CSYS 300 Assignment 1

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Link to Github for Assignment Code: `https://github.com/brynchristineloftness/csys300pocs`

Question 1.

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, re-scaled world record?

Normalization here means relative:

$100 \times (\frac{M_{worldrecord}}{cM^{\beta}_{weightclass}} - 1)$,

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

Responses:
(a) *For each figure below the following steps were taken.*
With: y = $log_{10}M_r[0]$, x = $log_{10}M_l[0]$, β as the scaling exponent, and the intercept as a...

$$log_{10}M_r = log_{10}c + \beta log_{10}M_l$$
$$y = (log_{10}c) + (scalingexponent) * x$$

which can be translated to

$$y = a + \beta x$$

y is thus replaced with $M_r[0]$, x is thus replaced with $M_l[0]$, β is replaced with the scaling exponent found, and a can subsequently be solved for by...

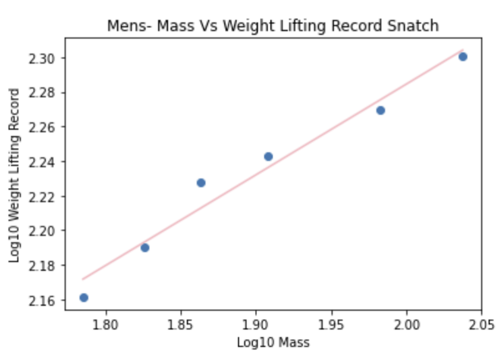
$$a = log_{10}c$$

where a is equal to the intercept found.

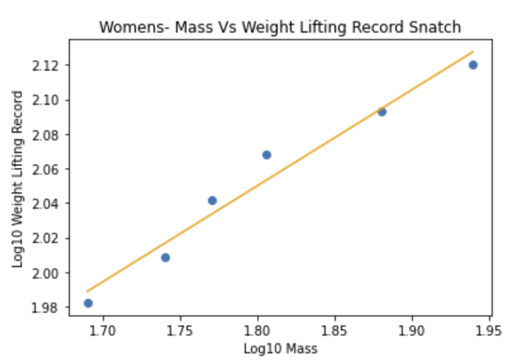
$$10^a = c$$

Figures

```
scaling exponent: [0.52526399]
intercept: 1.2339382117704663
M_r[0]: 2.161368002234975 M_l[0]: [1.78532984]
```

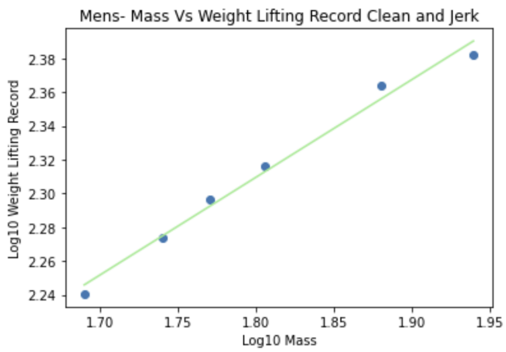



```
scaling exponent: [0.5560209]
intercept: 1.0489822901016215
M_r[0]: 1.9822712330395684 M_l[0]: [1.69019608]
```

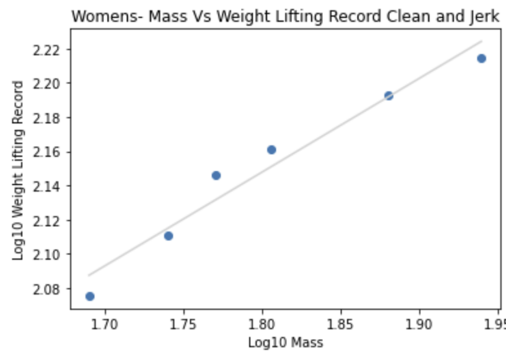


Men's Snatch c = 17.137134755953106 || Women's Snatch c = 17.915913248682678

```
scaling exponent: [0.57848269]
intercept: 1.2682008849652129
M_r[0]: 2.2405492482825995 M_l[0]: [1.69019608]
```

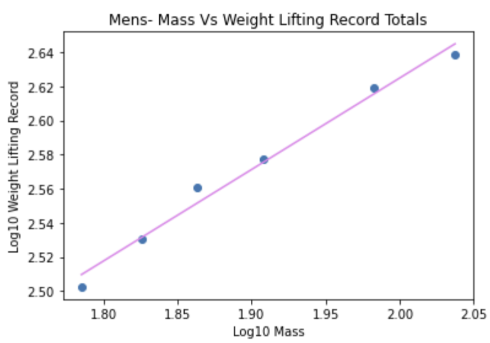



```
scaling exponent: [0.54837009]
intercept: 1.160648616591223
M_r[0]: 2.075546961392531 M_l[0]: [1.69019608]
```

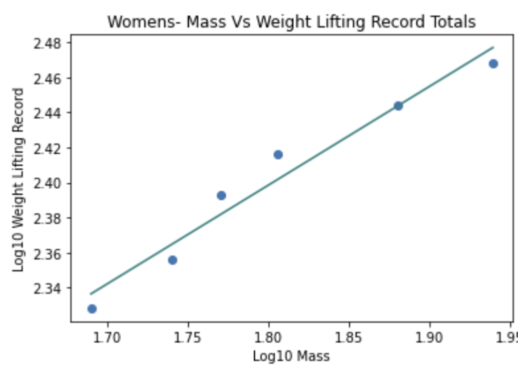


Men's Clean and Jerk c = 14.476001405121924 || Women's Clean and Jerk c = 24.228267605137226

```
scaling exponent: [0.53689281]
intercept: 1.5511103528624477
M_r[0]: 2.5024271199844326 M_l[0]: [1.78532984]
```




```
scaling exponent: [0.56337679]
intercept: 1.3843223618706018
M_r[0]: 2.3283796034387376 M_l[0]: [1.69019608]
```



Men's Totals c = 35.572169485062176 || Women's Totals c = 11.193922353464204

As can be seen from the coefficients in each test summarized below, they all differ from 2/3 scaling (0.6666) slightly ...

