<u>Following questions will not be graded, they are for you to practice and will be discussed at the recitation:</u>

1. [Practice question, not graded] SW Problem 4.1

(a) The predicted average test score is

$$\widehat{Test\ Score} = 520.4 - 5.82\text{x}22 = 392.36$$

(b) The predicted <u>decrease</u> in the classroom average test score is

$$\Delta\widehat{TestScore} = (-5.82\text{x}19) - (-5.82\text{x}23) = 23.28$$

or the predicted <u>change</u> is

$$\Delta\widehat{TestScore} = (-5.82\text{x}23) - (-5.82\text{x}19) = -23.28$$

(c) Using the formula for $\hat{\beta}_0$, we know the sample average of the test scores across the 100 classroom is

$$\overline{TestScore} = \hat{\beta}_0 + \hat{\beta}_1\text{x}\overline{CS} = 520.4 - 5.82\text{x}21.4 = 395.85$$

(d) Use the formula for the standard error of the regression (SER) to get the sum of squared residuals:

$$SSR = (n-2)SER^2 = (100-2)\text{x}11.5^2 = 12961$$

Use the formula for R^2 to get the total sum of squares:

$$TSS = \frac{SSR}{1-R^2} = \frac{12961}{1-0.08} = 14088$$

The sample variance is $s_Y^2 = \frac{TSS}{n-1} = \frac{14088}{99} = 142.3$. Thus, the standard deviation is $s_Y = \sqrt{s_Y^2} = 11.9$

2. [Practice question, not graded] SW Problem 4.3

(a) The coefficient 9.6 shows the marginal effect of Age on AWE; that is, AWE is expected to increase by \$9.6 for each additional year of age. 696.7 is the intercept of the regression line. It determines the overall level of the line.

(b) SER is in the same units as the dependent variable (Y, or AWE in this example). Thus SER is measures in dollars per week.

(c) R^2 is unit free.

(d) (i) $696.7 + 9.6 \times 25 = \$936.7$;

(ii) $696.7 + 9.6 \times 45 = \$1{,}128.7$

(e) No. The oldest worker in the sample is 65 years old. 99 years is far outside the range of the sample data.

(f) No. The distribution of earning is positively skewed and has kurtosis larger than the normal.

(g) $\hat{\beta}_0 = \overline{Y} - \hat{\beta}_1\overline{X}$, so that $\overline{Y} = \hat{\beta}_0 + \hat{\beta}_1\overline{X}$. Thus the sample mean of AWE is $696.7 + 9.6 \times 41.6 =$ \$1,096.06.

3. [Practice question, not graded] Let $KIDS$ denote the number of children born to a woman, and let $EDUC$ denote years of education for the woman. A simple model relating fertility to years of education is

$KIDS = a + b * EDUC + u,$

where u is the unobserved residual.

a) What kinds of factors are contained in u? Are these likely to be correlated with level of education?

Income, age, and family background (such as number of siblings) are just a few possibilities. It seems that each of these could be correlated with years of education.(Income and education are probably positively correlated; age and education may be negatively correlated because women in more recent cohorts have, on average, more education; and number of siblings and education are probably negatively correlated.)

b) Will simple regression of kids on *EDUC* uncover the ceteris paribus ('all else equal') effect of education on fertility? Explain.

Not if the factors we listed in part (i) are correlated with EDUC. Because we would like to hold these factors fixed, they are part of the error term. But if u is correlated with EDUC, then E(u|EDUC) is not zero, and thus OLS Assumption (A2) fails.

4. [Practice question, not graded] SW Problem 4.9

(a) With $\hat{\beta}_1 = 0$, $\hat{\beta}_0 = \overline{Y}$, and $\hat{Y}_i = \hat{\beta}_0 = \overline{Y}$. Thus ESS = 0 and $R^2 = 0$.

(b) If $R^2 = 0$, then ESS = 0, so that $\hat{Y}_i = \overline{Y}$ for all i. But $\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_i$, so that $\hat{Y}_i = \overline{Y}$ for all i, which implies that $\hat{\beta}_1 = 0$, or that X_i is constant for all i. If X_i is constant for all i, then $\sum_{i=1}^{n}(X_i - \overline{X})^2 = 0$ and $\hat{\beta}_1$ is undefined (see equation (4.7)).

