

ME685A: Applied Numerical Methods: Home Assignment 3

Due: March 03, 2020, in class

1. (60 points) In a paper dealing with the efficiency of energy utilization of the larvae of the modest sphinx moth (*Pachysphinx modesta*), Dr. L. A. Schroeder¹ used the following experimental data to determine the relation between W , the live weight of the larvae in grams, and R , the oxygen consumption of the larvae in milliliters/hour.

W	R	W	R	W	R	W	R	W	R
0.017	0.154	0.025	0.23	0.020	0.181	0.020	0.180	0.025	0.234
0.087	0.296	0.111	0.357	0.085	0.260	0.119	0.299	0.233	0.537
0.174	0.363	0.211	0.366	0.171	0.334	0.210	0.428	0.783	1.47
1.11	0.531	0.999	0.771	1.29	0.87	1.32	1.15	1.35	2.48
1.74	2.23	3.02	2.01	3.04	3.59	3.34	2.83	1.69	1.44
4.09	3.58	4.28	3.28	4.29	3.40	5.48	4.15	2.75	1.84
5.45	3.52	4.58	2.96	5.30	3.88			4.83	4.66
5.96	2.40	4.68	5.10					5.53	6.94

For biological reasons, it is assumed that the relationship between W and R would be of the following form

$$\ln R = a + b \ln W + c (\ln W)^2$$

Using least square regression evaluate the constants a , b , c ; use Gaussian elimination program (written earlier) to solve the linear equations. Write the algorithm and the final answer and submit that document in class. Submit your computer program via e-mail.

2. (40 points) Linear least square regression problem leads to solution of a system of linear equations. Show that the system of linear equation has unique solution.

¹ Lauren A. Schroeder, Energy Budget of the Larvae of the Moth *Pachysphinx modesta*, *Oikos*, Vol 24(2), 1973, pp 278-281