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EE325 homework 6

Chapter 6 question 3

i.) Take the derivative of rdintens hat with respect to sales and set it equal to 0:

0 = 0.0003 - 0.000000014 sales
0.000000014 sales = 0.0003
Sales = 0.0003 / 0.000000014
Sales = 21,428.5714
The marginal effect of sales then becomes negative when sales = 21,428.57

ii.) The t-statistic on β̂sales2 is (note: β̂sales2 is beta hat sales squared)

- 0.0000000070 - 0 / 0.0000000037 = -1.89

From the t-statistic the outcome is |t|<1.96 which means that sales^2 is not significant at 5% significance level. Therefore we should not keep the quadratic form

iii.) rdintens hat = 2.613 + 0.0003 sales − 0.000000007 sales^2
= 2.613 + 0.0003 (1000 ∗ salesbil) − 0.000000007(1000)^2 (salesbil)^2
= 2.613 + 0.3 salesbil − 0.0072 salesbil^2

se(β̂j) = σ̂ / [SSTj(1 − R^2)]1/2
Rescaling sales will have no effect on σ̂ or R^2 since it does not change the fit of the regression. It will, however, affect SSTsales, SSTsales^2 and the standard error.
Note: β^j is read as beta hat j and R^2 is R squared

iv.) The equation in iii.) is more easy to interpret because of the fewer zeros.

Chapter 7 question 1

i.) Coefficient on male is 87.75, so a man is estimated to sleep one and one-half hours more per week than a comparable woman. This is significant at the 1% level.

ii.) The coefficient estimate on totwrk is negative and significant at the 1% level. One more hour of work is associated with 0.163(60) or about 9.8 minutes less sleep.

iii.) The null we are interested in testing here is that the coefficients on age and age^2 are jointly zero. So, we will test the F-test H: βage = βage^2 = 0
F = (R^2ur −R^2r) / q(1−R^2ur)/(n−k−1)
Note: βage^2 is read as beta age squared

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Chapter 7 question 8

i.) log(wage) =β0 + β1usage + β2educ + β3exper + β4female + u

ii.) log(wage) =β0 + β1usage + β2educ + β3exper + β4female + β5usage · female + u

Test hypothesis: H0: β5 = 0 and H1 : β5 not equal 0

iii.) log(wage) =β0 + β1light + β2moderate + β3heavy + β4educ+ + β5exper + β6female + u

In this model, non-user is the omitted category.

iv.) The null hypothesis is H0 : β1 = β2 = β3 = 0.

So this is going to be an F-test on q = 3 restrictions.

We are also going to have degrees of freedom df = n − 6 − 1 for a sample of size n, since we have 6 independent variables in the unrestricted model.

So we would be obtaining a critical value from the Fq,n−7 distribution

v.) There may be omitted variables for marijauna usage and wage.

Chapter 7 question 11

Note: β^j is read as beta hat j

R^2 ur is R squared ur

R^2 r is R squared r

i.) The coefficient for male is 3.83 this can be interpreted as the expected difference in class score between male and female is 3.83.

The 95% confidence interval for βmale

= [β^j - 1.96 s.e.(β^j) , β^j + 1.96 s.e.(β^j)]

= 3.83 - 1.96(0.74) , 3.83 + 1.96(0.74)

= 2.3786 , 5.2084

ii.) H0: βmale = 0   Ha: βmale*colgpa = 0

F = [(R^2 ur - R^2 r)/q)] / [(1- R^2 ur)/(n-k-1)]

= [(0.348 - 0.329)/2] / (1 - 0.348)/ (856-3-1)]

= 13.09

F 2854 = 13.09 this is more than 3.01, we can reject H0 that there is no gender difference in score at 5% significance level.

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Computer exercise C4

i.) I think hsperc will be negative

ii.)

```
. reg colgpa hsize hsizesq hsperc sat female athlete

      Source |       SS           df       MS      Number of obs   =     4,137
-------------+----------------------------------   F(6, 4130)      =    284.59
       Model |  524.819305         6  87.4698842   Prob > F        =    0.0000
    Residual |  1269.37637     4,130  .307355053   R-squared       =    0.2925
-------------+----------------------------------   Adj R-squared   =    0.2915
       Total |  1794.19567     4,136  .433799728   Root MSE        =     .5544

------------------------------------------------------------------------------
      colgpa |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       hsize |  -.0568543   .0163513    -3.48   0.001    -.0889117   -.0247968
     hsizesq |   .0046754   .0022494     2.08   0.038     .0002654    .0090854
      hsperc |  -.0132126   .0005728   -23.07   0.000    -.0143355   -.0120896
         sat |   .0016464   .0000668    24.64   0.000     .0015154    .0017774
      female |   .1548814   .0180047     8.60   0.000     .1195826    .1901802
     athlete |   .1693064   .0423492     4.00   0.000     .0862791    .2523336
       _cons |   1.241365   .0794923    15.62   0.000     1.085517    1.397212
------------------------------------------------------------------------------
```

Holding other factors fixed, an athlete is predicted to have a GPA about 0.169 points higher than a nonathlete.

