Omdugga 2014-02-19

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. You can write in Swedish and on both sides of the page. Personal-number and Dugga-id on all pages.

NOTE: the yellow expression has been changed compared to the original Omdugga, to make for a more fun/meaningful question

1. Consider the following little model:

d/dt(x1) = u – k1*x1*x2 –k2*x1

d/dt(x2) = k2*x1 – k3*x2

k1 = 1, k2 = 2, k3 = 3, x1(0) = 2, x2(0) = 3, yhat(t,p) = ky*x1*k2, ky = 4

a) What are the states? b) What are the parameters? c) What can be measured? (to get full point: describe what can be measured in words)

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 the experimental data are y(0) = 6 ?

3. Consider again the model in question 1
a) What are the reactions? Or, alternatively, what is the interaction graph?
b) What changes if the k2-reaction now allows for a saturation of the rate?

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

5. Closing the loop
a) A core prediction has been tested experimentally, and the experiment shows that a value outside the predicted interval has been 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) Is it better to have a well-determined or an undetermined prediction when trying to convince a biologist to collect experimental measurements of that prediction? Motivate your answer.

Good luck!
Gunnar