

More F Test Examples (part 1)

In all cases the full model has a separate mean for all 7 judges: μ_1 for judge A, μ_2 for judge B, \dots μ_6 for judge F, and μ_7 for Spock's judge.

We estimate this model with: `fit_full <- lm(Percent ~ Judge, data = juries)`

The sample size is $n = 46$, so the degrees of freedom for the full model is: $46 - 7 = 39$

Null Hypothesis	Reduced Model Groups	Reduced df, Extra df	R Code and Output																					
$\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = \mu_7$	1 group: <ul style="list-style-type: none">all judges	Reduced: 46-1=45 Extra: 45 - 39 = 6 7 - 1 = 6	<pre>anova(fit_full)</pre> <p>Analysis of Variance Table</p> <p>Response: Percent</p> <table><thead><tr><th></th><th>Df</th><th>Sum Sq</th><th>Mean Sq</th><th>F value</th><th>Pr(>F)</th></tr></thead><tbody><tr><td>Judge</td><td>6</td><td>1927.1</td><td>321.18</td><td>6.7184</td><td>6.096e-05 ***</td></tr><tr><td>Residuals</td><td>39</td><td>1864.5</td><td>47.81</td><td></td><td></td></tr></tbody></table>		Df	Sum Sq	Mean Sq	F value	Pr(>F)	Judge	6	1927.1	321.18	6.7184	6.096e-05 ***	Residuals	39	1864.5	47.81					
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$\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$	2 groups: <ul style="list-style-type: none">A,B,C,D,E,FSpock's Judge	Reduced: 46-2=44 Extra: 44 - 39 = 5 7 - 2 = 5	<pre>juries <- juries %>% mutate(judges_grouped = ifelse(Judge %in% c("A", "B", "C", "D", "E", "F"), "grouped", Judge)) fit_reduced <- lm(Percent ~ judges_grouped, data = juries) anova(fit_reduced, fit_full)</pre> <p>Analysis of Variance Table</p> <p>Model 1: Percent ~ judges_grouped Model 2: Percent ~ Judge</p> <table><thead><tr><th></th><th>Res.Df</th><th>RSS</th><th>Df</th><th>Sum of Sq</th><th>F</th><th>Pr(>F)</th></tr></thead><tbody><tr><td>1</td><td>44</td><td>2190.9</td><td></td><td></td><td></td><td></td></tr><tr><td>2</td><td>39</td><td>1864.5</td><td>5</td><td>326.46</td><td>1.3658</td><td>0.2582</td></tr></tbody></table>		Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)	1	44	2190.9					2	39	1864.5	5	326.46	1.3658	0.2582
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More F Test Examples (part 2)

In all cases the full model has a separate mean for all 7 judges: μ_1 for judge A, μ_2 for judge B, \dots μ_6 for judge F, and μ_7 for Spock's judge.

We estimate this model with: `fit_full <- lm(Percent ~ Judge, data = juries)`

The sample size is $n = 46$, so the degrees of freedom for the full model is: $46 - 7 = 39$

Null Hypothesis	Reduced Model Groups	Reduced df, Extra df	R Code and Output																					
$\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$	3 groups: <ul style="list-style-type: none">A,B,C,D,EFSpock's Judge	Reduced: 46-3=43 Extra: 43 - 39 = 4 7 - 3 = 4	<pre>juries <- juries %>% mutate(judges_grouped = ifelse(Judge %in% c("A", "B", "C", "D", "E"), "grouped", Judge)) fit_reduced <- lm(Percent ~ judges_grouped, data = juries) anova(fit_reduced, fit_full)</pre> <p>Analysis of Variance Table</p> <p>Model 1: Percent ~ judges_grouped Model 2: Percent ~ Judge</p> <table><thead><tr><th></th><th>Res.Df</th><th>RSS</th><th>Df</th><th>Sum of Sq</th><th>F</th><th>Pr(>F)</th></tr></thead><tbody><tr><td>1</td><td>43</td><td>2104.7</td><td></td><td></td><td></td><td></td></tr><tr><td>2</td><td>39</td><td>1864.5</td><td>4</td><td>240.28</td><td>1.2565</td><td>0.3035</td></tr></tbody></table>		Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)	1	43	2104.7					2	39	1864.5	4	240.28	1.2565	0.3035
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$\mu_1 = \mu_2 = \mu_3 = \mu_4$	4 groups: <ul style="list-style-type: none">A,B,C,DEFSpock's Judge	Reduced: 46-4=42 Extra: 42 - 39 = 3 7 - 4 = 3	<pre>juries <- juries %>% mutate(judges_grouped = ifelse(Judge %in% c("A", "B", "C", "D"), "grouped", Judge)) fit_reduced <- lm(Percent ~ judges_grouped, data = juries) anova(fit_reduced, fit_full)</pre> <p>Analysis of Variance Table</p> <p>Model 1: Percent ~ judges_grouped Model 2: Percent ~ Judge</p> <table><thead><tr><th></th><th>Res.Df</th><th>RSS</th><th>Df</th><th>Sum of Sq</th><th>F</th><th>Pr(>F)</th></tr></thead><tbody><tr><td>1</td><td>42</td><td>2016.9</td><td></td><td></td><td></td><td></td></tr><tr><td>2</td><td>39</td><td>1864.5</td><td>3</td><td>152.5</td><td>1.0633</td><td>0.3758</td></tr></tbody></table>		Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)	1	42	2016.9					2	39	1864.5	3	152.5	1.0633	0.3758
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