

Computational Statistics

Problem Set 2

1. An electronics engineer is interested in the effect on tube conductivity of five different types of coating used for cathode ray tubes used in a telecommunications system display device. The following conductivity data are observed.

Coating Type	Conductivity			
1	143	141	150	146
2	152	149	137	143
3	134	133	132	127
4	129	127	132	129
5	147	148	144	142

- (a) Is there any difference in conductivity due to coating type? (Use $\alpha = 0.05$.)
 - (b) Estimate overall mean and the treatment effects.
 - (c) Compute 95% confidence interval estimate of the mean of coating type 1.
 - (d) Compute 99% confidence interval estimate of the difference of means of types 2 and 4.
 - (e) Perform residual analysis and discuss if the model selection is justified.
 - (f) Test all pairs of means using Turkey's test with $\alpha = 0.05$.
 - (g) Assuming that the coating type 4 is currently in use, what are your recommendations to the manufacturer? (The lesser the conductivity the better for user.)
2. A manufacturer suspects that the batches of raw material furnished by his supplier differ significantly in calcium content. The five batches that have arrived today from the supplier are used to analyze the quality of the raw material. The data obtained for the calcium content is as follows:

Batch 1	Batch 2	Batch 3	Batch 4	Batch 5
23.46	23.59	23.52	23.28	23.29
23.48	23.46	23.64	23.40	23.46
23.56	23.42	23.46	23.37	23.37
23.39	23.49	23.52	23.46	23.32
23.40	23.50	23.49	23.39	23.38

- (a) Is there significant variation in calcium content from batch to batch. (Use $\alpha = 0.05$)

- (b) Analyze the residuals from the experiment. Are all the assumptions in analysis of variance satisfied?
 - (c) Compute 99% confidence interval for calcium content in Batch 3 and Batch 5.
3. Consider testing the equality of the means of two normal populations where variance are unknown but assumed to be equal. The appropriate test procedure is two sample t-test. Show that the two sample t-test is equivalent to the one-way classification analysis of variance.
4. Four different designs for a digital circuit are being studied to compare the amount of noise present. The following data have been observed.

Circuit Design	Noise					
1	19	20	19	30	8	16
2	80	61	73	56	80	73
3	47	26	25	35	50	32
4	95	46	83	78	97	87

- (a) Draw the box plots to represent the noise data for each circuit design.
- (b) Is the same amount of noise present for all four designs? (Use $\alpha = 0.01$)
- (c) Analyze the residuals from the experiment. Are all the assumptions in analysis of variance satisfied?
- (d) Which circuit design would you select for use?