

Tamhane's T2 Unequal-Variance Post Hoc Analysis

Workflow:

1. Load dataset.csv from the Tamhanes T2 folder.
2. Select dependent variable and grouping factor.
3. Check descriptive statistics, Levene/Brown-Forsythe context, classic ANOVA, and Welch ANOVA.
4. Run Tamhane's T2-style pairwise tests using Welch SE, Welch df, and Sidak adjusted p-values.
5. Treat SPSS /POSTHOC=TAMHANE output as the official software reference when available.

Interpretation summary:

dependent_variable	group_variable	method	why_this_method	groups	total_n	largest_variance_ratio	levene_p_value	welch_anova_p_value	classic_anova_p_value	significant_tamhane_pairs_alpha_0_05	total_pairwise_comparisons	smallest_tamhane_adjusted_p_value	overall_sentence	official_reference_note
G3	studytime	Tamhane's T2 unequal-variance post hoc test	Use when comparing group means under unequal variances and/or unequal sample sizes.	4	649	1.680029	0.380358	5.188109e-10	5.705728e-10	4	6	1.024187e-10	Tamhane's T2 found 4 significant pairwise difference(s) out of 6 comparisons at alpha = .05. When SPSS output is available, report SPSS /POSTHOC=TAMHANE results as the official table.	

Group summary:

group	n	mean	standard_deviation	standard_error	variance	minimum	maximum	welch_weight_n_over_variance	ci95_low_unadjusted	ci95_high_unadjusted
1	212	10.844340	3.218624	0.221056	10.359541	0.0	18.0	20.464227	10.411070	11.277609
2	305	12.091803	3.243125	0.185701	10.517860	0.0	19.0	28.998294	11.727830	12.455777
3	97	13.226804	2.502104	0.254050	6.260524	8.0	18.0	15.493911	12.728866	13.724742
4	35	13.057143	3.038410	0.513585	9.231933	6.0	19.0	3.791189	12.050516	14.063769

Welch ANOVA context:

test	weighted_grand_mean	f_statistic	df_num	df_den	p_value	alpha	decision_alpha_0_05	method_note
Welch one-way ANOVA context for unequal variances	12.029503	18.182877	3	139.100569	5.188109e-10	0.05	Reject equal means	Welch ANOVA is an unequal-variance omnibus context before Tamhane's T2 pairwise follow-up.

Levene/Brown-Forsythe context:

context_test	statistic	p_value	alpha	variance_decision_alpha_0_05	interpretation
Median-centered Levene / Brown-Forsythe variance context	1.026312	0.380358	0.05	No strong unequal-variance evidence	Levene is not significant; Tamhane's T2 remains valid but may be conservative.

