**Solutions for HW No 1**

1. Assuming that the variances are equal, do not reject H0, since

 

1. Do not reject. There is no evidence to indicate that the new filtering device has affected the mean, since



1. (a) *H*0: 21 = 2 versus *H*1: 21 2

, assuming that the data is normally distributed.

The test statistic is: , reject if 

1. 

🡪 *z*0 = -1.05; using α=0.05, , do not reject.

1. Yes, the *F*-value is 14.76 with a corresponding *P*-value of 0.000. The percentage of cotton in the fiber appears to have an affect on the tensile strength.

**One-way ANOVA: Tensile Strength versus Cotton Percentage**

Analysis of Variance for Tensile

Source DF SS MS F P

Cotton P 4 475.76 118.94 14.76 0.000

Error 20 161.20 8.06

Total 24 636.96

1. The residual plots below show nothing unusual.





1. Yes, there is a difference in means. Refer to the Design-Expert output below..

**Design Expert Output**

**ANOVA for Selected Factorial Model**

**Analysis of variance table [Partial sum of squares]**

**Sum of** **Mean** **F**

**Source** **Squares** **DF** **Square** **Value** **Prob > F**

Model 844.69 3 281.56 14.30 0.0003 significant

*A* *844.69* *3* *281.56* *14.30* *0.0003*

Residual 236.25 12 19.69

*Lack of Fit* *0.000* *0*

*Pure Error* *236.25* *12* *19.69*

Cor Total 1080.94 15

The Model F-value of 14.30 implies the model is significant. There is only

a 0.03% chance that a "Model F-Value" this large could occur due to noise.

**Treatment Means (Adjusted, If Necessary)**

**Estimated** **Standard**

**Mean** **Error**

1-1 145.00 2.22

2-2 145.25 2.22

3-3 132.25 2.22

4-4 129.25 2.22

**Mean** **Standard** **t for H0**

**Treatment** **Difference** **DF** **Error** **Coeff=0** **Prob > |t|**

1 vs 2 -0.25 1 3.14 -0.080 0.9378

1 vs 3 12.75 1 3.14 4.06 0.0016

1 vs 4 15.75 1 3.14 5.02 0.0003

2 vs 3 13.00 1 3.14 4.14 0.0014

2 vs 4 16.00 1 3.14 5.10 0.0003

1. vs 4 3.00 1 3.14 0.96 0.3578
2. Estimate the overall mean and the treatment effects.



(c) Compute a 95 percent interval estimate of the mean of coating type 4. Compute a 99 percent interval estimate of the mean difference between coating types 1 and 4.

Treatment 4: 



Treatment 1 - Treatment 4: 



(d) Test all pairs of means using the Fisher LSD method with *α*=0.05.

Refer to the Design-Expert output above. The Fisher LSD procedure is automatically included in the output.

The means of Coating Type 2 and Coating Type 1 are not different. The means of Coating Type 3 and Coating Type 4 are not different. However, Coating Types 1 and 2 produce higher mean conductivity than does Coating Types 3 and 4.

1. Use the graphical method discussed in Section 3.5.3 to compare the means. Which coating produces the highest conductivity?

 Coating types 1 and 2 produce the highest conductivity.



1. Assuming that coating type 4 is currently in use, what are your recommendations to the manufacturer? We wish to minimize conductivity.

Since coatings 3 and 4 do not differ, and as they both produce the lowest mean values of conductivity, use either coating 3 or 4. As type 4 is currently being used, there is probably no need to change.