Duncans Multiple Range Test

Dependent variable: G3
Grouping variable: studytime

ANOVA context:

source	sum_of_squares	df	mean_square	f_value	p_value
Between groups	465.077825	3	155.025942	15.876268	5.705728e-10
Within groups	6298.188739	645	9.764634	NaN	NaN
Total	6763.266564	648	NaN	NaN	NaN

Group summary:

group	n	mean	standard_deviation	variance	standard_error	minimum	maximum	mean_ci95_lower	mean_ci95_upper
1	212	10.844340	3.218624	10.359541	0.221056	0	18	10.411070	11.277609
2	305	12.091803	3.243125	10.517860	0.185701	0	19	11.727830	12.455777
3	97	13.226804	2.502104	6.260524	0.254050	8	18	12.728866	13.724742
4	35	13.057143	3.038410	9.231933	0.513585	6	19	12.050516	14.063769

Homogeneous subsets:

group	mean	n	duncan_grouping_letters	note
3	13.226804	97	A	Groups sharing a letter are not separated by this Duncan-style rule.
4	13.057143	35	A	Groups sharing a letter are not separated by this Duncan-style rule.
2	12.091803	305	B	Groups sharing a letter are not separated by this Duncan-style rule.
1	10.844340	212	C	Groups sharing a letter are not separated by this Duncan-style rule.

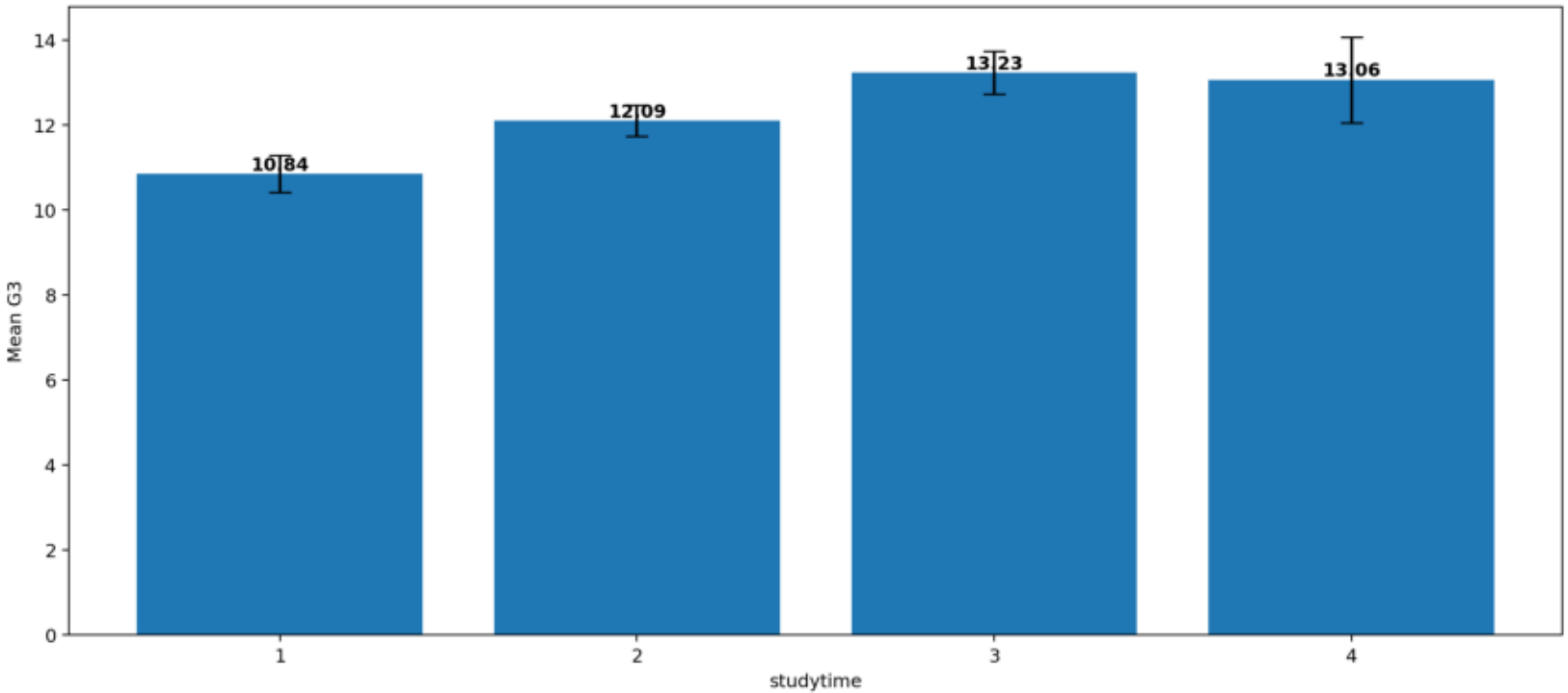
Method note: Duncan-style range testing uses rank-distance critical ranges after one-way ANOVA.

