

lipo1.R:

```
source("n:/courses/STAT8230/Fall109/compmodel.R")
par(mfrow=c(2,2))
"Lipo" <-
  structure(list(time = c(0.5, 1, 1.5, 2, 3, 4, 5, 6, 7, 8, 9, 10),
                conc = c(46.1, 25.9, 17, 12.1, 7.22, 4.51, 3.19, 2.4, 1.82,
                        1.41, 1, 0.94)),
            .Names = c("time", "conc"), row.names = as.character(1:12),
            class = "data.frame",
            reference = "A1.16, p. 282")
plot(Lipo$time, Lipo$conc, xlab = "Time (days)", ylab =
     "Concentration (%)")
title(main = "Lipoprotein Data - Concentration vs. Time")

m1Lipo.nls <- nls(conc ~ 100*exp(-time*exp(th1)), data=Lipo,
  start = c(th1 = log(1.55)))
coef(m1Lipo.nls)
exp(coef(m1Lipo.nls))

J<-matrix(c(1,1,0,2,1,2,2,2,1),nrow=3,byrow=T)
J
datalist <- as.list(Lipo)
datalist$J <- J
datalist$gamma0 <- c(100,0)

th<-c(log(1.01),log(.31))
#formcompmodel(J,th,gamma0)
m2aLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2),gamma0,time,1), data=datalist,
  start = c(th1 = log(1), th2 = log(0.31)))
coef(m2aLipo.nls)
exp(coef(m2aLipo.nls))

J<-matrix(c(1,1,0,2,1,2,3,2,1),nrow=3,byrow=T)
J
datalist$J <- J
m2bLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2,th3),gamma0,time,1), data=datalist,
  start = c(th1 = log(.99), th2 = log(0.67), th3 = log(.65)))
coef(m2bLipo.nls)
exp(coef(m2bLipo.nls))
summary(m2bLipo.nls)
plot(fitted(m2bLipo.nls),resid(m2bLipo.nls,type="p"),xlab = "Fitted Values",
  ylab="Standardized Residuals")
abline(h=0)
title(main="Residuals vs. Fitteds, 2 Comp. Model")
plot(Lipo$time,resid(m2bLipo.nls,type="p"),xlab = "Time (days)",
  ylab="Standardized Residuals")
abline(h=0)
title(main="Residuals vs. Time, 2 Comp. Model")

J<-matrix(c(1,1,0,2,1,2,3,2,1,4,2,3,5,3,2),nrow=5,byrow=T)
J
datalist$J <- J
datalist$gamma0 <- c(100,0,0)
m3acatLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2,th3,th4,th5),gamma0,time,1),
  data=datalist,
  start = c(th1 = log(1), th2 = log(0.66), th3 = log(.82),th4=log(.5),th5=log(.2)),
  trace=T)
coef(m3acatLipo.nls)
exp(coef(m3acatLipo.nls))
#summary(m3acatLipo.nls)
plot(Lipo$time,resid(m3acatLipo.nls,type="p"),xlab = "Time (days)",
  ylab="Standardized Residuals")
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abline(h=0)
title(main="Resids vs. Time, 3 Comp. Catenary",sub="5 parameters")

J<-matrix(c(1,1,0,2,1,2,3,2,1,4,1,3,5,3,1),nrow=5,byrow=T)
J
datalist$J <- J
m3amamLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2,th3,th4,th5),gamma0,time,1),
  data=datalist,
  start = c(th1 = log(1), th2 = log(0.66), th3 = log(.82),th4=log(.5),th5=log(.2)),
  trace=T)
coef(m3amamLipo.nls)
exp(coef(m3amamLipo.nls))
#summary(m3amamLipo.nls)
plot(Lipo$time,resid(m3amamLipo.nls,type="p"),xlab = "Time (days)",
  ylab="Standardized Residuals")
abline(h=0)
title(main="Resids vs. Time, 3 Comp. Mamillary",sub="5 parameters")

J<-matrix(c(1,1,0,2,1,2,3,2,1,4,2,3,4,3,2),nrow=5,byrow=T)
J
datalist$J <- J
m3bcatLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2,th3,th4),gamma0,time,1),
  data=datalist,
  start = c(th1 = log(.99), th2 = log(0.76), th3 = log(1.01),th4=log(.3)),
  trace=T)
coef(m3bcatLipo.nls)
exp(coef(m3bcatLipo.nls))
#summary(m3bcatLipo.nls)
plot(Lipo$time,resid(m3bcatLipo.nls,type="p"),xlab = "Time (days)",
  ylab="Standardized Residuals")
abline(h=0)
title(main="Resids vs. Time, 3 Comp. Catenary",sub="4 parameters")

J<-matrix(c(1,1,0,2,1,2,3,2,1,4,1,3,4,3,1),nrow=5,byrow=T)
J
datalist$J <- J
m3bmamLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2,th3,th4),gamma0,time,1),
  data=datalist,
  start = c(th1 = log(.99), th2 = log(0.53), th3 = log(1.34),th4=log(.25)),
  trace=T)
coef(m3bmamLipo.nls)
exp(coef(m3bmamLipo.nls))
#summary(m3bmamLipo.nls)
plot(Lipo$time,resid(m3bmamLipo.nls,type="p"),xlab = "Time (days)",
  ylab="Standardized Residuals")
abline(h=0)
title(main="Resids vs. Time, 3 Comp. Mamillary",sub="4 parameters")

anova(m3acatLipo.nls,m3bcatLipo.nls)
anova(m3amamLipo.nls,m3bmamLipo.nls)
AIC(m3bcatLipo.nls,m3bmamLipo.nls)
#BIC(m3bcatLipo.nls,m3bmamLipo.nls)

plot(Lipo$time, Lipo$conc, xlab = "Time (days)", ylab =
  "Concentration (%)")
title(main = "Concentration vs. Time w/ Fitted Curve")
that <- coef(m3bmamLipo.nls)
t0 <- seq(from=min(Lipo$time),to=max(Lipo$time),length=100)
y0 <- compmodel(J,that,c(100,0,0),t0,1)
lines(t0, y0, lty = 2)

