CSC 401, Weekly Coding Assignment #5, Fall 2024 Name_____

Instructions: For these weekly coding assignments, you will be asked to extend the examples from class to create custom code to answer the questions below. You will create an R code file that uses built-in datasets as the data sources. You will write the code, and an example showing that the code works. Be sure to include any packages in the code that are required for the functions to run (you may want to clear the environment in RStudio before your final check to make sure nothing is missing). The instructor will run the file to ensure that it works with no errors. Clearly label your code so it's clear which question/task is being responded to.

Submission:
A word document with any explanations (if needed), and a clearly labeled R code file.

Tasks/Questions:

1. Run through the "bakeoff" in Surrogates 5.2.7 (https://bookdown.org/rbg/surrogates/chap5.html#chap5bakeoff). Describe your results.

2. In the lecture notes, we modeled a "toy" problem generated from a trig function (and the same function plus noise). Generate your own "toy" problem generated from a high degree polynomial (or a polynomial plus trig function). Model it as we did in the notes both without noise, and then with noise. Use at least 20 sample points in your model.

3. In the notes, we looked at the two-dimensional input function $y(\vec{x}) = x_1 e^{-x_1^2 - x_2^2}$. Modify this function to be $y(\vec{x}) = 5x_1 x_2 e^{-\frac{x_1^2}{4} - x_2^2}$. Repeat the example in the lecture notes and generate appropriate model graphs in 2D and 3D.

4. Using your 1D example in #2, what happens when you extrapolate beyond the range of the original data? Select one of the packages that models Gaussian processes (it can be any package; it does not need to be one mentioned in the notes). Recreate your example with the package. Does the package include a method for changing the way that the model extrapolates? If so, apply an extrapolation function and describe how this changes the model. Why might such an ability be useful?