Question 1

Consider the following estimated equation:

$$\underset{}{sleep\_hat} = \underset{(112.28)}{3{,}638.25} - \underset{(.017)}{.148}\, totwrk - \underset{(5.88)}{11.13}\, educ + \underset{(1.45)}{2.20}\, age$$

$$n = 706,\ R^2 = 0.113,$$

standard errors are in parenthesis.

(i) Is either *educ* or *age* individually significant at the 5% level against a two-sided alternative? Show your work.

(ii) Dropping *educ* and *age* from the equation gives

$$sleep\_hat = \underset{(38.91)}{3{,}586.38} - \underset{(.017)}{.151}\ totwrk$$

$$n = 706,\ R^2 = 0.103.$$

Are *educ* and *age* jointly significant in the original equation at the 5% level? Justify your answer.

(iii) Does including *educ* and *age* in the model greatly affect the estimated tradeoff between sleeping and working?

(iv) Suppose that the sleep equation contains heteroskedasticity. What does this mean about the tests computed in parts (i) and (ii)?

Question 2

The following equation was estimated:

$$sat\_hat = \underset{(6.29)}{1{,}028.10} + \underset{(3.83)}{19.30}\, hsize - \underset{(.53)}{2.19}\, hsize^2 - \underset{(4.29)}{45.09}\, female$$

$$- \underset{(12.71)}{169.81}\, black + \underset{(18.15)}{62.31}\, female*black$$

$$n = 4{,}137,\ R^2 = 0.0858.$$

The variable *sat* is the combined SAT score, *hsize* is size of the student's high school graduating class, in hundreds, female is a gender dummy variable, and black is a race dummy variable equal to one for blacks and zero otherwise.

(i) Is there strong evidence that $hsize^2$ should be included in the model? From this equation, what is the optimal high school size?

(ii) Holding *hsize* fixed, what is the estimated difference in SAT score between nonblack females and nonblack males? How statistically significant is this estimated difference?

(iii) What is the estimated difference in SAT score between nonblack males and black males? Test the null hypothesis that there is no difference between their scores, against the alternative that there is a difference.

(iv) What is the estimated difference in SAT score between black females and nonblack females? What would you need to do to test whether the difference is statistically significant?

Question 3

The following equation was estimated for the fall and second semester students:

$$trmgpa\_hat = \underset{\substack{(.55)\\ [.55]}}{22.12} + \underset{\substack{(.175)\\ [.166]}}{.900}\, crsgpa + \underset{\substack{(.064)\\ [.074]}}{.193}\, cumgpa + \underset{\substack{(.0012)\\ [.0012]}}{.0014}\, tothrs$$

$$+ \underset{\substack{(.0002)\\ [.0002]}}{.0018}\, sat - \underset{\substack{(.0018)\\ [.0019]}}{.0039}\, hsperc + \underset{\substack{(.085)\\ [.079]}}{.351}\, female - \underset{\substack{(.098)\\ [.080]}}{.157}\, season$$

$$n = 269,\ R^2 = 0.465.$$

trmgpa is term GPA, *crsgpa* is a weighted average of overall GPA in courses taken, *cumgpa* is GPA prior to the current semester, *tothrs* is total credit hours prior to the semester, *sat* is SAT score, *hsperc* is graduating percentile in high school class, *female* is a gender dummy, and *season* is a dummy variable equal to unity if the student's sport is in season during the fall. The usual and heteroskedasticity-robust standard errors are reported in parentheses and brackets, respectively.

(i) Do the variables *crsgpa*, *cumgpa*, and *tothrs* have the expected estimated effects?

Which of these variables are statistically significant at the 5% level? Does it matter which standard errors are used?
(ii) Test the hypothesis H_0: $b_{crsgpa} = 1$ against the two-sided alternative at the 5% level, using both standard errors. Describe your conclusions.
(iii) Test whether there is an in-season effect on term GPA, using both standard errors. Does the significance level at which the null can be rejected depend on the standard error used?