2019 Spring – SPC&O HW#11

1. For the problem of "Glove Box Door Alignment" experiment to achieve parallelism equal to zero,
   (a) Calculate the nominal SN ratios ($10\log_{10}(\mu^2/s^2)$) of the parallelisms of the experimental results and all the main and interaction effects on the parallelism SN ratio. Use the third- and fourth-order interaction effects to estimate s_{effect} and test which main and two-factor interaction effects are significant (α=0.01);
   (b) With the s_{effect} and assuming no effects, plot the Q-Q plot of the factor effects and visually determine which factors may have effects on the SN ratio;
   (c) Build a regression model on the parallelism SN ratio using factors with significant effects;
   (d) Use the model built in (c) to determine the optimum settings to minimize the variability in the parallelism and then use the model on page 61 of SPCO6 to minimize the parallelism to zero.
   (e) Repeat (a) to (c) to build a regression model on the **smaller-the-better SN ratio** ($-10\log_{10}(\Sigma X_i^2/n)$) of the parallelism. Determine the optimum settings to maximize the smaller-the-better SN ratio and compare the results to (d)

2. For the yield problem in Problem 4 of hw#10,
   (a) With the model built in (d) of HW#10 Problem 4, perform the residual analysis including Q-Q plot, residual plots vs. run order, $\hat{y}$, $\bar{y}$, x_i.
   (a) Perform Bartletts' test with α=0.1 for the variance of the replicates.
   (b) Calculate the nominal SN ratios ($10\log_{10}(\mu^2/s^2)$) of the yield of the experimental results and all the main and interaction effects on the yield SN ratio. Use the smallest two-factor interaction and the three-factor interaction effects to estimate s_{effect} and test which main and two-factor interaction effects are significant (α=0.01);
   (c) With the s_{effect} and assuming no effects, plot the Q-Q plot of the factor effects and visually determine which factors may have effects on the SN ratio;
   (d) Build a regression model on the yield SN ratio using factors with significant effects;
   (e) Use the model built in (d) to determine the optimum settings that minimize the variability in the yield and then use the model built in (d) of HW#10 Problem 4 to achieve a 100% yield.
   (f) Repeat (b) to (d) to build a regression model on the **SN ratio** ($-10\log_{10}(\Sigma(100-X_i)^2/n)$) of the yield. Determine the optimum settings to maximize the SN ratio and compare the results to (e).