INTRODUCTORY ECONOMETRICS (12156)

All questions are compulsory.

Part one should be answered, very briefly, in a maximum of two sheets of paper.

PART ONE

1. Suppose that the annual salary of executives of a given firm, *salary*, depends on firm's performance, as measured by the average return on equity of the firm in the stock market, *roe*. To study this relationship, we estimated the equation

$$\hat{salary} = 963.191 + 18.501\, roe$$
$$n = 209, \quad R^2 = 0.0132$$

   where *salary* is measured in thousands of dollars, and return on equity, *roe*, is defined in terms of net income as a percentage of common equity.
   Suppose that *salary* is measured in hundreds of dollars, rather than in thousands of dollars, say *salaryhun*. What will be the OLS intercept and slope estimates in the regression of *salaryhun* on *roe*?

2. A simple model to explain city murder rates (*murdrate*) in terms of the probability of conviction (*prbconv*) and average sentence length (*avgsen*) is

$$murdrate = \beta_0 + \beta_1 prbconv + \beta_2 avgsen + u$$

   What are some factors contained in *u*? Do you think the key assumption $E(u \mid prbconv, avgsen) = 0$ is likely to hold?

3. Suppose that *u* is independent of the explanatory variables, and it takes on the values −2, −1, 0, 1, and 2 with equal probability of 1/5. Does this violate the Gauss-Markov assumptions? Does this violate the Classical Linear Model (CLM) assumptions?

4. Consider the equation

$$stndfnl = \beta_0 + \beta_1 atndrte + \beta_2 priGPA + \beta_3 ACT + \beta_4 priGPA^2$$
$$+ \beta_5 ACT^2 + \beta_6 priGPA \cdot atndrte + u$$

   If we add the term $\beta_7 ACT \cdot atndrte$ to the above equation, what is the partial affect of *atndrte* on *stndfnl*?

5. In a sample of baseball player salaries, players are given one of six positions: *frstbase*, *scndbase*, *thrdbase*, *shrtstop*, *outfield*, or *catcher*. To allow for salary differentials across position, with outfielders as the base group, which dummy variables would you include as independent variables?

PART TWO

6. Let y and x denote the U.K. savings and real income, respectively. We have information divided into two periods: 1946-1954, just finished the World War II, or "re-building period", and 1955-1963, "post-re-building" period. We want to assess whether the savings-real income relationship,

$$y = \beta_0 + \beta_1 x + u$$

has changed across time.

a) Suggest two alternative, but equivalent procedures, to test the hypothesis that there is no structural change in the parameters of the relationship between the two periods.
b) Using a dummy variable regression, the results are:

$$\hat{y} = -\ 1.75\ +\ 1.480\ \ d\ +\ 0.150\ \ x-\ 0.100\ \ dx$$
$$(0.33)\quad (0.470)\qquad (0.016)\qquad (0.033)$$

(standard errors in parenthesis) where $d = 1$ for the first period and zero otherwise; this is, $d = 1$ for 1946-1954. Test the individual significance of the *differential* intercept and slope, and obtain the separate regressions for both periods. Use graphics to explain the differences.

7. Let *qr*, *pr*, *pd* and *inc* be the demand of roses, price of roses, price of daisies and real income, respectively, all the variables are measured in natural logs. Using data from a recent survey, the following model were estimated:

Dependent Variable: QR
Method: Least Squares
Date: 05/31/06   Time: 13:00
Sample: 1 100
Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	56.55891	83.92950	0.673886	0.5020
PR	-1.430812	0.836762	-1.709939	0.0905
PD	3.816941	0.851488	4.482672	0.0000
INC	0.080026	0.080128	0.998720	0.3204

R-squared	0.206055	Mean dependent var	147.9504
Adjusted R-squared	0.181244	S.D. dependent var	13.05258
S.E. of regression	11.81065	Akaike info criterion	7.815058
Sum squared resid	13391.18	Schwarz criterion	7.919265
Log likelihood	-386.7529	F-statistic	8.305052
Durbin-Watson stat	2.216909	Prob(F-statistic)	0.000057

a) Write down the estimated model and interpret the sign and size of the coefficients.
b) Test the individual significance of all the parameters, at the 5% and 10% significance levels. Test the joint significance of all the parameters but the intercept.

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ANSWERS

PART ONE

1. The equation will be $sal\hat{a}ryhun = 9,631.91 + 185.01\,roe$, as is easily seen by multiplying the estimated equation by 10.

2. Just a few factors include age and gender distribution, size of the police force (or, more generally, resources devoted to crime fighting), population, and general historical factors. These factors certainly might be correlated with *prbconv* and *avgsen*, which means that the key assumption $E(u \mid prbconv, avgsen) = 0$ would not hold. For example, size of the police force is possibly correlated with both *prbconv* and *avgsen*, as some cities put more effort into crime prevention and enforcement. We should try to bring as many of these factors into the equation as possible.

3. Under these assumptions, the Gauss-Markov assumptions are satisfied: u is independent of the explanatory variables, so $E(u \mid x_1, x_2, \ldots, x_k) = E(u)$, and $\text{Var}(u \mid x_1, x_2, \ldots, x_k) = \text{Var}(u)$. Further, it is easily seen that $E(u) = 0$. Therefore, MLR.3 and MLR.5 hold. The Classical Linear Model (CLM) assumptions are not satisfied, because u is not normally distributed, which is a violation of MLR.6.

4. The new model would be

$$stndfnl = \beta_0 + \beta_1 atndrte + \beta_2 priGPA + \beta_3 ACT + \beta_4 priGPA^2$$
$$+ \beta_5 ACT^2 + \beta_6 priGPA \cdot atndrte + \beta_7 ACT \cdot atndrte + u$$

Therefore, the partial effect of *atndrte* on *stndfnl* is $\beta_1 + \beta_6 priGPA + \beta_7 ACT$. This is what we multiply by $\Delta.atndrte$ to obtain the ceteris paribus change in *stndfnl*.

5. With *outfield* as the base group, we would include the dummy variables *frstbase*, *scndbase*, *thrdbase*, *shrtstop*, and *catcher*.