Dugga 2017-02-13

All questions give 3 points, to pass you need to get 12/15 points. You can write in English or Swedish and on both sides of the page. Write your Dugga-id on all pages.

*If you are from earlier years, do questions 1-3 for Omdugga 1, questions 3-5 for Omdugga 2, questions 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\*x2 –k2\*x1

d/dt(x2) = – k1\*x1\*x2 + k2\*x1 – k3\*x2

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

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 k3-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 whiteness test?

c) What happens if you do not reject a chi-square 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