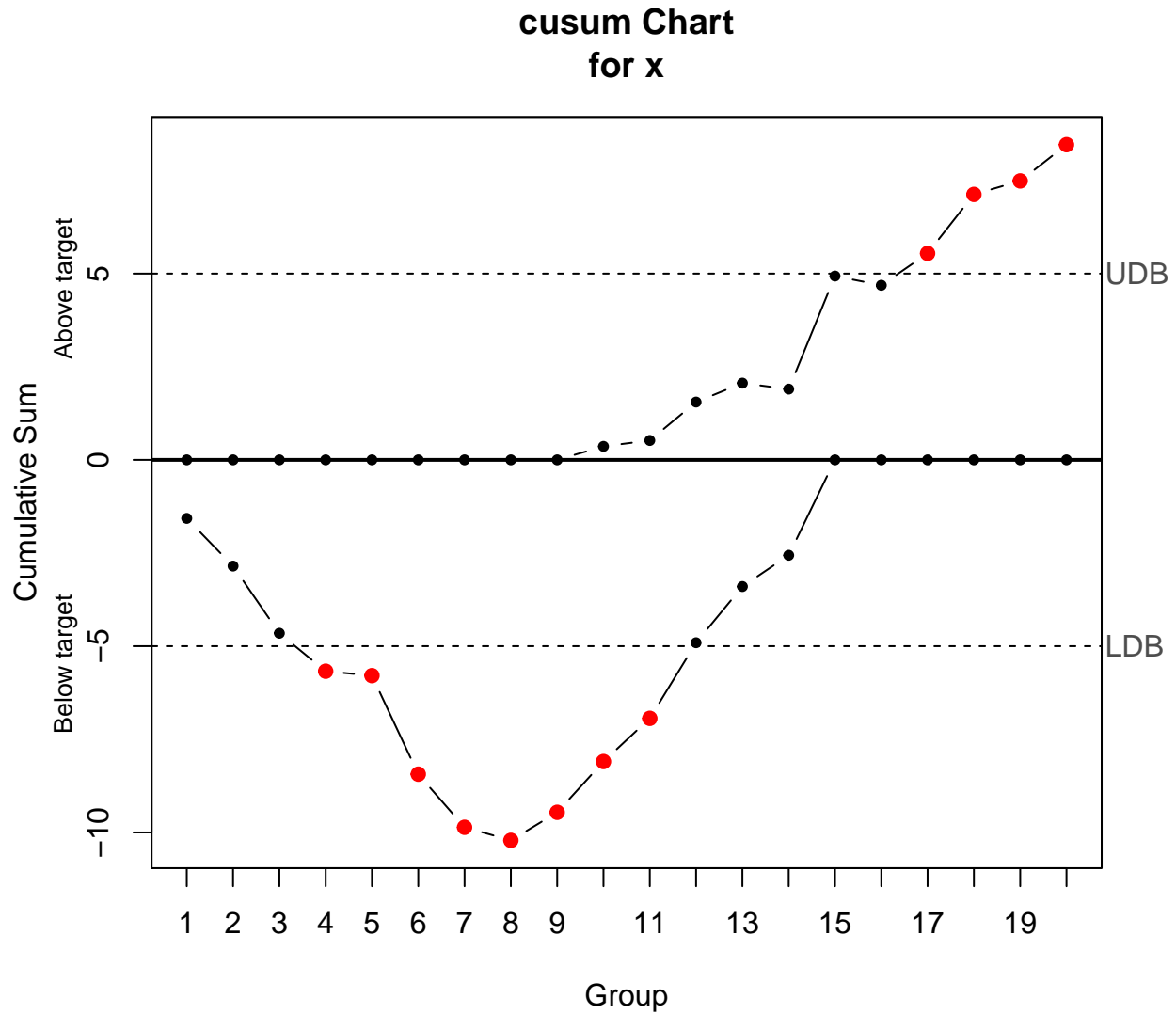There are 11 observations that are beyond the boundry of $5\sigma = 125$.

b)

The estimate for σ in part a doesn't seem reasonable, $\hat{\sigma} = 34.4344905$.

