Dugga 1, TBMT19 and TBMT37, 2015-01-30

3 questions, with 3 points each. 7 points needed to pass. You can answer in Swedish or English, and write on both sides of the paper. Name, personal number, and Dugga-id on all papers you hand in!

1 Model components

Consider the following model

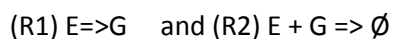$d/dt([A]) = u1 - k1*[A] - k2*[A]$

$d/dt([B]) = k2*[A]$

$[A](0) = 0.5, [B](0) = 1, k1 = 4, k2 = 3$

$yhat(t,p) = ky*[B]/(Km\_y + [B])$ $ky=4, Km\_y = 5$

a) What are the reaction rates? b) What are the states? c) Describe the yhat-equation, what does it mean? (if you can: also describe the actual functional relationship it describes)

2 Model formulation

Consider the following reactions

(R1) E=>G   and (R2) E + G => Ø

a) Write up the differential equations. Assume that R1 has a saturation with respect to E and that R2 is governed by mass action kinetics. Don't forget to specify the initial conditions, and to give values to any parameters you may introduce.

b) Extend the model so that it describes that you can measure the rate of R2 times an unknown scaling parameter.

3) Cost function and simulation

a) What is the principle behind numerical integration of ordinary differential equations?

b) Consider the model from question 1. What is the value of B(0.1) if you take one Euler forward step to get there.

c) Consider again the model from question 1. What are the inputs and outputs of that model?

Good luck! //Gunnar