Duncan pairwise range results

lower_mean_group	higher_mean_group	mean_difference	range_size_r	duncan_alpha_for_range	standard_error	q_statistic	q_critical	critical_range	p_value_studentized_range_context	significant_at_alpha_0_05	interpretation
1	2	1.247464	2	0.050000	0.197579	6.313752	2.777019	0.548680	9.473280e-06	Yes	Different mean range
1	4	2.212803	3	0.097500	0.403143	5.488874	2.923689	1.178666	3.370027e-04	Yes	Different mean range
1	3	2.382465	4	0.142625	0.270856	8.796057	3.021824	0.818479	5.367514e-09	Yes	Different mean range
2	4	0.965340	2	0.050000	0.394338	2.448001	2.777019	1.095084	8.393031e-02	No	Homogeneous mean range
2	3	1.135001	3	0.097500	0.257567	4.406624	2.923689	0.753046	5.431301e-03	Yes	Different mean range
4	3	0.169661	2	0.050000	0.435692	0.389406	2.777019	1.209926	7.831343e-01	No	Homogeneous mean range

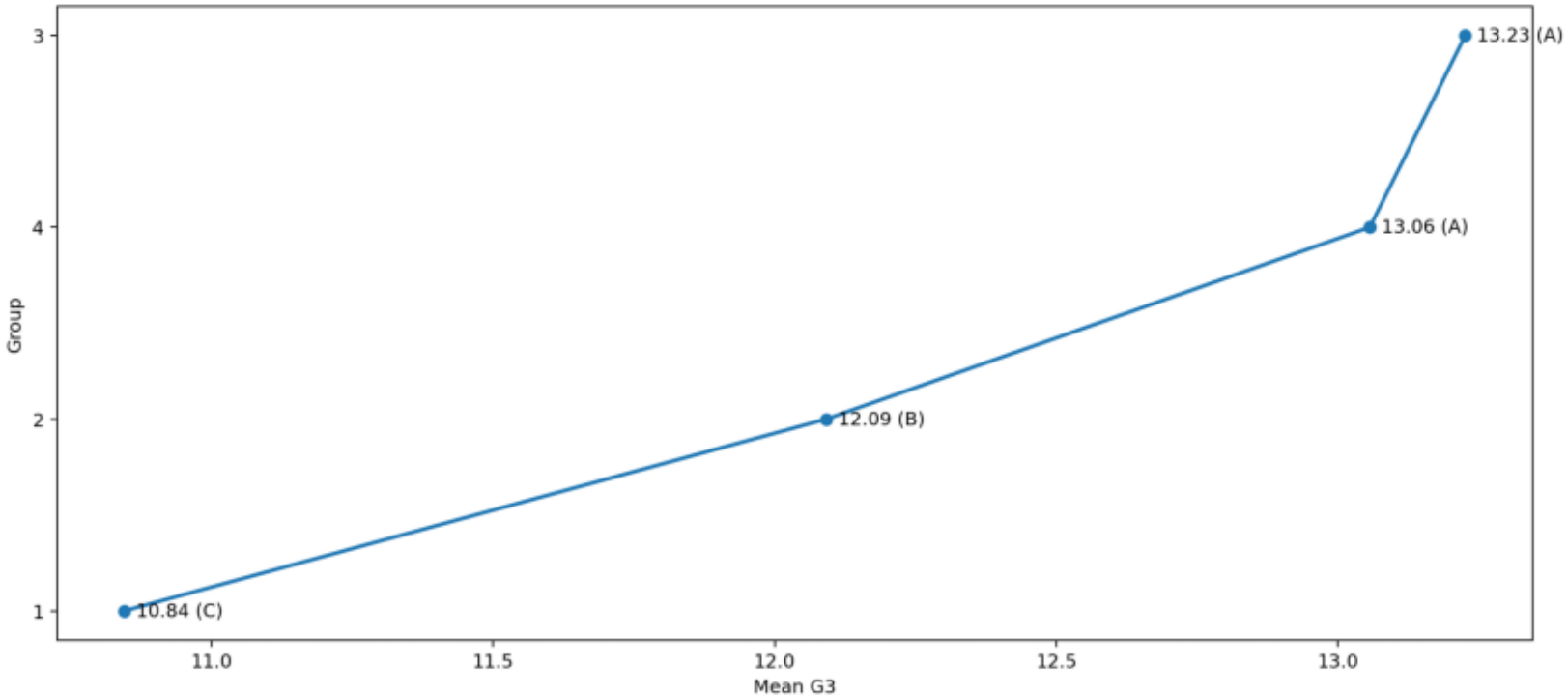
Duncans Multiple Range Test: Group Means