9.2

Using

$$y_i = \frac{x_i - \bar{x}}{\hat{\sigma}}$$

cusum Chart
for x

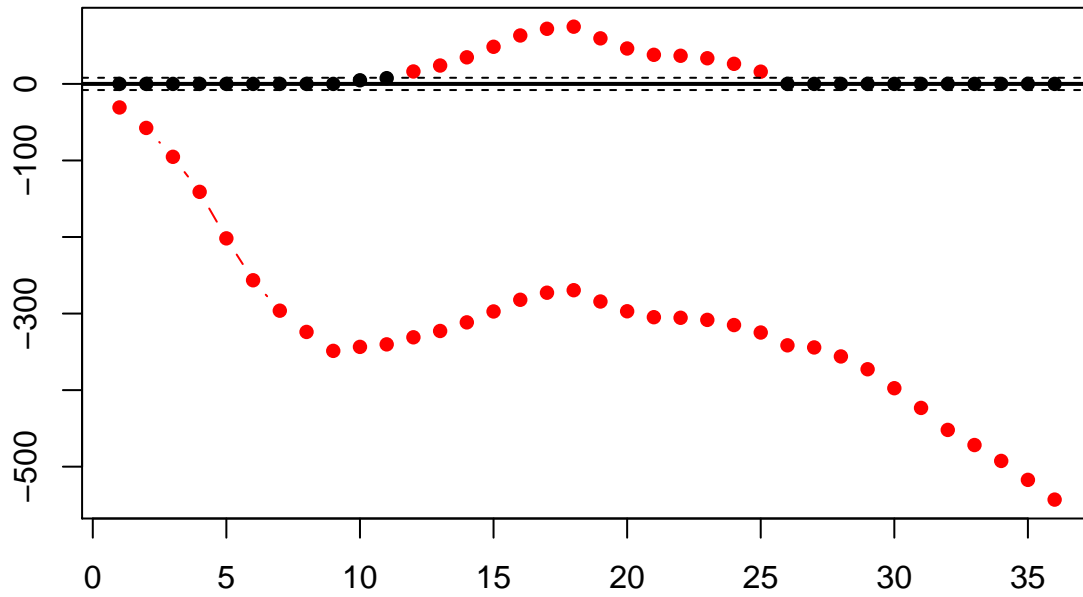Standardizing has no effect on the ability to detect OOC points.

9.9

To estimate the process standard deviation, where $n = 1$, we first calculate the moving range of the oberservations x.

$$Moving\ Range = 4, 11, 8, 15, 6, 15, 12, 3, 30, 2, 6, 1, 3, 3, 1, 6, 6, 18, 2, 5, 7, 2, 4, 3, 7, 14, 9, 5, 8, 1, 3, 9, 1, 4, 1$$

$$\hat{\sigma} = \frac{\bar{R}}{d_2} = \frac{6.7142857}{1.128} = 5.952381$$

See plot below (red points are above or below h):