The t statistic is 0.169/0.042 = 4.02, which is more than 1.96 showing that it is statistically significant at 5% level of significance.

iii.)

```
. reg colgpa hsize hsizesq hsperc female athlete

      Source |       SS           df       MS      Number of obs   =     4,137
-------------+----------------------------------   F(5, 4131)      =    191.92
       Model |  338.217123         5  67.6434247   Prob > F        =    0.0000
    Residual |  1455.97855     4,131   .35245184   R-squared       =    0.1885
-------------+----------------------------------   Adj R-squared   =    0.1875
       Total |  1794.19567     4,136  .433799728   Root MSE        =    .59368

------------------------------------------------------------------------------
      colgpa |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       hsize |  -.0534038   .0175092    -3.05   0.002    -.0877313   -.0190763
     hsizesq |   .0053228   .0024086     2.21   0.027     .0006007     .010045
      hsperc |  -.0171365   .0005892   -29.09   0.000    -.0182916   -.0159814
      female |   .0581231   .0188162     3.09   0.002     .0212333     .095013
     athlete |   .0054487   .0447871     0.12   0.903    -.0823582    .0932556
       _cons |   3.047698   .0329148    92.59   0.000     2.983167    3.112229
------------------------------------------------------------------------------
```

With sat dropped from the model, the coefficient on athletes becomes about 0.0054 (se 0.0448), which is not statistically significant.

This happens because we do not control for SAT scores, and athletes score lower on average than nonathletes.

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Part (ii) shows that, once we account for SAT differences, athletes do better than nonathletes. Even if we do not control for SAT scores, there is no difference.

iv.)

```
. gen male = female == 0

. gen nonathlete = athlete == 0

. gen maleathlete = male*athlete

. gen malenonathlete = male*nonathlete

. gen femaleathlete = female*athlete

. reg colgpa hsize hsizesq hsperc sat femaleathlete maleathlete malenonathlete
```

Source	SS	df	MS
Model	524.821272	7	74.9744674
Residual	1269.3744	4,129	.307429015
Total	1794.19567	4,136	.433799728

Number of obs	=	4,137
F(7, 4129)	=	243.88
Prob > F	=	0.0000
R-squared	=	0.2925
Adj R-squared	=	0.2913
Root MSE	=	.55446

colgpa	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
hsize	-.0568006	.0163671	-3.47	0.001	-.0888889	-.0247124
hsizesq	.0046699	.0022507	2.07	0.038	.0002573	.0090825
hsperc	-.0132114	.000573	-23.06	0.000	-.0143349	-.012088
sat	.0016462	.0000669	24.62	0.000	.0015151	.0017773
femaleathlete	.1751106	.0840258	2.08	0.037	.0103748	.3398464
maleathlete	.0128034	.0487395	0.26	0.793	-.0827523	.1083591
malenonathlete	-.1546151	.0183122	-8.44	0.000	-.1905168	-.1187133
_cons	1.39619	.0755581	18.48	0.000	1.248055	1.544324

The coefficient on femaleathlete shows that colgpa is predicted to be about 0.175 points higher for a female athlete than a female nonathlete, other variables in the equation fixed.

The hypothesis that there is no difference between female athletes and female nonathletes is testing by using the t statistic on femath.

t = 2.08, which is statistically significant at the 5% level against a two-sided alternative.

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v.)

```
. gen femalesat = female*sat

. reg colgpa hsize hsizesq hsperc sat femaleathlete maleathlete malenonathlete femalesat
```

Source	SS	df	MS
Model	524.873728	8	65.609216
Residual	1269.32195	4,128	.307490781
Total	1794.19567	4,136	.433799728

Number of obs	=	4,137
F(8, 4128)	=	213.37
Prob > F	=	0.0000
R-squared	=	0.2925
Adj R-squared	=	0.2912
Root MSE	=	.55452

colgpa	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
hsize	-.0568198	.0163688	-3.47	0.001	-.0889114	-.0247282
hsizesq	.0046773	.002251	2.08	0.038	.0002641	.0090904
hsperc	-.0132236	.0005738	-23.04	0.000	-.0143487	-.0120986
sat	.001624	.0000858	18.93	0.000	.0014558	.0017922
femaleathlete	.1779989	.0843247	2.11	0.035	.0126771	.3433207
maleathlete	.0652958	.1361172	0.48	0.631	-.2015674	.3321589
malenonathlete	-.0990198	.1358427	-0.73	0.466	-.3653447	.1673051
femalesat	.0000539	.0001306	0.41	0.680	-.0002021	.00031
_cons	1.364334	.1079746	12.64	0.000	1.152646	1.576023

Its coefficient is about 0.00005 and its t statistic is about 0.40. There is very little evidence that the effect of sat differs by gender.