Mean comparison with approximate 95% confidence intervals before post-hoc grouping.



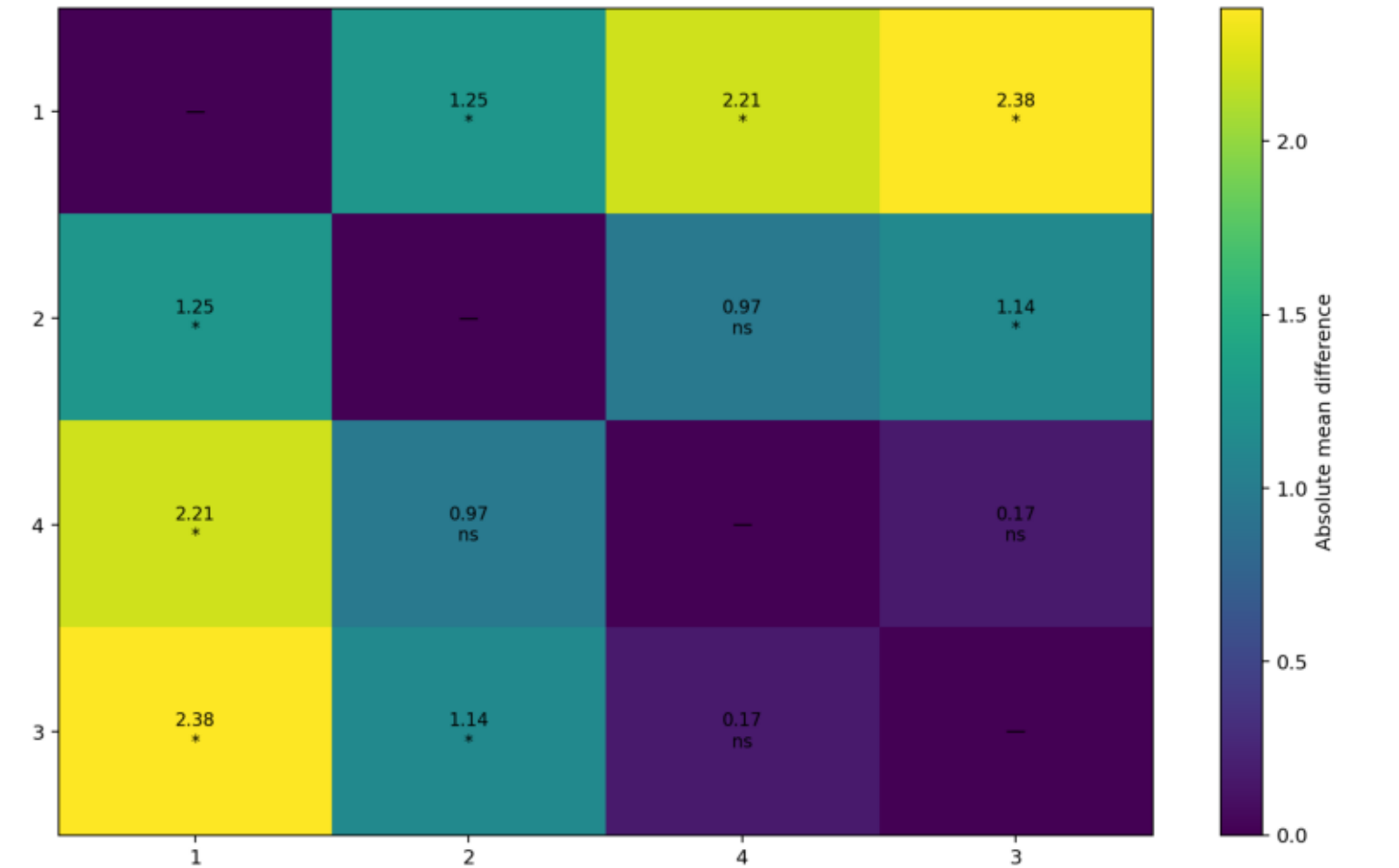
Duncans Multiple Range Test: Ranked Means

