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| **Issues in Exp. Des.**  **-** Eliminate bias: control group, randomization, blinding  - Reduce sampling error: replication (↑n, ↓SE), balance, blocking  **Descriptive Stats:** Numerical/ graphical to summarize data (sample data, comparative exp)  **Inferential:** pop. info from sample (conf. int. and hypo. test), pop. - parameter, sample - stat., sampling dist. – dist of a sample stat. to detail avg. error and error var.  (↑n ↓SD ↑power)  **Central limit thm:** ↑n, sample mean dist. becomes normal  t-value: measures the diff. (small t = accept H0)  **Type II error:** dep. on , n, pop. var., diff between actual and hypo mean  **T-test:**  - two tailed test when H1 ≠ 0  -If two-tailed test then multiply det. P-value from table by 2.  If you’re testing H0: 1=2, then the df = (n1+n2)-2 | Single Sample:    comparison:  https://lh5.googleusercontent.com/hyCyD7I42m2YNPBwkbUXb1x3CXf-TYV2GQm5785_ydB3p52g6BAf317M6f-wzLh5HZ3gXHZEtucoVsS9UFBJomwyGoDVlicjAQzp2_kcm_8_c9sf7bctCKFyi-zZ_x2e9S4h6dDu17CL  Sample var.    https://lh3.googleusercontent.com/QWZZEk7zdgk17Yp9jkHhJpTLXVbzTeYoYa4E7rF3ppuxElUaDWgH1P8Vd6VJ0DRdd6R7hKdtvFR0em9KHH89E6GCts1y8YC4MNfCENpbJWqN6LQeH0zIYcEDpLJbPHF3csbDr6RWw1CU  https://lh6.googleusercontent.com/sZ81F6E6ExXPWkCV36Xy_kp4_cCEfCSL_3eGO1iEjDcBIdo6KNzXKm0KNLXahwYqU-5l1KAF-mXxIFIBgkxdzL7TwkbSNp7oxbWwtj7oukitEGKtXWnRP396qOVvgWswsu2JYTF9WJMc  Two sample one sample    Two means CI:  https://lh3.googleusercontent.com/ifwORDZGIR0exzyuNiu_A5YS95jMFu-xtQaJsskYbPA9ZKPj_gTwnytijTw02cJwX02a73haW_A_lS484TjuCtz44l62ZMS0yWYhEpv6dQwnWWMLbrQ5D8ErSX8snVwqPQGU5n4L_8zg    https://lh5.googleusercontent.com/3jRGijBcijtTWoez1GrzGeUxF_DJAE7Fw_N6J76CYn3wT8iiPIIkjSMFUCRUlbKpNCLAAeDByRZHTHTQ__VaCskTO_OPSEvtYoR5DSA-vbMeglBh7ODJG46ZtpvhmkJUoFsKU5Noi6Iz  Two-tailed:  One-tailed (look at H1 value!): |
| Completely randomized design – 1 treatment  RCBD – 1 nuisance, 1 treatment  Latin – 2 nuisance, 1 treatment  Graeco – 3 nuisance, 1 treatment  BIBD – missing values  **Comparison Testing:**  Tukey non-additivity tests the no interaction assumption, else lost orthogonality, design unbalanced, ineffective blocking needs (a-1)(b-1)  - crit. diff.  **Type I SS**: sequential, relies on prev. value  **Type II SS**: marginal, order of effects unimportant  **Comparison (contrasting):**  **Def.**  MSE: estimation of the pop. var. | const. var., normal i.i.d.                Missing value: |
| **ANOVA 2+ factors:**  H0: all means are equal  - pairwise compar. on 2+ factors, ↑type I error (mult. tests ↑ chance of rejecting at least once)  - var. est. by MSE  - means model compares  , effect model -   MSE: Meas. of var. after group eff.  SST: measures variability  Large F 🡪small p-value  **Model Checking:**  Constant variance: if error var. depends on mean, then not const.  - plot mean resp. (pred.) v. error (resid) – look at range dist.  - use transformations to stabilize variance log(x), , 1/x, boxcox, to make var. not dep. on   -  Normality: looks at residuals, outliers  Independence  Nonparametric: use when not normal    Orthog Contrasts:  - Sum of the product of the coefficients of the contrasts equals 0  Multiple comparisons (not pairwise): use Bonferroni when m is small, use Scheffe when m is large  Pairwise: Tukey which considers the pair to be sig. diff. when critical difference:  Comparing treatment with control: Dunnett  LSD (pairwise): controls Type I comparisonwise error rate  Tukey’s pair wise: controls Type I experiment wise error rate, but with higher Type II error  Dunnet: controls Type I experimentwise error for comparisons | Norm. (resid) Norm. (outliers)    Nonpara. Kruskal-Wallis test      Scale factor:  Linear combinations of treatment means:  mean: var:  Contrasts: |

