Answer each of the following questions.

1) Econometric models are described as stochastic rather than deterministic. The stochastic nature of the models comes from the error term which we have labeled $\epsilon$. Describe the sources of this error term. (15 points)

2) Suppose the model is $Y_i = a + X_{i1}b_1 + Z_{i2}b_2 + \epsilon$, where $\epsilon = g + \epsilon_{i-1} + X_i\nu_i$, and $\nu_i$ satisfies all the usual assumptions we make about the error. Which, if any, of the error or model assumptions are violated by the model? (21 points)

3) Suppose you are given the three equation model:

$$
Y_1 = a_0 + a_1X_1 + a_2Y_2 + a_3Y_3 + u_1 \\
Y_2 = b_0 + b_1X_2 + u_2 \\
Y_3 = X_1 + X_3 + Y_1
$$

where $Y_i$'s are endogenous variables and $X_i$'s are predetermined or exogenous variables. Assume that $E(u_1u_2) = 0$. Why does this assumption matter? Find the reduced form equations and, if possible, the structural parameters. Describe how you would estimate the first two equations. (20 points)

4) Your estimate of a quarterly consumption model on 50 observations is:

$$
\text{Consumption} = -48.7 + .68\text{Income} - .04\text{intrate} \\
\quad (17.3) \quad (.23) \quad (.02)
$$

$R^2 = .75$, $dw = 3.75$

Numbers in parentheses are standard errors. Test for statistical significance of the slope coefficients. Test the hypothesis that the income coefficient equals $.9$. Is autocorrelation present? What is the magnitude of the correlation between the errors? Does this seem sensible? If autocorrelation is present what can be said about the results of the estimation? (18 points)

5) Specification errors often show up as either autocorrelation or heteroskedasticity. Explain. (10 points)

6) You formulate a distributed lag model $Y_t = a + b_0X_t + b_1X_{t-1} + b_2X_{t-2} + b_3X_{t-3} + u$. You believe that the effect of $X$ is small at first, rises, then declines. Describe how you would estimate this model and what issues you must face. (14 points)

7) You believe that the demand for telephone service varies by season of the year. Explain how you would test this hypothesis. (10 points)