```

Output from lipo1.R:

```
> source("n:/courses/STAT8230/Fall09/compmodel.R")
> par(mfrow=c(2,2))
> "Lipo" <-
+   structure(list(time = c(0.5, 1, 1.5, 2, 3, 4, 5, 6, 7, 8, 9, 10),
+     conc = c(46.1, 25.9, 17, 12.1, 7.22, 4.51, 3.19, 2.4, 1.82,
+     1.41, 1, 0.94)),
+     .Names = c("time", "conc"), row.names = as.character(1:12),
+     class = "data.frame",
+     reference = "A1.16, p. 282")
> plot(Lipo$time, Lipo$conc, xlab = "Time (days)", ylab =
+ "Concentration (%)")
> title(main = "Lipoprotein Data - Concentration vs. Time")
>
> mlLipo.nls <- nls(conc ~ 100*exp(-time*exp(th1)), data=Lipo,
+ start = c(th1 = log(1.55)))
> coef(mlLipo.nls)
      th1
0.272444
> exp(coef(mlLipo.nls))
      th1
1.31317
>
> J<-matrix(c(1,1,0,2,1,2,2,2,1),nrow=3,byrow=T)
> J
      [,1] [,2] [,3]
[1,]    1    1    0
[2,]    2    1    2
[3,]    2    2    1
> datalist <- as.list(Lipo)
> datalist$J <- J
> datalist$gamma0 <- c(100,0)
>
> th<-c(log(1.01),log(.31))
> #formcompmodel(J,th,gamma0)
> m2aLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2),gamma0,time,1), data=datalist,
+ start = c(th1 = log(1), th2 = log(0.31)))
> coef(m2aLipo.nls)
      th1      th2
-0.00760145 -0.41058589
> exp(coef(m2aLipo.nls))
      th1      th2
0.9924274 0.6632615
>
> J<-matrix(c(1,1,0,2,1,2,3,2,1),nrow=3,byrow=T)
> J
      [,1] [,2] [,3]
[1,]    1    1    0
[2,]    2    1    2
[3,]    3    2    1
> datalist$J <- J
> m2bLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2,th3),gamma0,time,1), data=datalist,
+ start = c(th1 = log(.99), th2 = log(0.67), th3 = log(.65)))
> coef(m2bLipo.nls)
      th1      th2      th3
0.02745553 -0.41222185 -0.19872560
> exp(coef(m2bLipo.nls))
      th1      th2      th3
1.0278359 0.6621774 0.8197748
> summary(m2bLipo.nls)
```

