Mathematics 245 Assignment 4 Fall 2015

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Due: Friday November 13

Topics

- Degree of precision (defined in Section 5.2)
- Integration (Section 5.2)
- Least squares fitting (Sections 4.1 and 4.2)

1. Integration (C. f. Exercise 5.2.12)

   Consider the goal of approximating $I = \int_0^1 f(x)\,dx$ with three evaluations of the function f, by

   $$c_0 f(0) + c_1 f(1/2) + c_2 f(1).$$

   Determine the coefficients that give the highest possible *degree of precision.*
   Then rescale this formula to give an approximation

   $$\int_a^b f(x)dx \approx [C_0 f(a) + C_1 f((a+b)/2) + C_2 f(b)](b-a)$$

   What is its degree of precision?
   Do you recognize this result?

2. **Computer Problem:** first version due by Friday November 13.

   The following can be done using Python or by hand; an IPython notebook presentation would be nice, so I will provide a notebook version of this table. Be sure to provide a written explanation of your results, not just numerical output.

   For the following data, find:

   (a) A linear least squares fit

   $$\text{(Blood Pressure)} \approx P_0 + P_1\text{(Weight)}.$$

   (b) A power law fit

   $$\text{(Blood Pressure)} \approx P\text{(Weight)}^a.$$

   Illustrate your results with graphs, and compare how the two methods perform.

Species	Blood Pressure (mm Hg)	Weight (g)
Cow	157	800000
Cat	129	2000
Dog	120	5000
Duck	162	2000
Frog	24	50
Giraffe	300	900000
Goat	98	30000
Guinea Pig	60	100
Human	120	90000
Monkey	140	5000
Pig	128	150000
Snake	55	100<
Turkey	193	15000