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Economics 240A

Problem set 7

[15.44]

- Here we use two-factor analysis of variance, where the two factors are Alloy type and machine type. Each of them has two levels, making there be a total of 4 means.
- $H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4$
  $H_1 : two\_means\_differ$
- Running the test in excel we get:

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	10	4409.973	440.9973	1.185214456
Column 2	10	4401.25	440.125	1.010683556
Column 3	10	4422.141	442.2141	0.682617878
Column 4	10	4414.409	441.4409	1.4734941

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	22.83015087	3	7.610050291	6.994515464	0.000795152	2.866265557
Within Groups	39.1680899	36	1.088002497			
Total	61.99824077	39				

- This clearly shows that there is indeed difference between the means. (Significant F statistic) Now we conduct the second test which will let us know what causes the difference (is it the Machine type, alloy type or both?)
- Running it in excel we get:
- Running the two way ANOVE analysis we get:

Anova: Two-Factor With Replication

SUMMARY	Machine 1	Machine 2	Total
Alloy A			
Count	10	10	20
Sum	4409.973	4401.25	8811.223
Average	440.9973	440.125	440.56115
Variance	1.185214456	1.010683556	1.240400976
Alloy B			
Count	10	10	20
Sum	4422.141	4414.409	8836.55
Average	442.2141	441.4409	441.8275
Variance	0.682617878	1.4734941	1.178642053
Total			
Count	20	20	
Sum	8832.114	8815.659	
Average	441.6057	440.78295	
Variance	1.274394853	1.63239805	

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Sample	16.03642322	1	16.03642322	14.73932575	0.000480701
Columns	6.769175624	1	6.769175624	6.221654493	0.017347947
Interaction	0.024552028	1	0.024552028	0.02256615	0.881429297
Within	39.1680899	36	1.088002497		
Total	61.99824077	39			

- In the above table, Sample refers to the Alloy type and Columns refer to the Machine type.
- Based upon the F statistic, there is enough evidence (with 5% significance level) to conclude that Alloy types are sources of variation
- Also based upon the F statistic we can conclude that there is enough evidence that machine types are a source of variation.
- However we cannot conclude that there is any interaction between machine types and alloy types based on the F statistic.