[0.52526399]

[0.55718565]

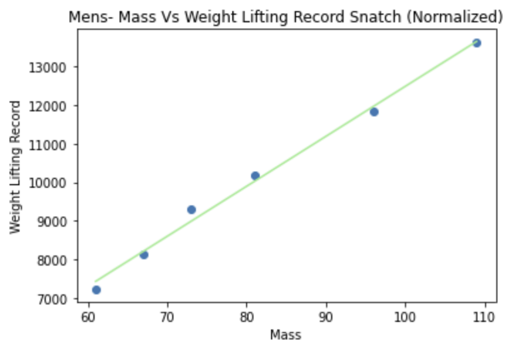
[0.53689281]

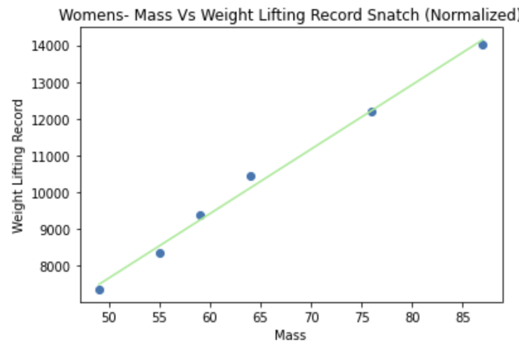
[0.5560209]

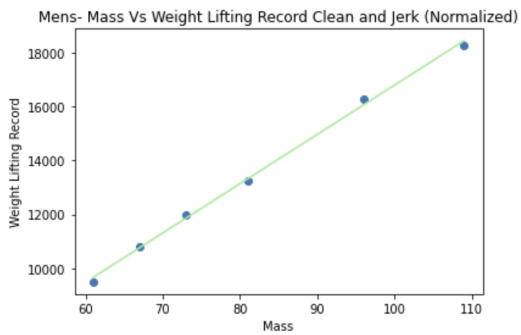
[0.54837009]

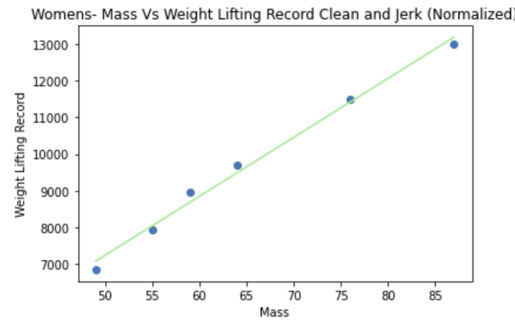
[0.56337679]

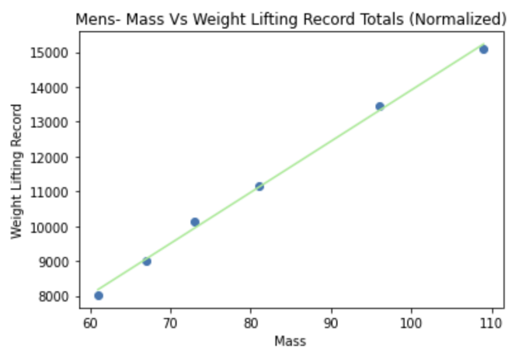
(b) Each of the regressions above were scaled according to their respective β and c values. The new figures can be seen below. As can be gathered from the new normalized figures, all of the original record holding trends are the same (ie, the shape of the distribution has not changed). The only aspect that has changed is that the values are more closely fit to the regression line and to each other, such can be expected from such normalization.

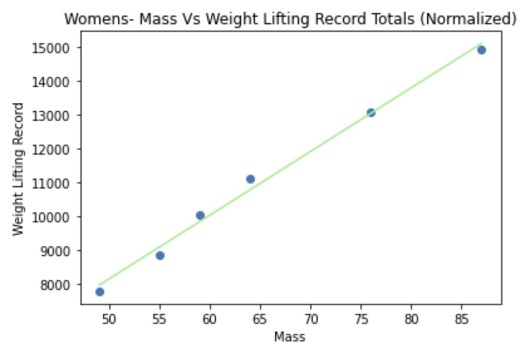












Question 2.

Consider a random variable X with a probability distribution given by $P(x) = cx^{-\gamma}$ where c is a normalization constant, and $0 < a \geq x \geq b$. (a and b are the lower and upper cutoffs respectively.) Assume that $\gamma > 1$.

(a) Determine c.
(b) Why did we assume $\gamma > 1$?

Responses:
(a)

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

$$\int_a^b P(x) = 1$$

$$c * \frac{x^{(1-\gamma)}}{1-\gamma}\Big|_a^b = 1$$

$$c(\frac{b^{(1-\gamma)}}{1-\gamma} - \frac{a^{(1-\gamma)}}{1-\gamma}) = 1$$

$$\frac{c}{(1-\gamma)} * (b^{(1-\gamma)} - a^{(1-\gamma)}) = 1$$

$$c * (b^{(1-\gamma)} - a^{(1-\gamma)}) = (1-\gamma)$$

$$\frac{1-\gamma}{b^{(1-\gamma)} - a^{(1-\gamma)}} = c$$

(b) γ can not be 0 (see above equation solving for c), because you can not divide by 0. γ can not be less than 1 or negative because P(x) would never converge (ie. increase infinitely from both tails).