Problem Set 3

November 12, 2010

1 Problem 1

1.1 Part a

Given this growth rate

$$\frac{dX}{dt} = aX(b - t)$$

where
a and b are constants.

Integrate to find the explicit form of the growth function. Hint: You can add X_0 to determine the condition where $X = X_0$ at $t = 0$.

1.2 Part b

Fit the previous model in R using the following data.

```
     tt     yy
1  0.00  0.727
2  0.25  1.906
3  0.50  5.138
4  0.75  5.801
5  1.00  6.465
6  1.25 10.988
7  1.50 11.567
8  1.75 12.957
9  2.00 14.811
```

```
10 2.25 25.104
11 2.50 20.893
12 2.75 19.235
13 3.00 18.829
14 3.25 12.248
15 3.50  9.435
16 3.75  7.819
17 4.00  6.864
18 4.25  6.464
19 4.50  6.248
20 4.75  1.389
21 5.00  0.732
```

1. Identify the value of the parameter estimates and the residual variance. (I want to know that you know how to read this from the output).
2. Plot observations and fitted values vs. time.
3. Plot residual versus fitted and describe the results in terms of the assumptions of the model.
4. Identify a few of the most extreme outliers
5. Calculate mean bias and concordance correlation.

2 Problem 2

Given the data `growth-eu.csv` fit a non-linear model.

1. Test two different mean functions
2. Test assumptions of the model
3. Modify the model to accommodate assumptions

3 Problem 3

Create a function in R that performs a grid search for the parameters `rue` and `lai.c` for the `RUEmod`. The function should identify the combination of

parameters that results in the lowest residual sum of squares. To test the method you can use the data simulated in the file `RUE-ex-ma.txt`.

Being able to write a function like this is useful because one of the weaknesses of non-linear models is that they tend to fail to converge when poor starting values are chosen. A preliminary search of reasonable values for parameters can be helpful in finding optimized values.