Practice Filling ANOVA tables

Experiment to test the ultimate strength of stainless steel, steel alloy and titanium alloy:
An experiment was conducted to test the ultimate strength (in MPa's) of random samples of stainless steel, steel alloy and titanium alloy.

Source of variation	Sum of Squares	df	Mean Square	F	Sig
Between Groups	18110.08	2	905.0400	5.66	0.014
Within Groups	25605.71	16	1600.3569		
Total	43715.79	18			

At the 5% significance level, what conclusion can you draw regarding the ultimate strength of the three materials?

(a) There is no significant difference in ultimate strength of the three materials.
(b) Ultimate strength of titanium alloy is greater than that of steel alloy but is not greater than that of stainless steel.
(c) Ultimate strength of Titanium alloy is greater than that of both steel alloy and stainless steel.
(d) All the means for ultimate strength of the three materials are different.
(e) At least two of the means for ultimate strength of the three materials are different.

Source of variation	Sum of Squares	df	Mean Square	F	Sig
Between Groups	557	5	111.4	5.550	
Within Groups	461.9	23	20.069		
Total	1018.9	28			

3.3 Multiple Comparisons

3.3.1 Tukey's Method

<table>
<tr><th>VigEx-RedNa</th><th>MEx-RNA</th><th>VigEx-TypNa</th><th>NoEx-RNa</th><th>ModEx-TypNa</th><th>NoEx-TypNa</th></tr>
<tr><td>131.75</td><td>137.88</td><td>139.88</td><td>145.38</td><td>148.88</td><td>154.38</td></tr>
<tr><td colspan="3">|________________________________|</td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="4">|____|</td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">|_________________________________|</td></tr>
</table>

Conclusion in words: It is estimated with 95% confidence that there is insufficient evidence of a difference in mean SBP between VigEx-RedNa, ModEx-RedNa, and VigEx-TyNa, nor between

ModEx-RedNa, VigEx-TypNa, NoEx-RedNa, and ModEx-TypNa, nor between NoEx-RedNa, ModEx-TypNa and NoEx-TypNa. All other pairds of means can be declared different.

3.3.2 Bonferroni's Method of Multiple Comparisons

Effect of Certain Diseases on Human Ventilation Rates.

Step 1: Number of multiple comparisons : $m = \frac{k(k-1)}{2} = 3$

Step 2:
Individual error rate: $\alpha_I = \frac{\alpha_F}{m} = \frac{0.05}{3} = 0.0167$

Step 3:
CV of t at df = n - k = 17 - 3 = 14
$\alpha_{I/2} = 0.008$
$t_{14,\,0.008} \approx t_{14,\,0.005} = 2.977$

Step 4:

$$ME_{ij} = t_{n-k,\alpha_{I/2}} \times \sqrt{MSE}\sqrt{\frac{1}{n_i} + \frac{1}{n_j}}$$

For μ_1 versus μ_2 : $ME_{1,2} = 2.977 \times \sqrt{\frac{17.21429}{17-3}}\sqrt{1/4 + 1/7} = 3.3011 \times 0.6268 = 2.069$
For μ_1 versus μ_3 : $ME_{1,3} = 3.3011 \times \sqrt{1/4 + 1/6} = 2.131$
For μ_2 versus μ_3 : $ME_{2,3} = 3.3011 \times \sqrt{1/7 + 1/6} = 1.836$

Step 5:
$\mu_i - \mu_j \neq 0$ if $|\bar{y}_i - \bar{y}_j| \geq ME$

	Cancer (1)	**Heart Disease (2)**	**Diabetes (3)**
Cancer (1)	---		
Heart Disease (2)	2.57 > 2.069 *		
Diabetes (3)	1.5 < 2.131	1.07 < 1.836	

(*) indicates pairwise comparison that can be declared different.

Step 6:
Means comparison diagram:

Cancer	**Diabetes**	**Heart Disease**
12	13.5	14.57
|_________________|		
	|_________________|	

Step 7: Conclusion: It is estimated with 95% confidence that the mean is different for those with heart disease than from caner, but no other means can be declared different.