



Principles of Complex Systems, Vols. 1, 2, & 3D
CSYS/MATH 6701, 6713, & a pretend number
University of Vermont, Fall 2023
Assignment 01

“Hard to believe I’m not really not really in space!”

Due: Friday, September 1, by 11:59 pm

<https://pdodds.w3.uvm.edu/teaching/courses/2023-2024pocsverse/assignments/01/>

Some useful reminders:

Deliverator: Prof. Peter Sheridan Dodds (contact through Teams)

Assistant Deliverator: Chris O’Neil (contact through Teams)

Office: The Ether

Office hours: See Teams calendar

Course website: <https://pdodds.w3.uvm.edu/teaching/courses/2023-2024pocsverse>

Overleaf: LaTeX templates and settings for all assignments are available at

<https://www.overleaf.com/read/tsxfwwmwdgxj>.

All parts are worth 3 points unless marked otherwise. Please show all your workings clearly and list the names of others with whom you conspired collaborated.

For coding, we recommend you improve your skills with Python, R, and/or Julia. The (evil) Deliverator uses (evil) Matlab.

Graduate students are requested to use \LaTeX (or related \TeX variant). If you are new to \LaTeX , please endeavor to submit at least n questions per assignment in \LaTeX , where n is the assignment number.

Assignment submission:

Via Brightspace or other preferred death vortex.

1. An amuse-bouche for scaling, to signal the flavors ahead:

Examine current weight lifting records for the snatch, clean and jerk, and the total for scaling with body mass (three regressions). Do so for both women and men’s records.

For weight classes, take the upper limit for the mass of the lifter.

Wikipedia is an excellent source.

- (a) How well does $2/3$ scaling hold up?
- (b) Normalized by the scaling you determine, who holds the overall, rescaled world record?

Normalization here means relative:

$$100 \times \left(\frac{M_{\text{worldrecord}}}{cM_{\text{weightclass}}^\beta} - 1 \right),$$

where c and β are the parameters determined from a linear fit.

2. Some kitchen table preparation for power-law size distributions:

Consider a random variable X with a probability distribution given by

$$P(x) = cx^{-\gamma}$$

where c is a normalization constant, and $0 < a \leq x \leq b$. (a and b are the lower and upper cutoffs respectively.) A Perishing Monk tells you to assume that $\gamma > 1$, that $a > 0$ always, and allow for the possibility that $b \rightarrow \infty$. And then the Monk disappears.

(a) Determine c .

(b) Why did the Perishing Monk tell us to assume $\gamma > 1$?

Think about what happens as $b \rightarrow \infty$.

3. Optional:

Watch “Basic Rocket Science.”

Community, S2E04.

https://en.wikipedia.org/wiki/Basic_Rocket_Science