Department of Computer Science, University of Karachi

BSCS: 306: Probability and Statistical Methods

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Assignment: 12: Analysis of Variance (ANOVA)

Q.1. Scroll speed is an important consideration in the development of color graphics cards. A study was conducted to compare the time, in seconds, required to scroll one screen of WORD documents using five different color graphics cards with 24-inch monitors. The test conducted was a standard Hydra Quick Draw performance test.

A	B	C	D	E
30.5	48.3	79.2	51.6	79.0
32.4	42.1	84.7	59.4	85.3
27.2	43.5	85.0	57.3	86.2
26.3	40.6	88.2	59.0	82.0
25.1	38.6	76.3	58.7	87.2
38.2	32.1	83.1	68.1	81.7
30.6	41.6	92.6	64.8	93.5
33.7	38.8	88.5	55.5	89.1

Test at 95% confidence that the five scroll speed for different color graphic card is same.

Q.2. Three different teaching methods are being used to teach Statistics. Method I is the classical lecture-recitation method with three 50-minute lectures per week. Method II comprises one 75-minute lecture and two 45-minute problem sessions per week. Method III is a self paced, or programmed, instruction approach. A random sample of students taught by each method is given a standard test, the highest score of which is 15. The results of that test are given here. Determine whether the students taught by three methods have significant different scores on the test. If the scores are significantly different (at α = 5%), determine which methods differ from one and another.

Method		
I	II	III
12.31	12.10	12.54
12.54	13.00	12.64
13.18	13.09	12.81
12.56	12.55	12.06
12.08	12.04	12.78
12.28	12.50	13.00
	12.67	12.98
	13.12	11.79
	12.25	13.34
		11.86
		11.74
		13.33

Q.3. The tensile strength of Portland cement is being studied. Four different mixing techniques can be used economically. The following data have been collected.

Mixing Techniques	Tensile Strength (lb/in.^{2})			
1	3129	3000	2865	2890
2	3200	3300	2975	3150
3	2800	2900	2985	3050
4	2600	2700	2600	2765

Test the hypothesis that mixing techniques affect the strength of the cement. Use $\alpha = 0.05$.

Q.4. An experiment was run to determine whether four specific firing temperatures affect the density of a certain type of brick. The experiment led to the following data:

Temperature	Density			
100	21.8	21.9	21.7	21.6
125	21.7	21.4	21.5	21.4
150	21.9	21.8	21.8	21.6
175	21.9	21.7	21.8	21.4

Does the firing temperatures affect the density of the bricks? Compare the means using Duncan's multiple range tests?

Q.5. Five different copper- silver alloys are being considered for the conducting material in large coaxial cables, for which conductivity is a very important material characteristic. Because of differing availabilities of the five kinds, it was impossible to make as many samples from alloys 2 and 3 as from other alloys. Given next is the coded conductivity Measurements from samples of wire made from each of the alloys. Determine whether the alloys have significantly different conductivities. If the conductivities are significantly different (at $\alpha = 0.05$). Determine which alloys differ from one another.

Alloy				
T1	T2	T3	T4	T5
60.60	58.88	62.90	62.72	57.93
58.93	59.43	63.63	60.41	59.85
58.40	59.30	62.33	59.60	61.06
58.63	56.97	63.27	59.79	57.31
60.64	58.02	61.25	59.72	61.28
59.05	58.59	62.67	62.35	59.68
59.93	60.19	61.29	60.26	57.82
60.82	57.99	60.77	60.53	59.29
58.77	59.24		58.91	58.65
59.15	57.38		58.55	61.96
64.40			61.20	57.96
59.00			59.73	59.42
			60.12	59.40
			60.49	60.30
				60.15

Formulae

$S.S.T. = \sum_{i=1}^{n}\sum_{j=1}^{k}\left(y_{ij} - \bar{y}\right)^2$ = sum of squared values – Correction Factor;

$S.S.Tr. = n\sum_{i=1}^{k}\left(\bar{y}_j - \bar{y}\right)^2$ =(sum of squared means)/ No. of values in each column - Correction Factor;

$S.S.E. = \sum_{i=1}^{n}\sum_{i=1}^{k}\left(y_{ij} - \bar{y}_j\right)^2$

S.S.E. = S.S.T. – SS.Tr.;

$\text{MS.Tr} = \frac{\text{S.S.Tr.}}{\text{k - 1}}$; $\text{MSE} = \frac{SSE}{N-k}$ *and* $F_{cal} = \frac{MS.Tr.}{MSE}$