Tamhane's T2 pairwise comparison table

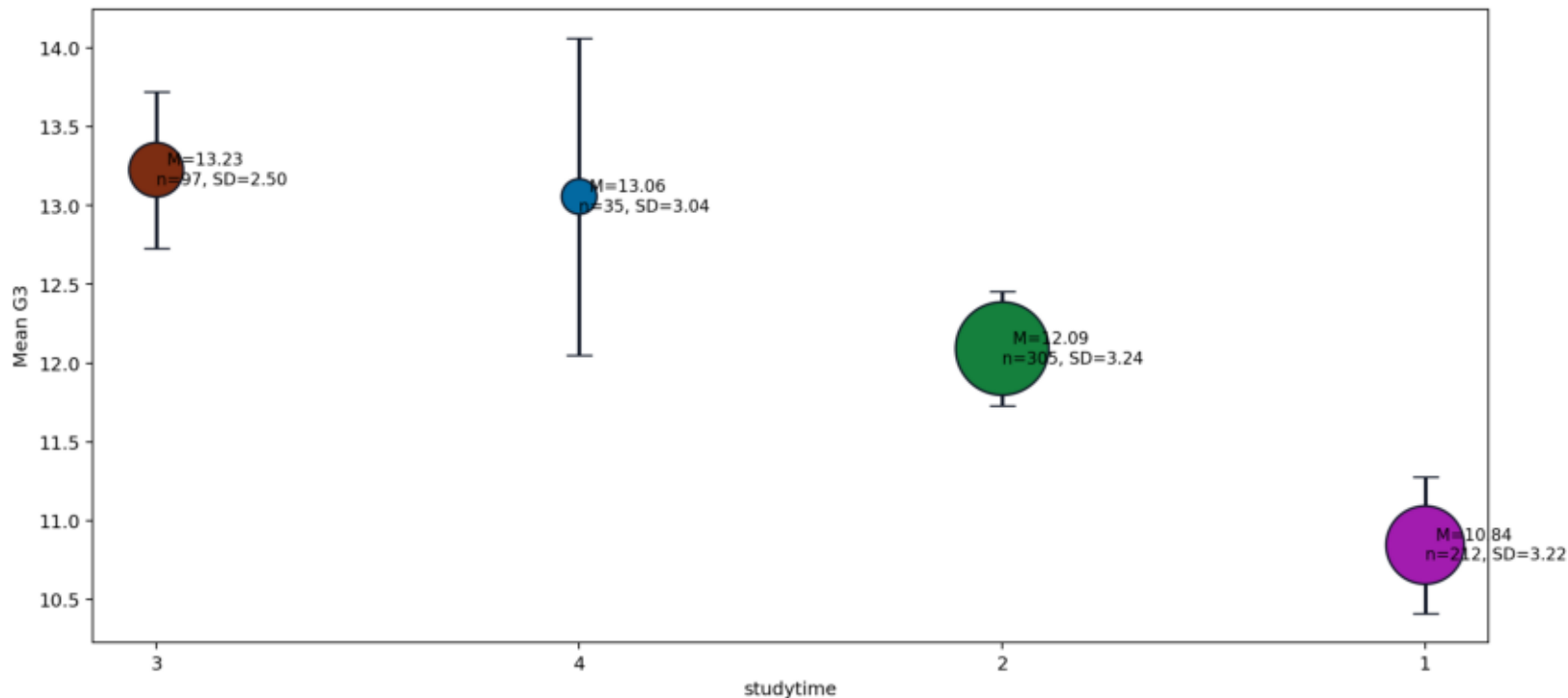
comparison_order	lower_mean_group	higher_mean_group	lower_mean	higher_mean	mean_difference_high_minus_low	standard_error_welch	welch_satterthwaite_df	t_statistic_abs	unadjusted_two_sided_p_value	number_of_pairwise_comparisons	sidak_alpha_per_comparison	t_critical_sidak_adjusted	tamhane_t2_sidak_adjusted_p_value	adjusted_ci_low	adjusted_ci_high	decision_alpha_0_05	method_note
1	1	2	10.844340	12.091803	1.247464	0.288705	456.197905	4.320895	1.908767e-05	6	0.008512	2.642508	1.145205e-04	0.484559	2.010369	Significant	Tamhane's T2-style unequal-variance pairwise comparison using Welch SE, Welch df, and Sidak adjustment; SPSS Tamhane output is official
2	1	4	10.844340	13.057143	2.212803	0.559138	47.501844	3.957526	2.518983e-04	6	0.008512	2.745163	1.510438e-03	0.677879	3.747728	Significant	Tamhane's T2-style unequal-variance pairwise comparison using Welch SE, Welch df, and Sidak adjustment; SPSS Tamhane output is official
3	1	3	10.844340	13.226804	2.382465	0.336760	235.085651	7.074668	1.706981e-11	6	0.008512	2.653381	1.024187e-10	1.488912	3.276017	Significant	Tamhane's T2-style unequal-variance pairwise comparison using Welch SE, Welch df, and Sidak adjustment; SPSS Tamhane output is official
4	2	4	12.091803	13.057143	0.965340	0.546127	43.388409	1.767611	8.415812e-02	6	0.008512	2.756456	4.099035e-01	-0.540035	2.470714	Not significant	Tamhane's T2-style unequal-variance pairwise comparison using Welch SE, Welch df, and Sidak adjustment; SPSS Tamhane output is official
5	2	3	12.091803	13.226804	1.135001	0.314684	207.303759	3.606791	3.884732e-04	6	0.008512	2.656402	2.328577e-03	0.299072	1.970929	Significant	Tamhane's T2-style unequal-variance pairwise comparison using Welch SE, Welch df, and Sidak adjustment; SPSS Tamhane output is official
6	4	3	13.057143	13.226804	0.169661	0.572984	51.580755	0.296101	7.683418e-01	6	0.008512	2.735807	9.998454e-01	-1.397913	1.737236	Not significant	Tamhane's T2-style unequal-variance pairwise comparison using Welch SE, Welch df, and Sidak adjustment; SPSS Tamhane output is official