5. [Practice question, not graded] SW Empirical Exercise 4.1

(a) $\widehat{AHE} = 1.08 + 0.60 \times Age$ Earnings increase, on average, by 0.60 dollars per hour when workers age by 1 year.

(b) Bob's predicted earnings = 1.08 + (0.60 × 26) = \$16.68 Alexis's predicted earnings = 1.08 + (0.60 × 30) = \$19.08

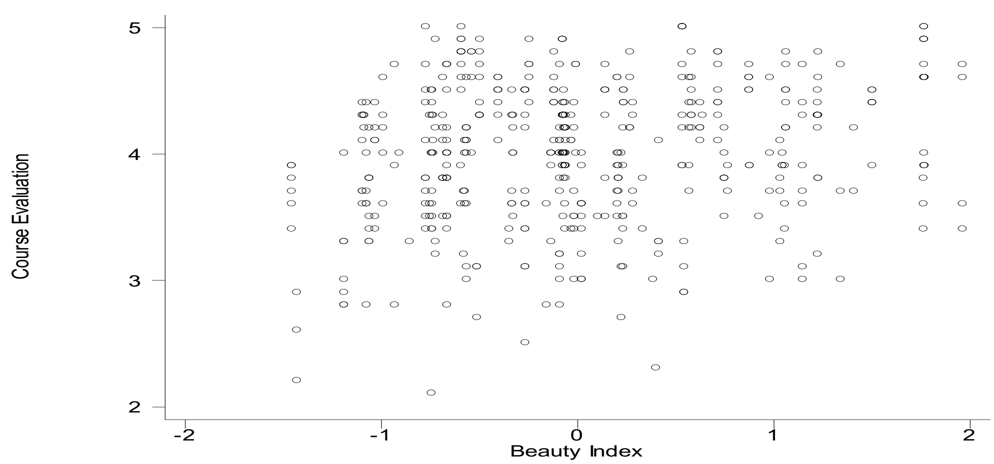
(c) The regression R^2 is 0.03.This means that age explains a small fraction of the variability in earnings across individuals.

.do file for q10:

```
use cps08.dta, clear // Load data and clear workspace
regress ahe age // Run regression to see effect of age on AHE
scalar b0 = _b[_cons] // save beta_0
scalar b1 = _b[age] // save beta_1
display b0+b1*26 // for 26 year-old
display b0+b1*30 // for 30 year-old
```

6. [Practice question, not graded] SW Empirical Exercises 4.2

(a)



There appears to be a weak positive relationship between course evaluation and the beauty index.

(b) $\widehat{Course\_Eval} = 4.00 + 0.133 \times Beauty$. The variable *Beauty* has a mean that is equal to 0; the estimated intercept is the mean of the dependent variable (*Course_Eval*) minus the estimated slope (0.133) times the mean of the regressor (*Beauty*). Thus, the estimated intercept is equal to the mean of *Course_Eval*.

(c) The standard deviation of *Beauty is* 0.789. Thus

Professor Watson's predicted course evaluations $= 4.00 + 0.133 \times 0 \times 0.789 = 4.00$

Professor Stock's predicted course evaluations $= 4.00 + 0.133 \times 1 \times 0.789 = 4.105$

(d) The standard deviation of course evaluations is 0.55 and the standard deviation of beauty is 0.789. A one standard deviation increase in beauty is expected to increase course evaluation by $0.133 \times 0.789 = 0.105$, or 1/5 of a standard deviation of course evaluations. The effect is small.

(e) The regression R^2 is 0.036, so that *Beauty* explains only 3.6% of the variance in course evaluations.

.do file for q 11:

```
use TeachingRatings, clear
scatter course_eval beauty
graph export beauty_effect.pdf, replace
reg course_eval beauty
scalar b0 = _b[_cons]
scalar b1 = _b[beauty]
sum beauty // The MACRO's `r(mean)' and `r(sd)' are loaded by this command
display b0+b1*`r(mean)' // Watson
display b0+b1*(`r(mean)'+`r(sd)') // Stock
sum course_eval
```