Formula: conc ~ compmodel(J, c(th1, th2, th3), gamma0, time, 1)

Parameters:

	Estimate	Std. Error	t value	Pr(> t)
th1	0.02746	0.01306	2.102	0.0649 .
th2	-0.41222	0.03746	-11.003	1.61e-06 ***
th3	-0.19873	0.06927	-2.869	0.0185 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3737 on 9 degrees of freedom

Number of iterations to convergence: 7

Achieved convergence tolerance: 3.144e-06

```
> plot(fitted(m2bLipo.nls),resid(m2bLipo.nls,type="p"),xlab = "Fitted Values",
+ ylab="Standardized Residuals")
> abline(h=0)
> title(main="Residuals vs. Fitteds, 2 Comp. Model")
> plot(Lipo$time,resid(m2bLipo.nls,type="p"),xlab = "Time (days)",
+ ylab="Standardized Residuals")
> abline(h=0)
> title(main="Residuals vs. Time, 2 Comp. Model")
>
> J<-matrix(c(1,1,0,2,1,2,3,2,1,4,2,3,5,3,2),nrow=5,byrow=T)
> J
      [,1] [,2] [,3]
[1,]    1    1    0
[2,]    2    1    2
[3,]    3    2    1
[4,]    4    2    3
[5,]    5    3    2
> datalist$J <- J
> datalist$gamma0 <- c(100,0,0)
> m3acatLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2,th3,th4,th5),gamma0,time,1),
+ data=datalist,
+ start = c(th1 = log(1), th2 = log(0.66), th3 = log(.82),th4=log(.5),th5=log(.2)),
+ trace=T)
16.98111 :    0.0000000 -0.4155154 -0.1984509 -0.6931472 -1.6094379
6.393692 :    0.09595996 -0.42694355  0.21271743 -1.60393250 -0.82698532
1.292479 :   -0.009831093 -0.254741808 -0.026313247 -1.292375716 -1.348012611
0.06358486 : -0.002429492 -0.280502239  0.023442864 -1.459934538 -1.029300119
0.0434168 :  -0.009898435 -0.270814740  0.014454739 -1.426469914 -1.046303568
0.04339249 : -0.009878152 -0.270880680  0.014729075 -1.426761375 -1.043985352
0.04339249 : -0.009882794 -0.270879266  0.014706417 -1.426815699 -1.044104524
0.04339249 : -0.009882493 -0.270879302  0.014708066 -1.426811440 -1.044096203
> coef(m3acatLipo.nls)
      th1      th2      th3      th4      th5
-0.009882493 -0.270879302  0.014708066 -1.426811440 -1.044096203
> exp(coef(m3acatLipo.nls))
      th1      th2      th3      th4      th5
0.9901662 0.7627085 1.0148168 0.2400732 0.3520098
> #summary(m3acatLipo.nls)
> plot(Lipo$time,resid(m3acatLipo.nls,type="p"),xlab = "Time (days)",
+ ylab="Standardized Residuals")
> abline(h=0)
> title(main="Resids vs. Time, 3 Comp. Catenary",sub="5 parameters")
>
> J<-matrix(c(1,1,0,2,1,2,3,2,1,4,1,3,5,3,1),nrow=5,byrow=T)
> J
      [,1] [,2] [,3]
[1,]    1    1    0
[2,]    2    1    2
```

```

[3,] 3 2 1
[4,] 4 1 3
[5,] 5 3 1
> datalist$J <- J
> m3amamLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2,th3,th4,th5),gamma0,time,1),
+ data=datalist,
+ start = c(th1 = log(1), th2 = log(0.66), th3 = log(.82),th4=log(.5),th5=log(.2)),
+ trace=T)
175.9260 : 0.0000000 -0.4155154 -0.1984509 -0.6931472 -1.6094379
5.95408 : 0.04151759 -0.81260693 0.70382931 -1.07406424 -1.15797445
0.466533 : -0.005061288 -0.774680710 0.272646199 -1.264322406 -1.123532718
0.1150945 : -0.009001356 -0.597393826 0.277850502 -1.491028796 -1.313648018
0.04353237 : -0.009793998 -0.632570766 0.293591113 -1.461640608 -1.319867208
0.04339249 : -0.009889082 -0.632052591 0.292896581 -1.464429391 -1.322509082
0.04339249 : -0.009882024 -0.632103668 0.292966026 -1.464316754 -1.322338600
0.04339249 : -0.009882548 -0.632100142 0.292961200 -1.464324675 -1.322351160
> coef(m3amamLipo.nls)
      th1      th2      th3      th4      th5
-0.009882548 -0.632100142 0.292961200 -1.464324675 -1.322351160
> exp(coef(m3amamLipo.nls))
      th1      th2      th3      th4      th5
0.9901661 0.5314745 1.3403908 0.2312341 0.2665080
> #summary(m3amamLipo.nls)
> plot(Lipo$time,resid(m3amamLipo.nls,type="p"),xlab = "Time (days)",
+ ylab="Standardized Residuals")
> abline(h=0)
> title(main="Resids vs. Time, 3 Comp. Mamillary",sub="5 parameters")
>
> J<-matrix(c(1,1,0,2,1,2,3,2,1,4,2,3,4,3,2),nrow=5,byrow=T)
> J
      [,1] [,2] [,3]
[1,] 1 1 0
[2,] 2 1 2
[3,] 3 2 1
[4,] 4 2 3
[5,] 4 3 2
> datalist$J <- J
> m3bcatLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2,th3,th4),gamma0,time,1),
+ data=datalist,
+ start = c(th1 = log(.99), th2 = log(0.76), th3 = log(1.01),th4=log(.3)),
+ trace=T)
0.6544844 : -0.01005034 -0.27443685 0.00995033 -1.20397280
0.06721782 : -0.03530887 -0.24647150 -0.05627221 -1.47731765
0.06196675 : -0.03366295 -0.25044496 -0.05325411 -1.49640094
0.06196296 : -0.03369527 -0.25058609 -0.05382349 -1.49820140
0.0619629 : -0.03369854 -0.25060315 -0.05389516 -1.49841850
0.0619629 : -0.03369895 -0.25060522 -0.05390389 -1.49844480
0.0619629 : -0.03369900 -0.25060547 -0.05390495 -1.49844799
> coef(m3bcatLipo.nls)
      th1      th2      th3      th4
-0.03369900 -0.25060547 -0.05390495 -1.49844799
> exp(coef(m3bcatLipo.nls))
      th1      th2      th3      th4
0.9668625 0.7783294 0.9475222 0.2234767
> #summary(m3bcatLipo.nls)
> plot(Lipo$time,resid(m3bcatLipo.nls,type="p"),xlab = "Time (days)",
+ ylab="Standardized Residuals")
> abline(h=0)
> title(main="Resids vs. Time, 3 Comp. Catenary",sub="4 parameters")
>
> J<-matrix(c(1,1,0,2,1,2,3,2,1,4,1,3,4,3,1),nrow=5,byrow=T)
> J
      [,1] [,2] [,3]

