品質管制 Homework 11

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5.17

For detecting the variance upward shifts, compute the charting statistics

$$E_{n,v} \;=\; \lambda\,\frac{S_n^2}{\sigma_0^2} \;+\; (1-\lambda)\;E_{n-1,v}\;,\text{ where } E_{0,v}=1\;,\;\lambda=0.1\;,\;\sigma_0=0.5$$

A signal of upward process variance shift is given at the n-th time point if

$$E_{n,v} \;>\; U \;=\; 1+\rho_U\,\sqrt{\frac{2\lambda}{(2-\lambda)(m-1)}[1-(1-\lambda)^{2n}]}\;,\text{ where } \rho_U \;=\; 2.836 \text{ by Exercise 5.16}$$

For detecting the mean shift, compute the charting statistics

$$E_{n,m} \;=\; \lambda\,\overline{X}_n \;+\; (1-\lambda)\;E_{n-1,m}\;,\text{ where } E_0 \;=\; \mu_0 \;=\; 1$$

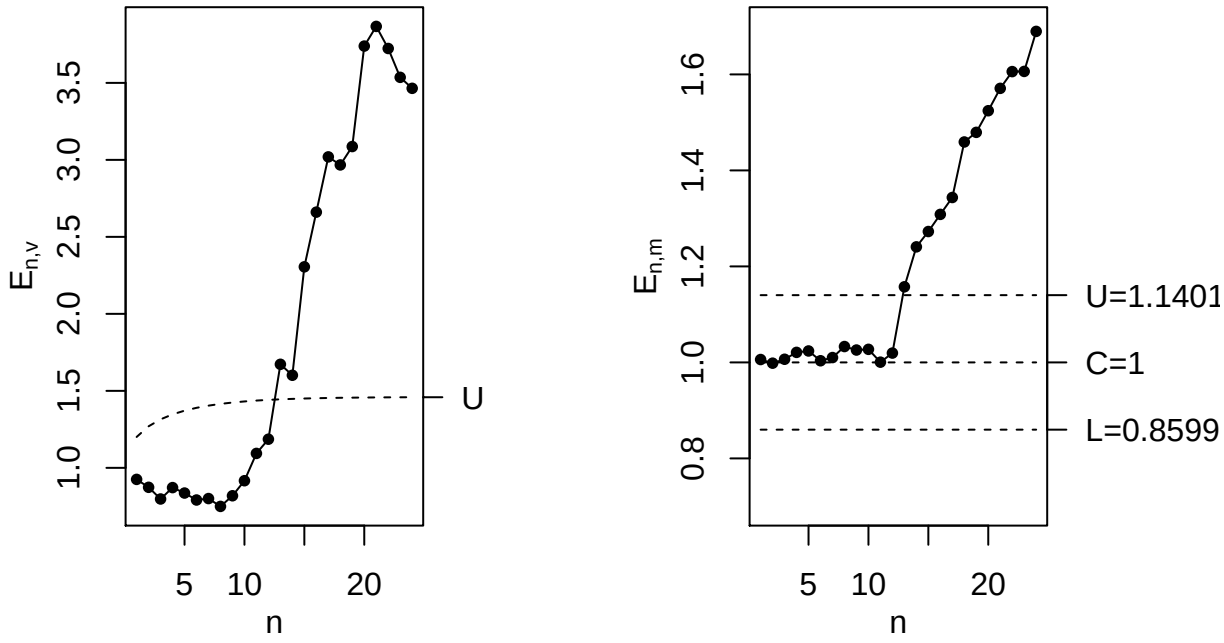
The control limits of the EWMA chart for detecting a mean shift is given by

$$\begin{aligned} U \;&=\; \mu_0 \;+\; \rho\sqrt{\frac{\lambda}{2-\lambda}}\;\frac{\sigma_0}{\sqrt{m}} \\ C \;&=\; \mu_0 \\ L \;&=\; \mu_0 \;-\; \rho\sqrt{\frac{\lambda}{2-\lambda}}\;\frac{\sigma_0}{\sqrt{m}} \end{aligned}$$

The charting statistics, control limits, and the EWMA charts are shown as below.

$\bar{X}_n$	S_n	$E_{n,v}$	U_v	$E_{n,m}$	U_m	C_m	L_m
1.06	0.25	0.9250	1.2005	1.0060	1.1401	1	0.8599
0.93	0.32	0.8735	1.2698	0.9984	1.1401	1	0.8599
1.08	0.17	0.7977	1.3149	1.0066	1.1401	1	0.8599
1.15	0.62	0.8717	1.3472	1.0209	1.1401	1	0.8599
1.05	0.36	0.8363	1.3713	1.0238	1.1401	1	0.8599
0.82	0.31	0.7911	1.3897	1.0034	1.1401	1	0.8599
1.07	0.47	0.8004	1.4040	1.0101	1.1401	1	0.8599
1.24	0.27	0.7495	1.4153	1.0331	1.1401	1	0.8599
0.96	0.60	0.8186	1.4241	1.0258	1.1401	1	0.8599
1.04	0.67	0.9163	1.4312	1.0272	1.1401	1	0.8599
0.76	0.82	1.0936	1.4368	1.0005	1.1401	1	0.8599
1.19	0.71	1.1859	1.4413	1.0194	1.1401	1	0.8599
2.40	1.23	1.6725	1.4449	1.1575	1.1401	1	0.8599
1.99	0.49	1.6012	1.4479	1.2407	1.1401	1	0.8599
1.56	1.47	2.3055	1.4502	1.2727	1.1401	1	0.8599
1.63	1.21	2.6606	1.4521	1.3084	1.1401	1	0.8599
1.66	1.25	3.0195	1.4536	1.3436	1.1401	1	0.8599

$\bar{X}_n$	S_n	$E_{n,v}$	U_v	$E_{n,m}$	U_m	C_m	L_m
2.50	0.79	2.9672	1.4548	1.4592	1.1401	1	0.8599
1.66	1.02	3.0866	1.4558	1.4793	1.1401	1	0.8599
1.93	1.55	3.7390	1.4566	1.5244	1.1401	1	0.8599
1.99	1.12	3.8668	1.4573	1.5709	1.1401	1	0.8599
1.92	0.78	3.7235	1.4578	1.6058	1.1401	1	0.8599
1.61	0.68	3.5361	1.4582	1.6062	1.1401	1	0.8599
2.44	0.84	3.4648	1.4586	1.6896	1.1401	1	0.8599



We detect the upward variance shift at the 13th time point, detect the mean shift at the 13th time point.