Econ 3180 - Midterm Formula Sheet

expected value of Y (mean of Y)	μ_Y
variance of Y	$\sigma_Y^2 = E(Y-\mu_Y)^2 = E(Y^2) - (\mu_Y)^2$
standard deviation of Y	$\sigma_Y = \sqrt{\sigma_Y^2}$
covariance between X and Y	$\sigma_{XY} = E[(X-\mu_X)(Y-\mu_Y)]$
correlation coefficient (between X and Y)	$\rho_{XY} = \frac{\sigma_{XY}}{\sigma_X \sigma_Y}$
expected value of the sample average, $\bar{Y}$	$E(\bar{Y}) = \mu_Y$
variance of the sample average, $\bar{Y}$	$\sigma_{\bar{Y}}^2 = \frac{\sigma_Y^2}{n}$
t-statistic for testing μ_Y (for large n, and when σ_Y^2 is *known*)	$t = \frac{\bar{Y}^{act} - \mu_{Y,0}}{\sigma_{\bar{Y}}} \sim N(0,1)$
sample variance (estimator for σ_Y^2)	$s_Y^2 = \frac{1}{n-1}\sum_{i=1}^{n}(Y_i - \bar{Y})^2$
sample covariance (estimator for covariance)	$s_{xy} = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})$
sample correlation (estimator for correlation)	$r_{xy} = \frac{s_{xy}}{s_x s_y}$
standard error of $\bar{Y}$ (estimator for the standard deviation of $\bar{Y}$)	$s_{\bar{Y}} = \sqrt{\frac{s_Y^2}{n}}$
t-statistic for testing μ_Y (for large n, and when σ_Y^2 is *unknown*)	$t = \frac{\bar{Y}^{act} - \mu_{Y,0}}{s_{\bar{Y}}} \sim N(0,1)$
95% confidence interval for μ_Y (for large n)	$conf.int. = \bar{Y} \pm 1.96 \times s_{\bar{Y}}$
population linear regression model with one regressor	$Y_i = \beta_0 + \beta_1 X_i + u_i, \qquad i = 1, \ldots, n$
OLS estimator of the slope (β_1)	$\hat{\beta}_1 = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{(X_i - \bar{X})^2}$
OLS estimator of the intercept (β_0)	$\hat{\beta}_0 = \bar{Y} - \hat{\beta}_1 \bar{X}$
OLS predicted values	$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_i$
OLS residuals	$\hat{u}_i = Y_i - \hat{Y}_i$

explained sum of squares	$ESS = \sum_{i=1}^{n} \left(\hat{Y}_i - \bar{Y}\right)^2$
total sum of squares	$TSS = \sum_{i=1}^{n} (Y_i - \bar{Y})^2$
sum of squared residuals	$SSR = \sum_{i=1}^{n} \hat{u}_i^2$
regression R^2	$R^2 = \frac{ESS}{TSS}$
standard error of regression	$\sqrt{\frac{1}{n-2} \times SSR}$
L.S.A. #1	$E(u \mid X = x) = 0$
L.S.A. #2	$(X_i, Y_i), i = 1, \ldots, n$, are i.i.d.
L.S.A. #3	Large outliers are rare.
The sampling distribution of $\hat{\beta}_1$ (for large *n*)	$\hat{\beta}_1 \sim N\left(\beta_1, \frac{var[(X_i - \mu_X)u_i]}{n\sigma_X^4}\right)$
t-statistic for testing β_1	$t = \frac{\hat{\beta}_1 - \beta_{1,0}}{SE\left(\hat{\beta}_1\right)}$
95% confidence interval for β_1 (for large *n*)	$conf.int. = \hat{\beta}_1 \pm 1.96 \times SE\left(\hat{\beta}_1\right)$