Math 525 – Statistics I, Fall 2020

Assignment 1

Due: TBA

Problem 1: With this problem, you will improve your coding and data visualization skills.

(i) Develop a function that takes as input the radius of a sphere and returns its surface area. Similarly, develop a function that takes as input the radius of a sphere and returns its volume.

(ii) Use the functions you developed for (i) to develop a new function that takes as input the radius of a sphere and returns both its surface area and volume.

(iii) In a single figure with multiple panels, demonstrate how the surface area and volume of a sphere changes as well as how a sphere's surface area and volume are related to each other when the sphere's radius varies between 0 and 1 μm. The resulting figure should be graphically informative and scientifically accurate.

(iv) Briefly describe how you could modify the source code you developed for (i) and (ii) so they apply to cubes instead of spheres.

(v) The dataset provided captures experimentally estimated surface areas and volumes of individual *E. coli* cells. Based on these data, argue on whether *E. coli* cells attain a spherical or cubical shape. Explain in detail your reasoning.

Associated data: For step (v) use `e_coli_volume_area.mat`. This dataset contains surface area and volume measurements. The measurements are reported in units of μm^2 and μm^3, respectively.