1. Consider the following model:

\[ x_i = \gamma y_i + u_i \]

where \( y_i \) and \( x_i \) are scalar and \( \{x_i, y_i\} \) are iid. Assume \( \gamma \neq 0 \) and \( E[y_i u_i] = 0 \). We are interested in the parameter \( \theta = 1/\gamma \).

(a) What is the OLS estimator for \( \gamma \)? Is it unbiased? Is it consistent?
(b) Find the asymptotic distribution of \( \hat{\gamma} \).
(c) Propose an estimator for \( \theta \).
(d) Find the asymptotic distribution of the estimator of the previous point \( \hat{\theta} \). [Hint: use the Delta Method.]

2. Assume that the CEF \( E[y_i|x_i] \) is non-linear in \( x_i = (1, x_{i1}, \ldots, x_{ik}) \) and \( \text{var}[y_i|x_i] = \sigma^2 \). Show that, if you use a linear model to approximate the CEF the quality of the fit between the regression line and the CEF depends on \( x_i \), i.e. the variance of the linear regression error is heteroskedastic by construction.

[Hint: \( E[(y_i - x_i\beta)^2|x_i] \) can be written as a function of \( E[y_i^2|x_i] \) and another term.]

3. [Julia] Create a function that takes as inputs, a vector with the dependent variable of interest, \( Y \), and a matrix of covariates \( X \), and that returns a table/matrix with the \( \beta_{OLS} \), standard errors and t-statistics.