Tamhane homogeneous subset letters

group	mean	tamhane_homogeneous_subset_letters
3	13.226804	A
4	13.057143	A
2	12.091803	B
1	10.844340	C

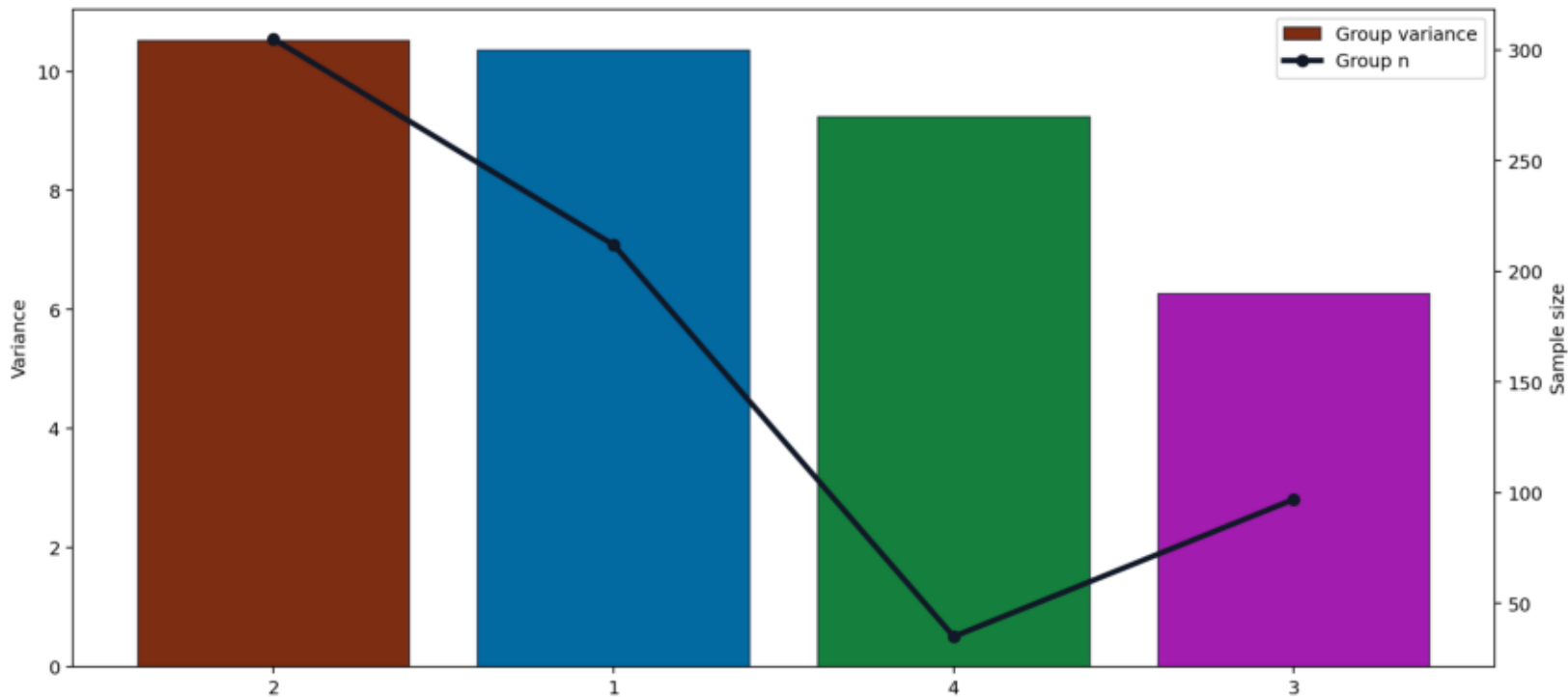
Tamhane's T2: Unequal-Variance Group Profile

