Understanding Regression Output

$$\text{Stats grade} = \beta_0 + (\beta_1 \times \text{IQ}) + (\beta_2 \times \text{Height}) + (\beta_3 \times \text{Female?}) + (\beta_4 \times \text{Tech major?}) + \mathcal{N}(0, \sigma_e^2)$$

Excel notes

P-value for t-stat x = `T.DIST.2T(|x|, n–k–1)`

$t_{n-k-1,p}$ = `T.INV(1–p, n–k–1)`

SUMMARY OUTPUT

Regression Statistics		
Multiple R	0.972464726	$\sqrt{R^2}$
R Square	0.945687643	$R^2 = \frac{SSR}{SST} = 1 - \frac{SSE}{SST}$
Adjusted R Square	0.930169826	$R^2_{\text{adj}} = 1 - \frac{SSE}{SST} \cdot \frac{n-1}{n-k-1}$
Standard Error	7.03377159	$\hat{\sigma}_e = \sqrt{MSE} = \sqrt{\frac{SSE}{n-k-1}}$
Observations	19	n

	SS	*MS*
Regression	$SSR = \sum_i (\hat{Y}_i - \bar{Y})^2$	$MSR = \frac{SSR}{k}$
Residual	$SSE = \sum_i (\hat{Y}_i - Y_i)^2$	$MSE = \frac{SSE}{n-k-1}$
Total	$SST = \sum_i (Y_i - \bar{Y})^2$	

Note that $SST = SSR + SSE$

ANOVA

Effective sample size

	df		*SS*	*MS*	*F*	*Significance F*
Regression	k	4	12060.17528	3015.04	60.94205659	1.06227E-08
Residual	$n-k-1$	14	692.6351988	49.4739		
Total	$n-1$	18	12752.81048			

If this is > 0.05, then there is no evidence the regression explains anything at the 95% level

		Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	$\hat{\beta}_0$	13.16664324	13.66535477	0.96351	0.351642348	-16.14262775	42.4759142
IQ	$\hat{\beta}_1$	0.49					
Height	$\hat{\beta}_2$	-0.06					
Female?	$\hat{\beta}_3$	-8.05					
Technical major?	$\hat{\beta}_4$	24.					

$\text{StdErr}(\beta_0)$

$$\hat{t}_{\beta_0} = \frac{\beta_0}{\text{StdErr}(\beta_0)}$$

If this is > 0.05, then there is no evidence that $\beta \neq 0$ at the 95% level. This will happen if the t-stat is "too close to 0". This is the P-value for the the H_0: $\beta = 0$ against H_1: $\beta \neq 0$

There is a 95% chance that the *real* β_0 lies between these two values, which are given by

$$\beta_0 \pm t_{n-k-1,0.025} \cdot \text{StdErr}(\beta_0)$$

Questions, corrections—email guetta@cantab.net