2.830J / 6.780J / ESD.63J Control of Manufacturing Processes (SMA 6303)
Spring 2008

6.780 Quiz 2 study guide
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Topic	Notes	References
ADVANCED SPC		
Moving Averages	Windowed Exponentially-weighted (EWMA)	L9 Ss 6–16
Cumulative sum charts		L9 Ss 17–24
Multivariate charts	Chi-square Hotelling T^2	L9 Ss 38–45 L9 Ss 16–49
YIELD		
Definitions	• Functional yield • Parametric yield	L10 [Non-standard or device-specific situations]
Concept of critical area		
Murphy yield model		
Clustering	Large α = little clustering Small α = lots of clustering	
ANOVA		
	Fixed effects model	Lecture 11
	Degrees of freedom	
FULL/FRACTIONAL FACTORIAL MODELS; DoE; REGRESSION	• Contrasts • Sums of squares – they add up (why?) • Projection to estimate effects from fractional-factorial designs • Aliasing	Lecture 12 Lecture 13 Lecture 14
Estimating residuals; dealing with replicates or a lack of them	• When you have replicates of corner points • Using replicated center points • By discarding factors and using their SS (but need to be happy that discarded factor is insignificant *e.g.* 3-way interaction) • Residual distribution should be normal, homoskedastic	PS6 Problem 1 PS7 Problem 2 ** PS6 Problem 4 ** plus Excel example From Lec 13
Identifying significant effects	• Normal probability plots (care needed) • Using ANOVA (but need SS_E estimate first)	e.g PS7 Problem 2
Curvature testing	• Estimate SS_R (residuals); then: $\bar{y}_F$ = grand mean of all factorial runs $\bar{y}_C$ = grand mean of all center point runs $SS_{Quadratic} = \frac{n_F n_C (\bar{y}_F - \bar{y}_C)^2}{n_F + n_C}$ $MS_{Quadratic} = \frac{SS_{Quadratic}}{n_c}$ • Define $F_0 = MS_{quadratic}/MS_{residual}$	Montgomery Ex 12-9; Excel example (from Lec 13)

Lack-of-fit testing	Possible when one or more effects has been disregarded. Curvature testing as a 'special' kind of lack-of-fit analysis, $SS_R = SS_L + SS_E$ $\frac{s_L^2}{s_E^2} \sim F_{\nu_L,\nu_E}$	Lecture 15
Model fitting	• From effects • Coefs directly from data (*write down formulae*)	Lecture 12, 13 May and Spanos §8.1
Confidence intervals	• Note formulae for variance of parameters	M+S section 8.1
PROCESS ROBUSTNESS		Lecture 16
NESTED VARIANCE	• Formulae for contamination of variance • Subtleties of performing the analysis • Requirements: random sampling	Drain Problem 4