Write clear and complete answers. Partial answers get partial credit. Show your work to get credit.

1. 10 points. An equation for CEO (chief executive officer) salary is

\[
\log (\text{salary}) = 4.59 + 0.257 \log(sales) + 0.011 \text{ roe} + 0.158 \text{ finance} \\
+ 0.181 \text{ consprod} + 0.283 \text{ utility}
\]

\[
(0.30) \\
(0.32) \\
(0.04) \\
(0.089)
\]

\[n = 209, \quad R^2 = 0.357, \quad SSR = 42.91\]

The variables are defined as follows. \text{salary} is 1990 salary, in thousands. \text{sales} is 1990 firm sales, in millions. \text{roe} is return on equity, 88-90 avg. \text{finance}, \text{consprod} and \text{utility} are dummy variables indicating that the firm is in the finance, consumer produce, or utility industry. The omitted industry category is transportation.

Use this equation to test the hypothesis (at the 5% significance level) that return on equity has no effect on CEO salary.

2. 10 points. Use the above equation to test the hypothesis (at the 5% significance level) that the elasticity of CEO salary with respect to firm sales is unit elastic (that is, the elasticity is one.)

3. 15 points. Construct a 95% confidence interval for the elasticity of CEO salary with respect to firm sales.

4. 15 points. Now you reestimate the above equation with \text{finance}, \text{consprod} and \text{utility} omitted. You obtain

\[
\log (\text{salary}) = 4.36 + 0.275 \log(sales) + 0.018 \text{ roe} \\
(0.294) \\
(0.033) \\
(0.004)
\]

\[n = 209, \quad R^2 = 0.282, \quad SSR = 47.91.\]

Use these equations to test the joint hypothesis that CEO salary is unaffected by industry type.
5. 15 points. We have learned that the OLS estimate \( \hat{\beta} \) is asymptotically normally distributed. Why is this important? (That is, why is this useful? What does the normal distribution allow us to do?)

6. 15 points. You have a dataset consisting of observations on individual house sales. The data include the sale price, the total square feet \( sqrft \), and a dummy variable \( urban \) for urban (city) locations. Write down a regression equation for the conditional mean of sale price which allows the effect of \( sqrft \) on price to be different for urban and rural locations.

7. 20 points. Take the quadratic regression

\[
Y_i = \beta_0 + \beta_1 X_i + \beta_2 X_i^2 + u_i.
\]

Let \( m \) be the \( X \) value such that \( g(x) = E(Y_i \mid X_i = x) \) is maximized. That is, \( g(x) \) is maximized at \( x = m \). Consider the hypothesis

\[
H_0 : m = 100.
\]

Suppose you have a sample of \( n \) observations. How would you test \( H_0 \)? (What regression(s) would you estimate, what is the form of the test statistic, and what value of the test statistic would lead to rejection/acceptance of \( H_0 \)?) Make sure to justify your answer.