2024 Spring – SPC&O HW#9

1. Use the thickness data (24Spring-HW#4.xls).
   (a) Assume that μ_0=350 and $\mu_1=\mu_0+\sigma_{\bar{x}}$ where $\sigma_{\bar{x}}$ is estimated by $s_{\bar{x}}$ of the first 45 wafers of the center zone. Construct the tabular sequential likelihood ratio test (slide 32 of SPCO2.2) to test the average thickness $\overline{X}$ of the last 40 wafers of the center zone with α=0.002 and β=0.2 and compare it to the $\bar{X}$ chart in 1(g) of HW#7
   (b) Assume that μ_0=350 and $\sigma_{\overline{X}}$ is estimated by $s_{\bar{x}}$ of the first 45 wafers of the center zone. Construct a "graphical" Tabular CUSUM charts (like the one on slide 36 of SPCO2.2.pdf) for the wafer thickness average $\overline{X}$ with the (k, h)=(0.5, 5) and (0.3, 7), respectively, to monitor the last 40 wafers of the center zone. Compare the two CUSUM control charts to the sequential likelihood ration test in (a). Estimate the change point and the new shifted process mean if there are out-of-control signals.
   (c) Design an optimal Tabular CUSUM chart with δ^*=1.5 $\sigma_{\overline{X}}$ and ARL$_0$=300. What would be the ARL$_1$ if the mean is shifted by 0.5 $\sigma_{\overline{X}}$, 1.0 $\sigma_{\overline{X}}$, 1.5 $\sigma_{\overline{X}}$, or 2.0 $\sigma_{\overline{X}}$. Using the $\sigma_{\overline{X}}$ estimated by $s_{\bar{x}}$ of the first 45 wafers of the center zone, construct the optimal CUSUM chart to monitor the last 40 wafers. Estimate the change point and the new shifted process mean if there are out-of-control signals.