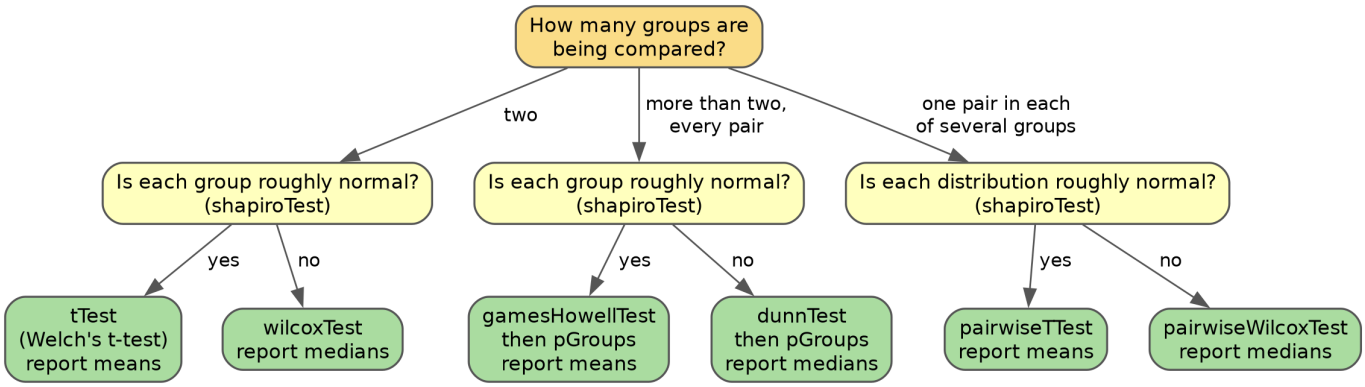
comparing groups: summary

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Before choosing a statistical test, look at the distribution of the data in each group. **Can each group be modeled by a normal distribution?** Check with the Shapiro test within each group. If they are not significantly different from normal, use a parametric test. If they are, use a rank test, which asks whether values in one group tend to be higher than values in the other. **How many groups are being compared?** With more than two, a separate t-test on every pair multiplies the chance of a false positive, so the Games-Howell and Dunn tests compare every pair at once and correct the p-values (read `p.adj`). The t-test used in this book is Welch's, and the Games-Howell test and `pairwiseTTest` likewise judge each pair on its own two spreads, so no test in this chapter needs a check for equal variances. The *p* value is the likelihood of getting data as extreme as the data in hand if the distributions they are coming from are in fact the same. The *p* value is not the probability that a detected difference is a false positive. Choosing a test comes down to how many groups are compared and whether the data are normal. Note that ANOVA is addressed in a separate, dedicated chapter.

Function	What it is for	How it is used in this chapter
`shapiroTest(abundance)`	is each group roughly normal? ($p > 0.05$ means not significantly different from normal)	after `group_by()` on the grouping column(s)
`tTest(abundance ~ aquifer_code)`	two groups, roughly normal (Welch's t-test)	`response ~ predictor` formula
`wilcoxTest(abundance ~ aquifer_code)`	two groups, not normal (rank test)	`response ~ predictor` formula
`gamesHowellTest(abundance ~ aquifer_code)`	more than two groups, every pair, roughly normal (each pair judged on its own spreads)	read `p.adj`
`dunnTest(abundance ~ aquifer_code)`	more than two groups, every pair, rank-based	read `p.adj`
`pGroups()`	letters for each group from Games-Howell or Dunn output (a shared letter means no significant difference)	piped after `gamesHowellTest` or `dunnTest`, then drawn with `geom_text()`
`pairwiseTTest(abundance ~ analyte)`, `pairwiseWilcoxTest(abundance ~ analyte)`	one comparison within each of several groups	after `group_by(aquifer_code)`, with `p.adj` corrected across all the groups
`geomSignif()`	draws brackets and stars from pairwise test output	`data =` a table built from the test output