Point size shows group n; error bars show unadjusted 95% mean intervals before Tamhane pairwise tests.



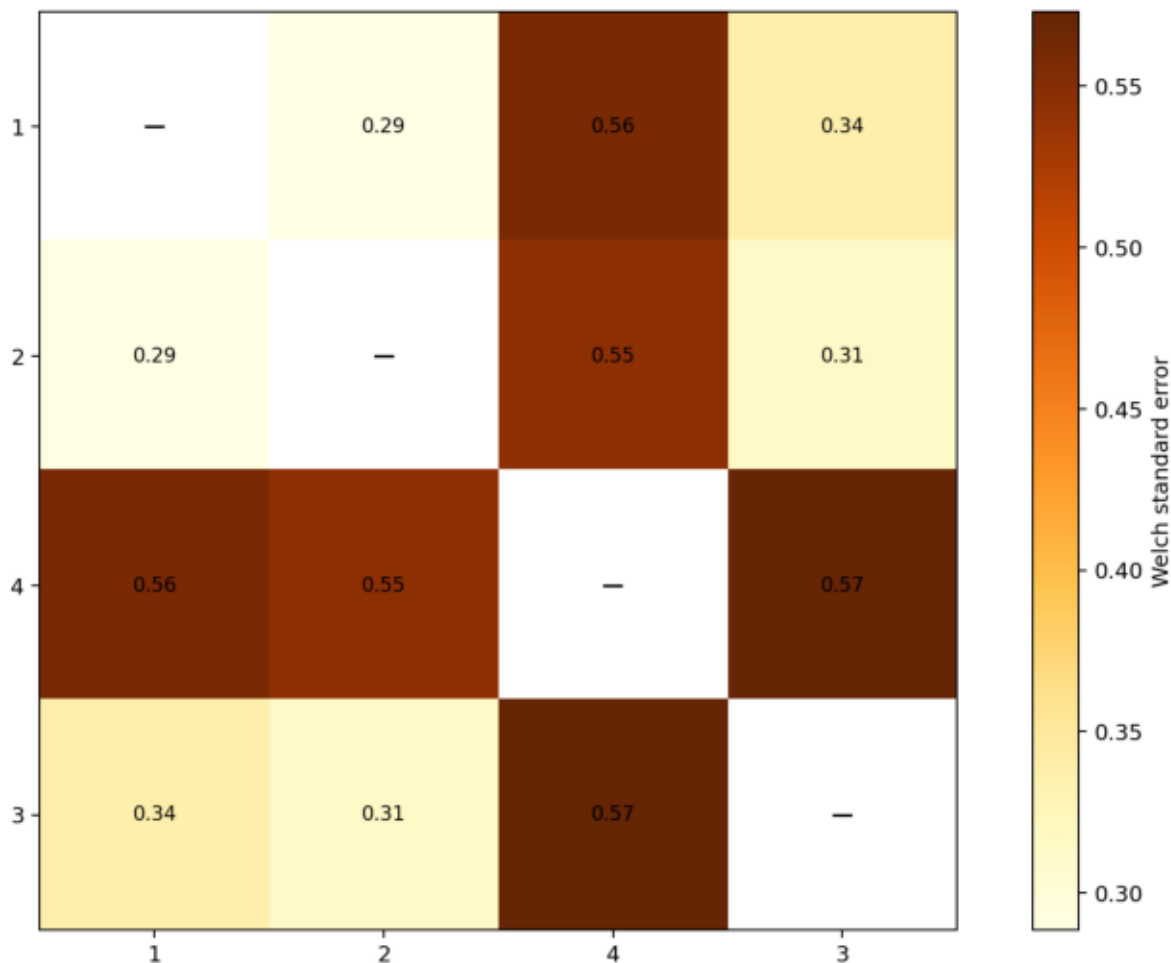
Variance and Sample Size Context

Tamhane's T2 is designed for pairwise mean comparisons when variance and sample size balance are questionable.



