P o C S  What's The Story?

Principles of Complex Systems, Vols. 1 & 2, CSYS/MATH 300 and 303
University of Vermont, Fall 2021
Assignment 01 • code name: Here I Go Again

Due: Friday, September 3, by 11:59 pm, 2021.
Relevant clips, episodes, and slides are listed on the assignment's page:
https://pdodds.w3.uvm.edu//teaching/courses/2021-2022principles-of-complex-systems//assignments/01/
Some useful reminders:
Deliverator: Prof. Peter Sheridan Dodds (contact through Teams)
Assistant Deliverator: Michael Arnold (contact through Teams)
Office: The Ether
Office hours: TBD
Course website: https://pdodds.w3.uvm.edu/pdodds/teaching/courses/2021-2022principles-of-complex-systems

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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: Via Blackboard.

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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.

   (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:

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

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 $0 < a \leq x \leq b$. (a and b are the lower and upper cutoffs respectively.) Assume that $\gamma > 1$.

   (a) Determine c.

   (b) Why did we assume $\gamma > 1$?