9.18

With $\lambda = 0.1$ when $i = 1$

$$UCL = 10.3$$
$$LCL = 9.7$$

With $\lambda = 0.2$ when $i = 1$

$$UCL = 10.6$$
$$LCL = 9.4$$

With $\lambda = 0.4$ when $i = 1$

$$UCL = 11.2$$
$$LCL = 8.8$$

It appears that the affect of λ is a positive one, meaning as λ increases so do our LCL and UCL. As i increases our control limits become steady. For example, when $i = 20$ and $\lambda = 0.4$ we get
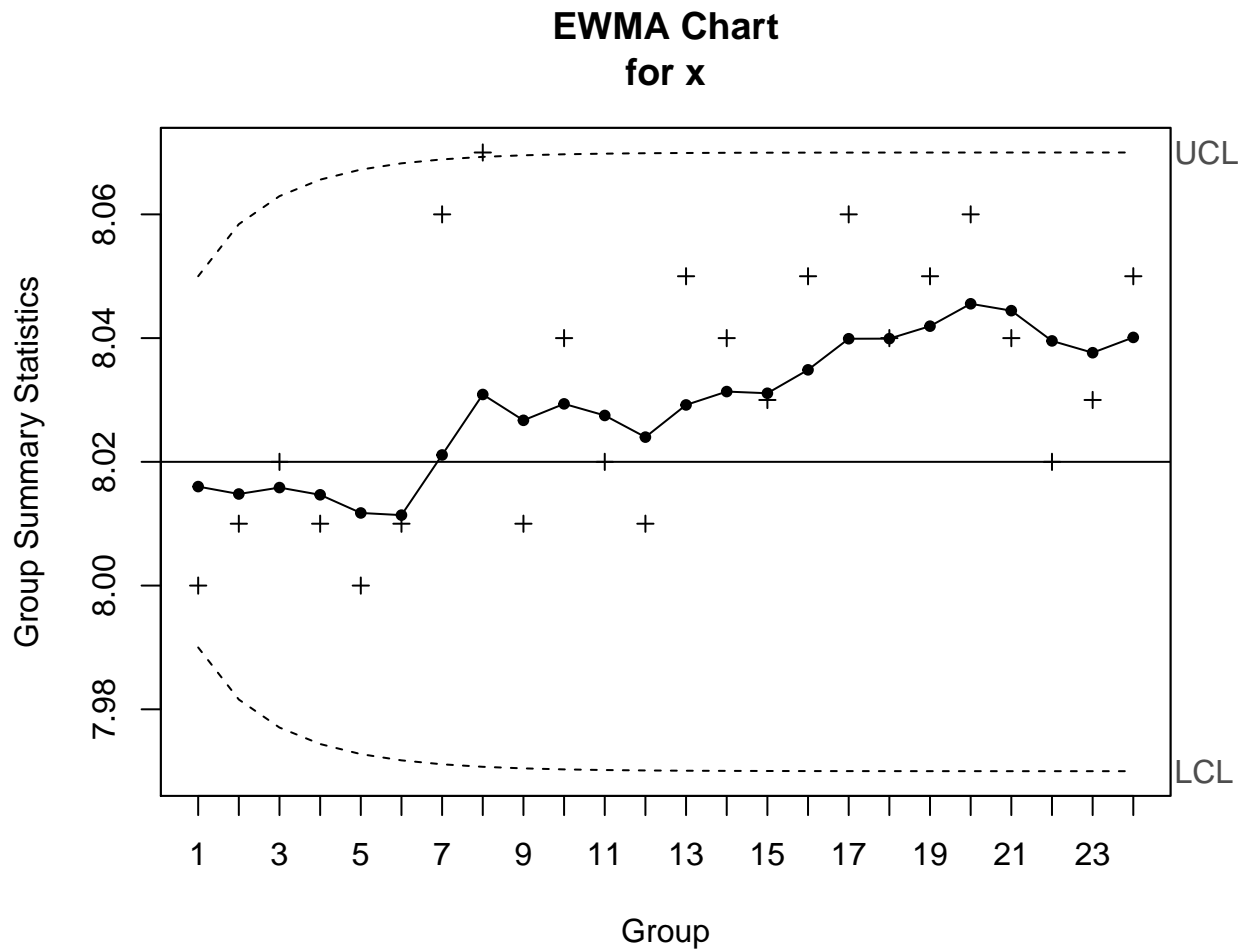
$$UCL = 11.5$$
$$LCL = 8.5$$

Or with $\lambda = 0.2$ we get

$$UCL = 10.9999335$$
$$LCL = 9.0000665$$

9.19

EWMA Chart
for x

Number of groups = 24   Smoothing parameter = 0.2
Center = 8.02   Control limits at 3*sigma
StdDev = 0.05   No. of points beyond limits = 0

With $center = 8.02$ and $\hat{\sigma} = 0.05$, the process is in control. After approximately point 11 or 12 the process limits are stable and

$$UCL = 8.0699994$$

$$LCL = 7.9700006$$