Exercise 7B.1

Linear regression was used to investigate the relationship between age (years) and systolic blood pressure (mmHg) in a sample of adults ranging from 29 to 69 years old. Partial Stata output is on the next page.

(a) How may people were in the sample?

29

(b) Test whether age is a significant predictor of SBP (at the $\alpha = 0.05$ level).

$H_0 : \beta_1 = 0$ $\quad$ $\beta_1 =$ *slope of age predicting SBP*
$H_a : \beta_1 \neq 0$
$t = \frac{\hat{\beta}_1}{\widehat{SE}(\hat{\beta}_1)} = \frac{0.9493225}{0.1161445} = 8.17$
Under H_0, $t \sim t_{27}$
Critical value $t^* = 2.052$
Is $|t| > t^*$*? Yes,* $|8.17| > 2.052 \rightarrow$ *Reject* H_0
There is evidence that age is significantly associated with SBP.
Note : P-value method yields p-value < 0.0005.

(c) What is the coefficient of determination for this model? Interpret this quantity.

$R^2 = 0.7122$ $\quad$ *71.2% of the variability in SBP is explained by age.*

(d) Calculate a 95% confidence interval for the population slope. Will 0 be in this interval?

0 will not be in the CI because we rejected the null, $H_0 : \beta_1 = 0$
$0.9493225 \pm 2.052 \times 0.1161445$
$(0.711, 1.19)$

Output for problem on previous page:

```
. regress sbp age

      Source |       SS       df       MS              Number of obs =      29
-------------+------------------------------           F(  1,    27) =   66.81
       Model |  6110.10173     1  6110.10173            Prob > F      =  0.0000
    Residual |  2469.34654    27  91.4572794            R-squared     =  0.7122
-------------+------------------------------           Adj R-squared =  0.7015
       Total |  8579.44828    28  306.408867            Root MSE      =  9.5633

------------------------------------------------------------------------------
         sbp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .9493225   .1161445
       _cons |   97.07708   5.527552
------------------------------------------------------------------------------
```

Exercise 7B.2

In a study of factors associated with levels of HDL, the "good cholesterol", investigators were interested in whether or not a person's education level might be a predictor of HDL (mg/dL). Education was measured as the number of years of education a person had. The researchers used linear regression and partial Stata output is on the next page.

(a) Test whether years of education is a significant predictor of HDL (at the $\alpha = 0.05$ level).

$H_0 : \beta_1 = 0$ $\quad$ $\beta_1 =$ *slope of education predicting HDL*

$H_a : \beta_1 \neq 0$

$t = \frac{\hat{\beta}_1}{\widehat{SE}(\hat{\beta}_1)} = \frac{-0.0322503}{0.4168166} = -0.077$

Under H_0, $t \sim t_{89}$

Critical value from table using df=60 (since 89 not on table): $t^* = 2.000$

Is $|t| > t^*$*? No,* $|-0.077| \not> 2.00 \rightarrow$ *Fail to reject* H_0

We do not have evidence that years of education is significantly associated with HDL.

Note : P-value method using Stata yields p-value $= 0.939$*. (code:* `dis 2*ttail(89, 0.077)`*)*

(b) What is the coefficient of determination for this model? Interpret this quantity.

$R^2 = 0.0001$

0.01% of the variability in HDL is explained by years of education.

(c) If you were to compute a 95% confidence interval for the population slope, would 0 be in the interval? Why or why not?

Yes, 0 would be in the CI, because we failed to reject H_0 *at the* $\alpha = 0.05$ *level. Thus 0 is a "plausible value" for the true slope, so 0 would be in the CI.*

Output for problem on previous page.

```
. regress hdl education

      Source |       SS       df       MS              Number of obs =      91
-------------+------------------------------           F(  1,    89) =    0.01
       Model |  1.52391634     1  1.52391634           Prob > F      =  0.9385
    Residual |  22655.4651    89  254.555788           R-squared     =  0.0001
-------------+------------------------------           Adj R-squared = -0.0112
       Total |   22656.989    90  251.744322           Root MSE      =  15.955

------------------------------------------------------------------------------
         hdl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   education |  -.0322503   .4168166
       _cons |   52.33561   4.781676
------------------------------------------------------------------------------
```