Homework 1

1. In the following table, "S" represents the standard setting and "M" represents the modified setting in an experiment studying the effect of three factors (A, B and C) on the lifetime of ball bearings under accelerated testing. Which 4 runs would be used in a one-at-a-time design? Would the one-at-a-time design fail to detect any experimental effects that a full factorial design would detect? Use a cube plot to help in answering this question.

Factor settings	Response (hrs)
(S,S,S)	17
(M,S,S)	26
(S,M,S)	25
(M,M,S)	85
(S,S,M)	19
(M,S,M)	16
(S,M,M)	21
(M,M,M)	128

2. In the following table, three factors are thought to affect the bonding strength of an integrated circuit board: Adhesive Type (D2A, H-1-E), Conductor Material (Cu, Tin), and Post Coating (Tin, Silver). Each combination of factors was replicated 5 times.

 (a) Compute the mean, range, variance and standard deviation of the 5 observations in each cell. Construct cube plots treating each of these summary statistics as response variables. Use the cube plots to answer the following questions.

 (b) Based on the *location* observed for each factor setting, which factors seem to affect the mean? Which settings would maximize the mean?

 (c) Undergraduates should select a single measure of variation in answering the following questions; graduate students should select range and one other measure of variation and note any discrepancies. Based on the *variation* observed for each factor setting, which factors seem to affect variation? Which settings result in the least variation?

Factor settings	Response (psi)
(D2A,Cu,Tin)	73.0,73.2,72.8,72.2,76.2
(H-1-E,Cu,Tin)	78.0,75.5,83.1,81.2,79.9
(D2A,Ni,Tin)	79.8,77.8,81.3,79.8,78.2
(H-1-E,Ni,Tin)	78.4,72.8,80.5,78.4,67.9
(D2A,Cu,Silver)	87.7,86.4,86.9,87.9,86.4
(H-1-E,Cu,Silver)	85.2,85.0,80.4,85.2,83.6
(D2A,Ni,Silver)	80.5,81.4,82.6,81.3,82.1
(H-1-E,Ni,Silver)	90.2,87.4,92.9,90.0,91.1