Summary of Hypothesis Tests
(only those covered in CENG / NANO114)

Symbol meanings (note that the actual definition depends on subscripts!)

μ: *Popoulation mean*
σ: *Popoulation standard deviation*
s: *Sample standard deviation*
n: *Sample size*
N: *Global sample size in ANOVA*
SS: *Sum of squares*
r: *Sample correlation coefficient*
ρ: *Population correlation coefficient*
MS: *Mean squares*

Name	Test statistic	Notes
One-sample *z*-test	$z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$	• Normal population or when n > 30 and population standard deviation is known.
One-sample *t*-test	$t = \frac{\bar{X} - \mu}{s_{\bar{X}}}$ $s_{\bar{X}} = \frac{s}{\sqrt{n}} = \sqrt{\frac{SS_X}{n(n-1)}}$ $dof = n - 1$	• Normal population or n > 30 and population standard deviation is unknown.
Two-sample *t*-test (independent)	$t = \frac{\overline{X_1} - \overline{X_2} - (\mu_1 - \mu_2)}{s_{\overline{X_1} - \overline{X_2}}}$ $s_{\overline{X_1} - \overline{X_2}} = \sqrt{\frac{{s_p}^2}{n_1} + \frac{{s_p}^2}{n_2}}$ ${s_p}^2 = \frac{SS_{X_1} + SS_{X_2}}{n_1 + n_2 - 2}$ $dof = n_1 + n_2 - 2$	• Normal population or n > 30 and population standard deviation is unknown. • Pooled variance estimate assumes X_1 and X_2 have similar population standard deviation. If this assumption is not valid, you can estimate the standard deviations of each population the regular way (same as one sample *t*-test).
Paired *t*-test	$t = \frac{\overline{D} - \mu_D}{\frac{s_D}{\sqrt{n}}}$ $dof = n - 1$	• *D* refers to paired differences

Name	Test statistic	Notes
Correlation Coefficient *t*-test	$t = \frac{r - \rho}{\sqrt{\frac{1 - r^2}{n - 2}}}$ $dof = n - 2$	
F-test ANOVA (one factor)	$F = \frac{MS_{between}}{MS_{within}}$ $MS_{between} = \frac{SS_{between}}{dof_{between}}$ $MS_{within} = \frac{SS_{within}}{dof_{within}}$ $dof_{between} = \frac{N}{n} - 1$ $dof_{within} = N - \frac{N}{n}$ $HSD = q\sqrt{\frac{MS_{within}}{n}}$	• Normal population or n > 30 and population standard deviation is unknown. • Tukey's HSD test is used when *F* test results in rejection of null hypothesis
F-test ANOVA (one factor) – repeated measures	$F = \frac{MS_{between}}{MS_{error}}$ $MS_{between} = \frac{SS_{between}}{dof_{between}}$ $MS_{error} = \frac{SS_{error}}{dof_{error}}$ $dof_{between} = \frac{N}{n} - 1$ $dof_{error} = N - \frac{N}{n} - (n - 1)$ $HSD = q\sqrt{\frac{MS_{error}}{n}}$	• Normal population or n > 30 and population standard deviation is unknown. • Tukey's HSD test is used when *F* test results in rejection of null hypothesis