Groups are ordered from the lowest mean to the highest mean for range testing.



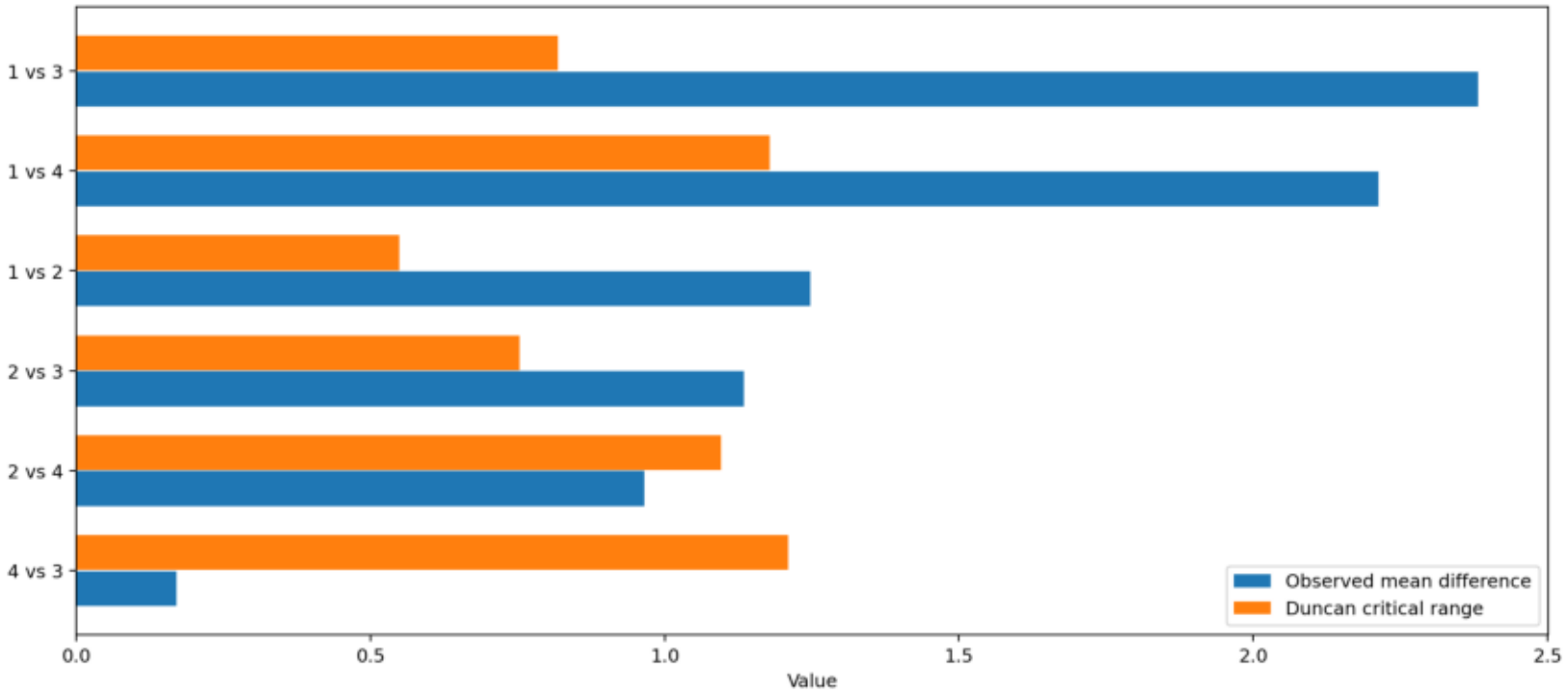
Duncans Multiple Range Test: Pairwise Mean Differences

A star marks pairs separated by the Duncan-style critical range rule.