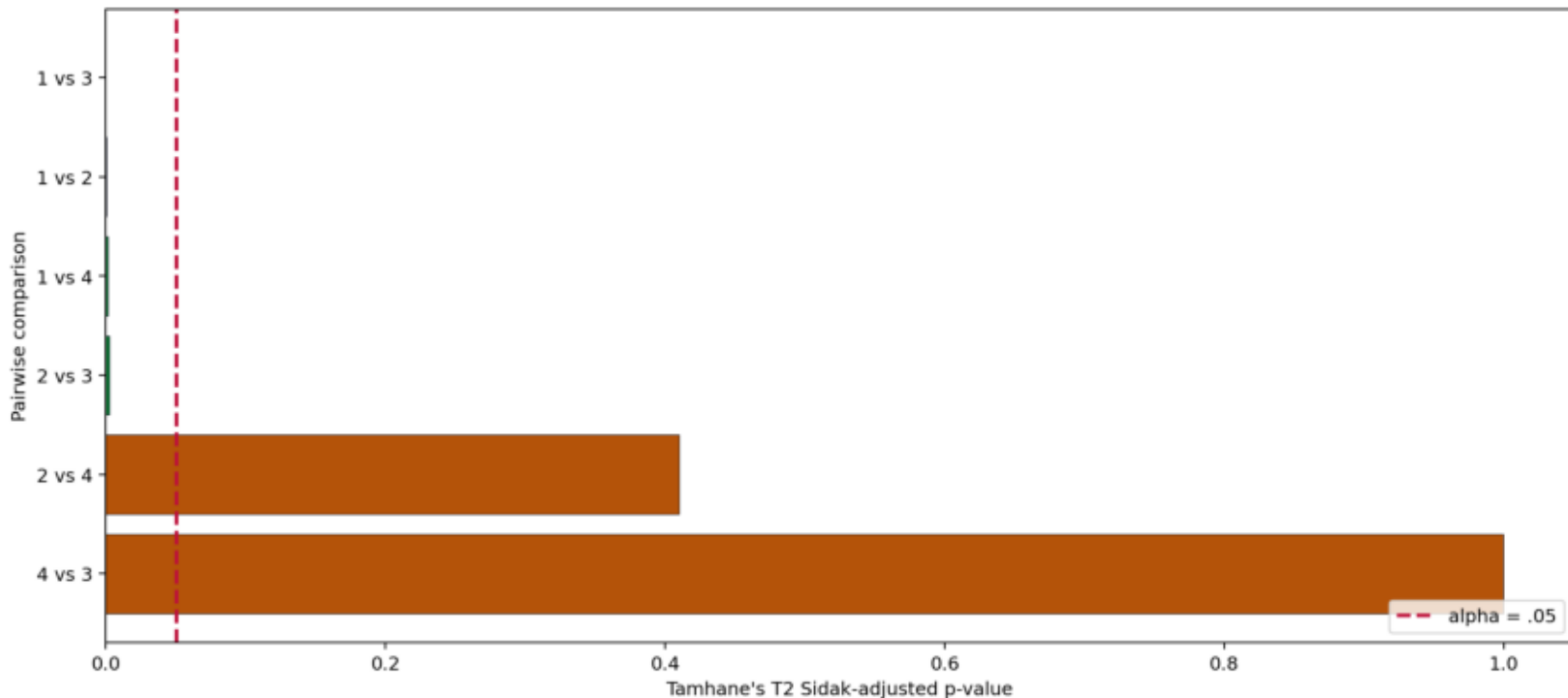
Tamhane Pairwise Welch Standard Error Map

Larger values mean the pairwise mean difference has more uncertainty under unequal variances.



