Omdugga 2013-02-11

All questions give 3 points. Do 1-3 for Omdugga 1, 3-5 for Omdugga 2, 1-5 for both.

7/9 to pass one, 12/15 to pass both

1. Consider the following little model:

   d/dt(x1) = u – k1*x1 –Vmax*x1/(Km + x1)

   d/dt(x2) = Vmax*x1/(Km + x1) – k3

   k1 = 1, Vmax = 2, Km = 3, k3 = 5, x1(0) = 2, x2(0) = 3, yhat(t,p) = ky*x2, ky = 4

   a) What are the states?, b) What are the parameters? c) What can be measured?

2. a) What is the input and output of a cost function?
   b) How does Euler's forward method for simulation work?
   c) What are the residuals in question 1, if y(0) = 3 ?

3. Consider again the model in question 1
   a) What are the reactions?
   b) What changes if you no longer assume that the reaction with saturation has this saturation?

4. Optimization and tests
   a) What is the input and output of an optimization algorithm?
   b) What is the null hypothesis of a whiteness test?
   c) What happens if you do not reject a chi-square test?

5. Closing the loop
   a) A core prediction is tested experimentally, and the experiment shows that a value outside the predicted interval was obtained. What can we then conclude? How would that be different if the prediction was not known to be a core prediction?
   b) You have two models that are acceptable given the current data. How can you use predictions to design an experiment that *ensures* that a new experiment will be able to distinguish between the models?
   c) Give an example of what makes modelling preferable to ordinary inspection and reasoning around data?

Good luck!
Gunnar