Notation and Equations for Exam 2

NOT TO BE USED DURING EXAM

q	The probability of a yes/correct/true outcome for a binary random variable
f or *frequency*	The number of "yes" outcomes in a sample of binary data
H_0	Null hypothesis
H_1	Alternative hypothesis
$p(M)$	The distribution of sample means, i.e. the probability distribution for M
σ_M	Standard error of the mean, which equals the standard deviation of $p(M)$
α	Alpha level; choice of Type I Error Rate; also the cutoff for the p-value between retaining and rejecting the null hypothesis
p	p-value, the probability of getting a result as extreme as you actually got, according to the null hypothesis; the smallest choice of α that would lead to rejecting the null hypothesis
t	t statistic
MS	Mean Square
df	Degrees of freedom
μ_0	Value of the population mean assumed by the null hypothesis in a single-sample t-test
n_A, M_A, μ_A, n_B, M_B, μ_B	Statistics and parameters for Samples A and B and Populations A and B
$\sigma_{M_A - M_B}$	Standard error of the difference between sample means in an independent-samples t-test
X_A, X_B	The two scores, or samples, in a paired-samples t-test
X_{diff}	Difference score in a paired-samples t-test (gets treated like a raw score)
d	Cohen's *d*, standardized effect size

Central Limit Theorem	$p(M) \approx Normal\left(\mu, \frac{\sigma}{\sqrt{n}}\right)$
Difference score, for paired-samples t-test	$X_{\text{diff}} = X_A - X_B$
Effect size for one-sample t-test (point estimate)	$M - \mu_0$
Effect size for independent-samples t-test (point estimate)	$M_{\mathrm{A}} - M_{\mathrm{B}}$
Effect size for paired-samples t-test (point estimate)	M_{diff}
t statistic (any t-test)	$t = \frac{\text{effect size}}{\text{standard error}}$
Standard error for single- or paired-samples t-test	$\sigma_M = \sqrt{MS\left(\frac{1}{n}\right)} = \frac{s}{\sqrt{n}}$
Standard error for independent-samples t-test	$\sigma_{M_A - M_B} = \sqrt{MS\left(\frac{1}{n_A} + \frac{1}{n_B}\right)}$
Mean Square for single- or paired-samples t-test	$MS = s^2 = \frac{\sum\left(X - M\right)^2}{df}$
Mean Square for independent-samples t-test	$MS = \frac{\sum_A\left(X - M_A\right)^2 + \sum_B\left(X - M_B\right)^2}{df}$

Degrees of freedom for single- or paired-samples t-test	$df = n - 1$
Degrees of freedom for independent-samples t-test	$df = n_A + n_B - 2$
Confidence interval for mean of a single sample	$CI = M \pm t_{crit} \cdot \sigma_M$
Confidence interval for difference between two independent means	$CI = \left(M_A - M_B\right) \pm t_{crit} \cdot \sigma_{M_A - M_B}$
Relation between alpha level and confidence	$confidence = 1 - \alpha$
Cohen's *d* (for any t-test)	$d = \frac{\text{effect size}}{\sqrt{MS}}$
Critical value for one-tailed t-test predicting positive effect	$p(t_{df} \geq t_{\text{crit}}) = \alpha$
Critical value for one-tailed t-test predicting negative effect	$p(t_{df} \leq t_{\text{crit}}) = \alpha$
Critical value for a two-tailed t-test	$p(t_{df} \geq t_{crit}) = p(t_{df} \leq -t_{crit}) = \alpha/2$
p-value for one-tailed t-test predicting positive effect	$p = p(t_{df} \geq t)$
p-value for one-tailed t-test predicting negative effect	$p = p(t_{df} \leq t)$
p-value for two-tailed t-test	$p = 2 \cdot p\left(t_{df} \geq \lvert t \rvert\right)$
Conclusions based on p-value	$p > \alpha \rightarrow$ retain H_0 $p < \alpha \rightarrow$ reject H_0, adopt H_1