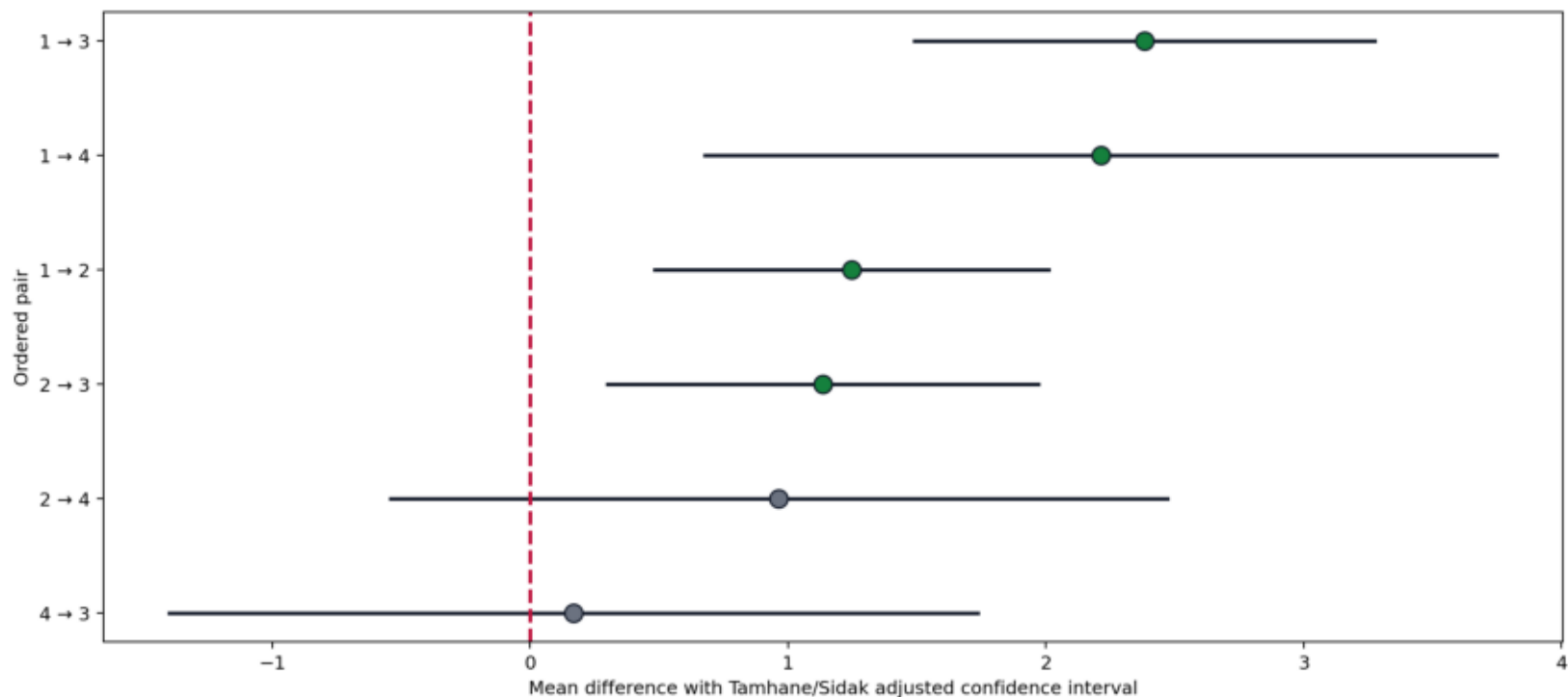
Tamhane's T2 Adjusted p-value Ranking

Significant pairs have adjusted p-values below .05 after unequal-variance correction.



