STAT1010: Exercise Sheet 6

1. The regression output for Model 1 on the reverse of this sheet investigates the dependence between beginning salary (in \$1000) and education level (in years).

   a) By how much does 3 years more education raise beginning salary on average?

   b) Find a 95% confidence interval for the increase in starting salary per extra year of education. *Hint: The excel command for finding critical values of two-sided t-tests is* T.INV.2T.

2. The regression output for Model 2 adds previous working experience as an additional regressor.

   a) Find R^2, $\overline{R^2}$ and confirm that your result for R^2 is consistent with the F-statistic reported for Model 2.

   b) Estimate the beginning salary of an employee with 15 years of education and 3 years of previous working experience.

   c) Apply the partial F-test in order to find out whether Model 1 is significantly worse than Model 2. *Hint:* F.INV.RT *yields* F_α.

3. Shown below are sales (y, in \$1000), advertising expenditure (x_1, in % of sales) and market share (x_2, in %) of a firm in ten successive years.

y:	10.8	12.6	8.3	9.2	11.1	10.9	7.9	11.6	8.2	9.0
x_1:	4.3	4.0	4.1	4.6	5.5	4.5	4.3	2.8	2.6	3.1
x_2:	26.2	32.2	17.3	16.7	18.9	13.2	14.4	27.1	20.8	22.0

   a) Set up the linear regression model in excel.

   b) Using the output from a), test the following hypotheses at $\alpha = 5\%$:
   ba) $H_0: \beta_1 = \beta_2 = 0$ against $H_1: \beta_1 \neq 0$ or $\beta_2 \neq 0$,
   bb) $H_0: \beta_1 = 0$ against $H_1: \beta_1 \neq 0$,
   bc) $H_0: \beta_1 = 0$ against $H_1: \beta_1 > 0$,
   bd) $H_0: \beta_1 = 1$ against $H_1: \beta_1 < 1$,
   be) $H_0: \beta_2 = 0$ against $H_1: \beta_2 \neq 0$.

   c) Use excel's matrix calculation capabilities in order to find 95% confidence intervals for both the estimated mean and individual predictions of sales when advertising expenditures are 5% of sales and the market share is 25%.

4. Consider again the data on teamwork production methods from exercise sheet 4. Regress production volume on a dummy for production method B and another dummy for production method C and compare your results with those of exercise sheet 4.

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Beginning Salary ($ 1000)	31.6277	9.7498	74
Educational Level (years)	17.42	1.65	74
Previous Experience (years)	6.7072	5.9772	74

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	778.926	1	778.926	9.104	.004[a]
	Residual	6160.370	72	85.561		
	Total	6939.296	73			

a. Predictors: (Constant), Educational Level (years)

b. Dependent Variable: Beginning Salary ($ 1000)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.920	11.501		-.254	.800
	Educational Level (years)	1.983	.657	.335	3.017	.004

a. Dependent Variable: Beginning Salary ($ 1000)

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	2672.795	2	1336.398	22.239	.000[a]
	Residual	4266.501	71	60.092		
	Total	6939.296	73			

a. Predictors: (Constant), Previous Experience (years), Educational Level (years)

b. Dependent Variable: Beginning Salary ($ 1000)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	-12.407	9.785		-1.268	.209
	Educational Level (years)	2.199	.552	.371	3.982	.000
	Previous Experience (years)	.854	.152	.524	5.614	.000

a. Dependent Variable: Beginning Salary ($ 1000)