

## Module 8: Simple linear regression

(The attached PDF file has better formatting.)

### *Homework assignment: Estimating regression parameters*

Some final exam problems give a set of points and ask to compute ordinary least squares estimators, sums of squares,  $t$  values, confidence intervals, and other regression statistics. The final exam may give one set of points and ask about several statistics and estimates, or separate points for each statistic. This homework assignment reviews the material you must know to solve the final exam problems. This module has another posting with worked out solutions to a similar problem.

An actuary fits a two-variable regression model  $Y_i = \alpha + \beta \times X_i + \varepsilon_i$  to the relation between the explanatory variable  $X$  and the response variable  $Y$ :

Policy Year	( $x$ )	( $y$ )	( $x - \bar{x}$ )	( $x - \bar{x}$ ) <sup>2</sup>	( $y - \bar{y}$ )	( $y - \bar{y}$ ) <sup>2</sup>	( $x - \bar{x}$ )( $y - \bar{y}$ )
20X1	66.00%	22.50%	0.00%	0.00%	0.60%	0.0036%	0.0000%
20X2	67.00%	19.50%	1.00%	0.01%	-2.40%	0.0576%	-0.024%
20X3	68.00%	21.00%	2.00%	0.04%	-0.90%	0.0081%	-0.018%
20X4	65.00%	22.50%	-1.00%	0.01%	0.60%	0.0036%	-0.006%
20X5	64.00%	24.00%	-2.00%	0.04%	2.10%	0.0441%	-0.042%
Average	66.00%	21.90%	0.00%	0.02%	0.00%	0.0234%	-0.0180%

The column captions in the table use lower case  $x$  and  $y$  for the variables; the deviations are shown explicitly as  $(x - \bar{x})$  and  $(y - \bar{y})$ . The last line has averages, not totals.

- What is the value of  $\hat{\beta}$  (B), the ordinary least squares estimator of  $\beta$ ? (P 81)
- What is the value of  $\hat{\alpha}$  (A), the ordinary least squares estimator of  $\alpha$ ? (P 81)
- What is the total sum of squares (TSS)? (P 83-86)
- What is the regression sum of squares (RegSS)? (P 83-86)
- What is the residual sum of squares (RSS), or error sum of squares (ESS)? (P 83-86)
- What is  $s^2$ , the estimated variance of the regression? (P 82)
- What is the value of  $R^2$ , the coefficient of determination? (P 83-86)

Show the computations for the homework assignment, not just the solution. You can check your solutions with Excel or other statistical software.