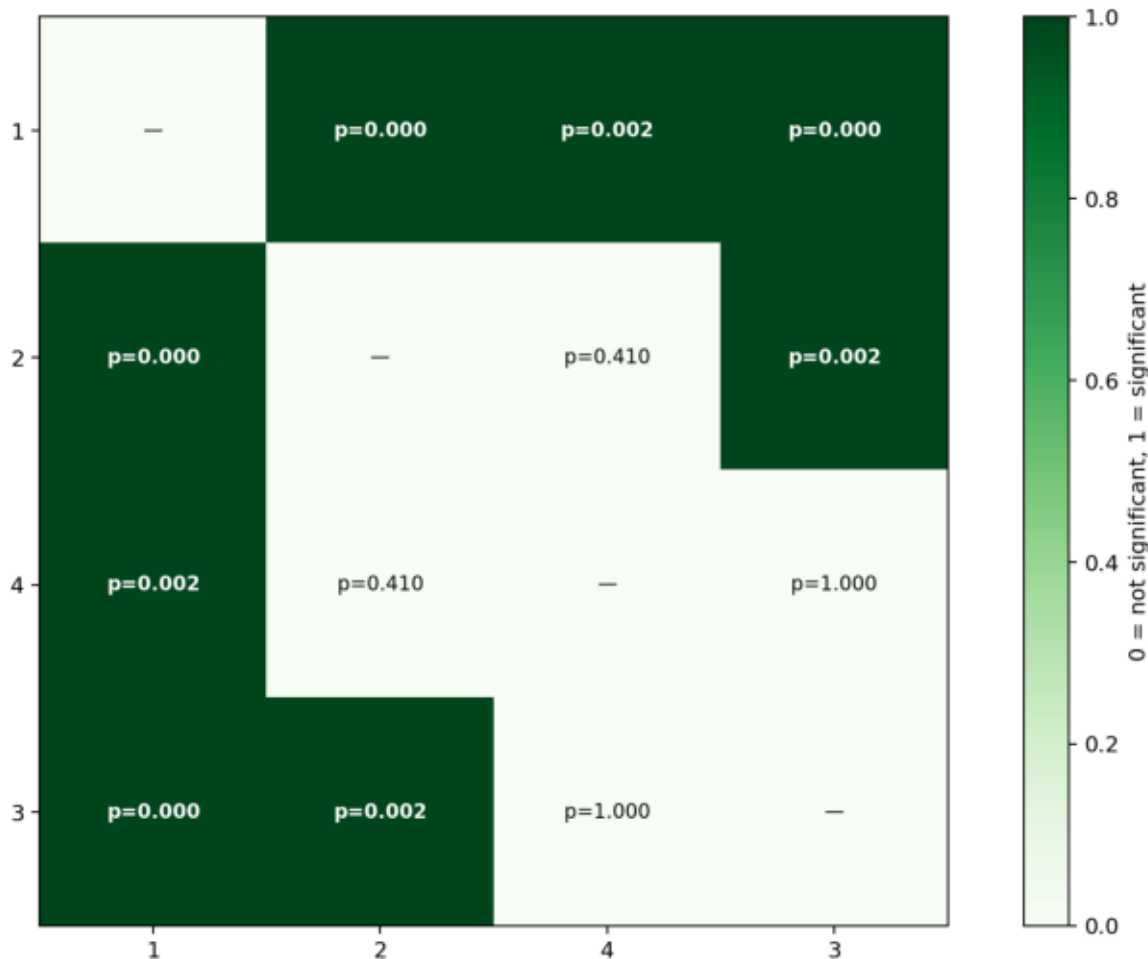
Tamhane Mean Differences with Adjusted Confidence Intervals

Intervals that do not cross zero indicate statistically significant unequal-variance pairwise differences.



