corn1

```
> corn <- read.table("C:/Documents and Settings/dhall/My Documents/Dans Work
Stuff/courses/STAT8230/Fall09/corn1.dat",header=T)
> library(nlme)
> corn$logwt <- log(corn$weight)
> logRichModel <- deriv( ~ th1-th4*log(1+exp(th2-th3*x)),c("th1","th2","th3","th4"),
+  function(x,th1,th2,th3,th4){})
> plot(corn$time,corn$logwt,xlab="Time Since Silking",ylab="Log(Weight)")
> m1corn.nls <- gnls(logwt~logRichModel(time,th1,th2,th3,th4),data=corn,
+  start=c(th1=5.5,th2=-1.5,th3=.07,th4=33),verbose=T,
+  control=list(returnObject=T,minScale=.0001))

NLS step: RSS =  2.090599
 model parameters:5.49992  -1.57189  0.0698934  35.3152
 iterations: 7

Convergence:
   params
0.06555701

NLS step: RSS =  2.089497
 model parameters:5.49983  -1.64869  0.0697869  37.977
 iterations: 7

Convergence:
   params
0.07009012

NLS step: RSS =  2.088753
 model parameters:5.49975  -1.73117  0.0696805  41.0696
 iterations: 7

Convergence:
   params
0.07530215

NLS step: RSS =  2.088463
 model parameters:5.49967  -1.82029  0.0695742  44.7069
 iterations: 7

Convergence:
   params
0.08135794
```

```
Warning message:
In gnls(logwt ~ logRichModel(time, th1, th2, th3, th4), data = corn,  :
  Step halving factor reduced below minimum in NLS step
> summary(m1corn.nls)
Generalized nonlinear least squares fit
  Model: logwt ~ logRichModel(time, th1, th2, th3, th4)
  Data: corn
      AIC      BIC    logLik
  21.39877 21.12832 -5.699383

Coefficients:
      Value Std.Error    t-value p-value
th1  5.49967     2.003  2.7463400  0.0710
th2 -1.82029   381.731 -0.0047685  0.9965
th3  0.06957     0.492  0.1414020  0.8965
th4 44.70685 16341.506  0.0027358  0.9980

 Correlation:
    th1    th2    th3
th2 -0.885
th3 -0.943  0.983
th4  0.883 -1.000 -0.982

Standardized residuals:
      Min        Q1       Med        Q3       Max
-0.9095127 -0.8148394 -0.5741433 -0.4592925 -0.3041928

Residual standard error: 0.8343586
Degrees of freedom: 7 total; 3 residual
> coefs<-coef(m1corn.nls)
> coefs
       th1        th2        th3        th4
 5.49966954 -1.82028689  0.06957416 44.70685290
> th1hat<-coefs[1]
> th2hat<-coefs[2]
> th3hat<-coefs[3]
> th4hat<-coefs[4]
> expfunhat <- logRichModel(corn$time,th1hat,th2hat,th3hat,th4hat)
> expfunhat
[1] 3.352244 4.298213 4.587125 5.042251 5.213127 5.333777 5.403681
attr(,"gradient")
    th1        th2      th3        th4
```

```
[1,]   1 -2.09666698 35.905422 -0.048033468
[2,]   1 -1.18545648 30.377322 -0.026874110
[3,]   1 -0.90329475 26.760107 -0.020411748
[4,]   1 -0.45508651 18.032803 -0.010231510
[5,]   1 -0.28562624 13.245917 -0.006409365
[6,]   1 -0.16558527  8.983001 -0.003710677
[7,]   1 -0.09588537  5.956878 -0.002147061
>
> Vhat <- attr(expfunhat,"gradient")
> Vhat
    th1        th2       th3         th4
[1,]   1 -2.09666698 35.905422 -0.048033468
[2,]   1 -1.18545648 30.377322 -0.026874110
[3,]   1 -0.90329475 26.760107 -0.020411748
[4,]   1 -0.45508651 18.032803 -0.010231510
[5,]   1 -0.28562624 13.245917 -0.006409365
[6,]   1 -0.16558527  8.983001 -0.003710677
[7,]   1 -0.09588537  5.956878 -0.002147061
>
> det(t(Vhat)%*%Vhat)
[1] 4.645152e-06
> eigen( t(Vhat)%*%Vhat )$values
[1] 3.556681e+03 1.901084e+00 2.636752e-01 2.605460e-09
>
> logRichModel3 <- deriv( ~ th1-log(1+exp(th2-th3*x)),c("th1","th2","th3"),
+  function(x,th1,th2,th3){})
> m2corn.nls <- nls(logwt~logRichModel3(time,th1,th2,th3),data=corn,
+  start=c(th1=5.5,th2=-1.5,th3=.07))
> summary(m2corn.nls)

Formula: logwt ~ logRichModel3(time, th1, th2, th3)

Parameters:
   Estimate Std. Error t value Pr(>|t|)
th1  4.78770    0.14411  33.223  4.9e-06 ***
th2  4.85333    0.85228   5.695   0.0047 **
th3  0.16920    0.04197   4.031   0.0157 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2398 on 4 degrees of freedom
```

Number of iterations to convergence: 10
Achieved convergence tolerance: 4.015e-06

```
> m2coefs<-coef(m2corn.nls)
> x0<-seq(from=min(corn$time),to=max(corn$time),by=.1)
> y0<-logRichModel3(x0,m2coefs[1],m2coefs[2],m2coefs[3])
> lines(x0,y0)
> title(main="Log(Wt) of Corn vs. Time Since Silking w/ Asymp. Reg. Curve")
>
```