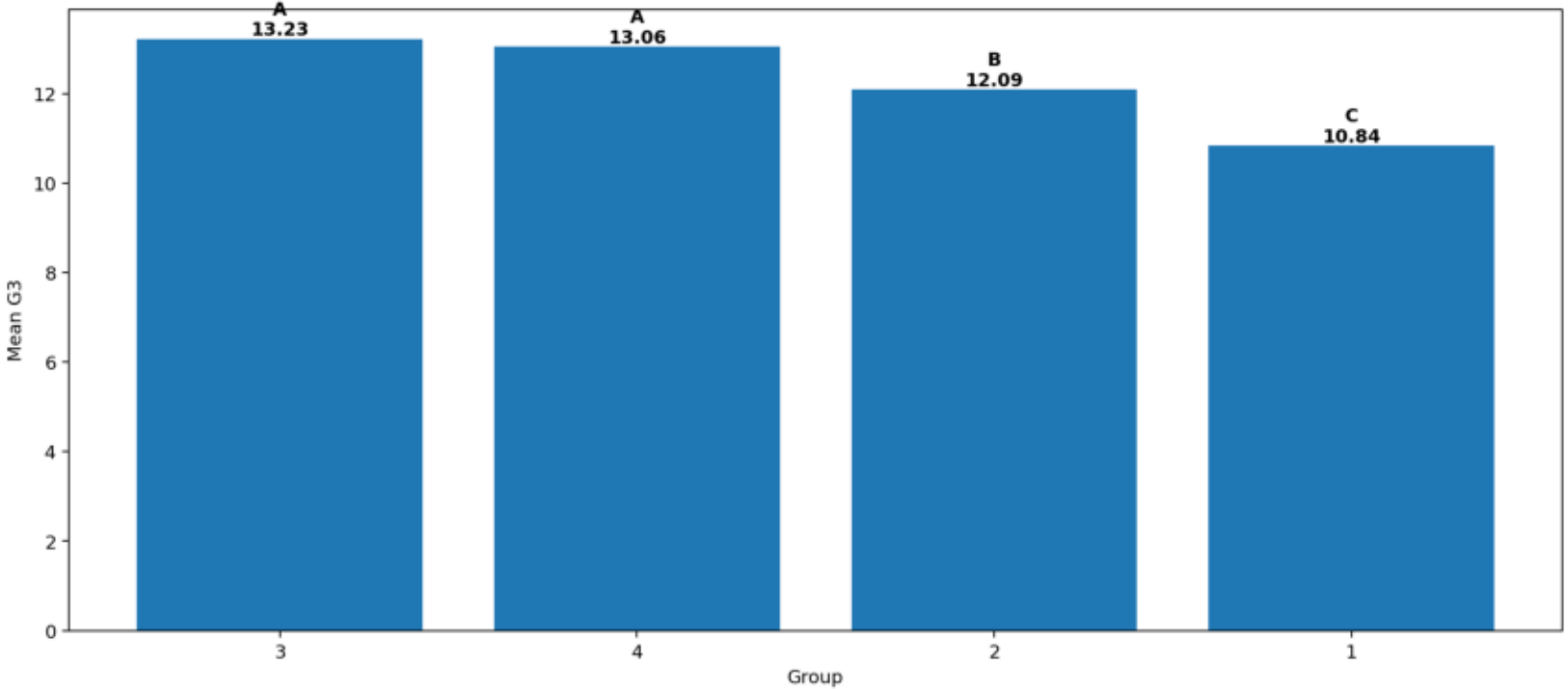
Duncans Multiple Range Test: Difference vs Critical Range

A pair is significant when the observed difference exceeds the critical range.



Duncans Multiple Range Test: Homogeneous Subsets

Groups sharing a letter are treated as not significantly different in this output.



Duncans Multiple Range Test: Distribution by Group

Boxplots show spread, medians, and outliers that should be reviewed with post-hoc results.