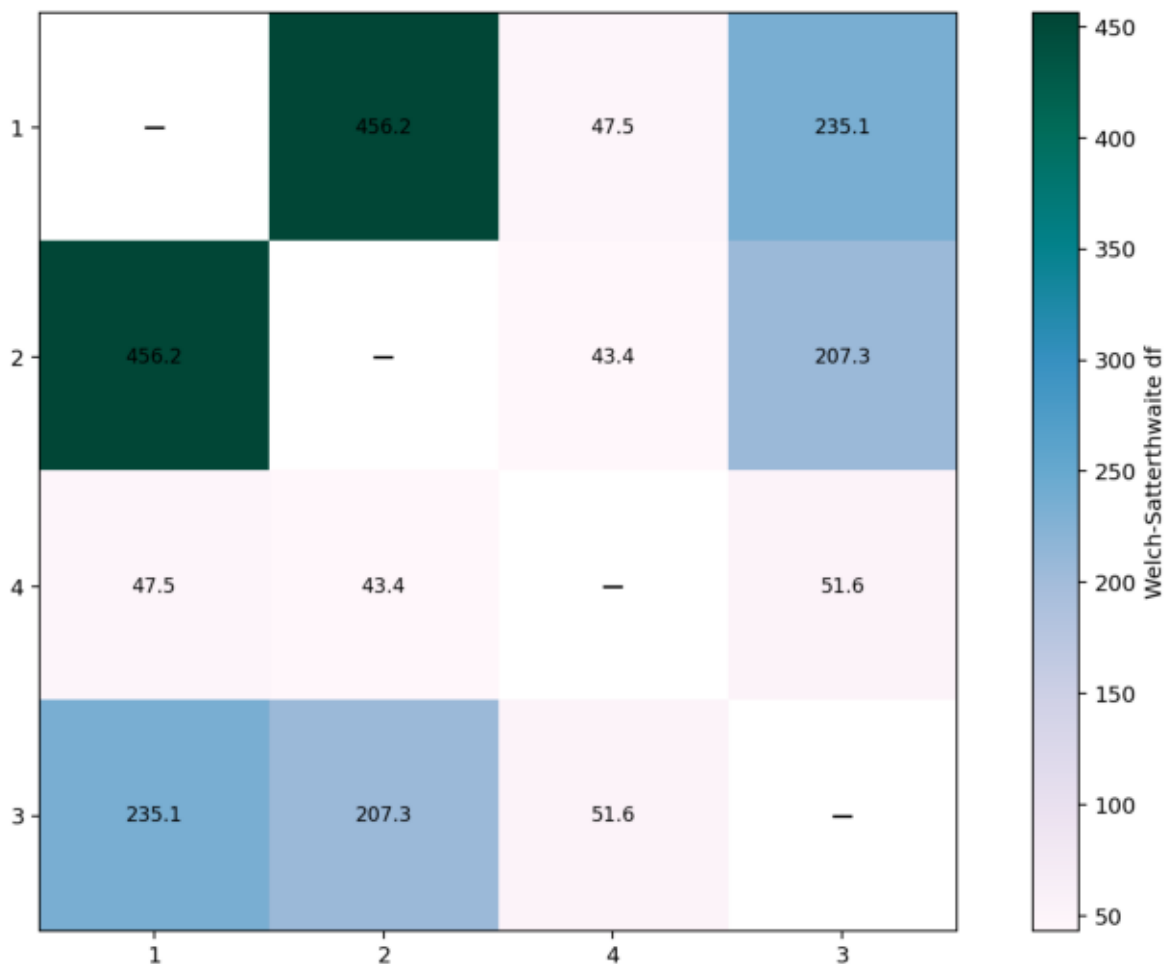
Tamhane's T2 Pairwise Decision Matrix

Green cells mark significant adjusted pairwise differences under the unequal-variance method.



Welch-Satterthwaite Degrees of Freedom Heatmap

Each pair gets its own df because Tamhane's T2 does not assume pooled equal variance.



Tamhane's T2 Method Report Card

Quick summary of unequal-variance context, omnibus evidence, and adjusted pairwise conclusions.

Method

Tamhane's T2

Variance stance

Unequal variances allowed

Welch ANOVA p

0.0000

Levene p

0.3804

Significant pairs

4/6

Smallest adj. p

0.0000

Tamhane's T2 found 4 significant pairwise difference(s) out of 6 comparisons at alpha = .05.