Econ 3040 - Assignment 4: Polynomials, Logs, Interactions, Heteroskedasticity

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Due date: April 12th, 2023. Worth 3% of your final grade.

Instructions: Submit your assignment in the "Assignment 4" drop box on UM Learn. Include your name and student number. Do not copy and paste output from `R`. Format your results nicely. Submit the `R` code that you used for each question in your assignment.

You may use ChatGPT or other AI to assist you. Do not copy AI generated text into your assignment.

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1. Use the diamond data from class:

   ```
   diam <- read.csv("https://rtgodwin.com/data/diamond.csv")
   ```

   a) Estimate a model with price as the dependent variable. As explanatory variables, use: $carat$, $carat^2$, $carat^3$, $colour$, and $clarity$.

   b) Determine the appropriate degree of the polynomial in the variable $carat$.

   c) What is the estimated effect of an increase in $carats$ of 0.1 on the price of a diamond? Use your model from part (b), and remember that for a non-linear relationship the effect of an increase in $carats$ depends on the value of $carats$ (so you should try two different scenarios).

   d) Does your answer depend on the values that you choose for the $colour$ and $clarity$ variables?

2. Use the CPS dataset from class:

   ```
   cps <- read.csv("http://rtgodwin.com/data/cps1985.csv")
   ```

   a) Estimate a model with $\log(wage)$ as the dependent variable (note the **log**!). As explanatory variables use $education$, $gender$, age, $experience$, and a $gender \times education$ **interaction term**.

   b) What is the estimated effect of education on $wage$ for men, and for women?

   c) Test the hypothesis that the effect of $education$ on $wage$ is the same for men as it is for women.

   d) Test for heteroskedasticity.

   e) Use White's heteroskedastic robust standard errors, regardless of the result of the test. What changes when you use White's estimator?