More F Test Examples (side 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, $\cdots$ μ_6 for judge F, and μ_7 for Spock's judge.

We estimate this model with: `spock_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: • all judges	Reduced: 46-1=45 Extra: 45 - 39 = 6 7 - 1 = 6	**anova(spock_fit_full)** Analysis of Variance Table Response: Percent 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
$\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = \mu_7$	1 group: • all judges	Reduced: 46-1=45 Extra: 45 - 39 = 6 7 - 1 = 6	**spock_fit_reduced <- lm(Percent ~ 1, data = juries)** **anova(spock_fit_reduced, spock_fit_full)** Analysis of Variance Table Model 1: Percent ~ 1 Model 2: Percent ~ Judge Res.Df RSS Df Sum of Sq F Pr(>F) 1 45 3791.5 2 39 1864.4 6 1927.1 6.7184 6.096e-05 ***
$\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$	2 groups: • A,B,C,D,E,F • Spock's Judge	Reduced: 46-2=44 Extra: 44 - 39 = 5 7 - 2 = 5	**juries <- juries %>%** **mutate(** **judges_grouped = ifelse(** **Judge %in% c("A", "B", "C", "D", "E", "F"),** **"grouped", Judge)** **)** **spock_fit_reduced <- lm(Percent ~ judges_grouped, data = juries)** **anova(spock_fit_reduced, spock_fit_full)** Analysis of Variance Table Model 1: Percent ~ judges_grouped Model 2: Percent ~ Judge 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

More F Test Examples (side 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, $\cdots$ μ_6 for judge F, and μ_7 for Spock's judge.

We estimate this model with: `spock_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:
	• A,B,C,D,E
	• F
	• Spock's Judge
		Reduced:
		46-3=43
		
		Extra:
		43 - 39 = 4
		7 - 3 = 4
			`juries <- juries %>%`
			`  mutate(`
			`    judges_grouped = ifelse(`
			`      Judge %in% c("A", "B", "C", "D", "E"),`
			`      "grouped", Judge)`
			`  )`
			`spock_fit_reduced <- lm(Percent ~ judges_grouped, data = juries)`
			`anova(spock_fit_reduced, spock_fit_full)`
			
			`Analysis of Variance Table`
			
			`Model 1: Percent ~ judges_grouped`
			`Model 2: Percent ~ Judge`
			`  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`

$\mu_1 = \mu_2 = \mu_3 = \mu_4$	4 groups:
	• A,B,C,D
	• E
	• F
	• Spock's Judge
		Reduced:
		46-4=42
		
		Extra:
		42 - 39 = 3
		7 - 4 = 3
			`juries <- juries %>%`
			`  mutate(`
			`    judges_grouped = ifelse(`
			`      Judge %in% c("A", "B", "C", "D"),`
			`      "grouped", Judge)`
			`  )`
			`spock_fit_reduced <- lm(Percent ~ judges_grouped, data = juries)`
			`anova(spock_fit_reduced, spock_fit_full)`
			
			`Analysis of Variance Table`
			
			`Model 1: Percent ~ judges_grouped`
			`Model 2: Percent ~ Judge`
			`  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`