

Principles of Complex Systems, Vols. 1, 2, & 3D CSYS/MATH 300, 303, & 394 University of Vermont, Fall 2022 Assignment 01

"I Aten't Dead" 🗹

Due: Friday, September 2, by 11:59 pm

Relevant clips, episodes, and slides are listed on the assignment's page:

https://pdodds.w3.uvm.edu/teaching/courses/2022-2023pocsverse//assignments/01/

Some useful reminders:

Deliverator: Prof. Peter Sheridan Dodds (contact through Teams) **Assistant Deliverator:** Dylan Casey (contact through Teams)

Office: The Ether Office hours: TBD

Course website: https://pdodds.w3.uvm.edu/teaching/courses/2022-2023pocsverse

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

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

When available, via Blackboard.

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 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 $0 < a \le x \le b$. (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 $b \to \infty$. And then disappears.

- (a) Determine c.
- (b) Why did the Perishing Monk tell us to assume $\gamma>1$? Think about what happens as $b\to\infty$.