```

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[1,] 1 1 0
[2,] 2 1 2
[3,] 3 2 1
[4,] 4 1 3
[5,] 4 3 1
> datalist$J <- J
> m3bmamLipo.nls <- nls(conc ~ compmodel(J,c(th1,th2,th3,th4),gamma0,time,1),
+ data=datalist,
+ start = c(th1 = log(.99), th2 = log(0.53), th3 = log(1.34),th4=log(.25)),
+ trace=T)
0.5534491 : -0.01005034 -0.63487827 0.29266961 -1.38629436
0.05981463 : -0.02259642 -0.57698877 0.23463368 -1.54507877
0.0502078 : -0.02181577 -0.58433180 0.23868624 -1.54824347
0.05020764 : -0.02181962 -0.58431211 0.23863696 -1.54836921
0.05020764 : -0.02181976 -0.58430926 0.23863085 -1.54837963
> coef(m3bmamLipo.nls)
      th1      th2      th3      th4
-0.02181976 -0.58430926 0.23863085 -1.54837963
> exp(coef(m3bmamLipo.nls))
      th1      th2      th3      th4
0.9784166 0.5574908 1.2695098 0.2125922
> #summary(m3bmamLipo.nls)
> plot(Lipo$time,resid(m3bmamLipo.nls,type="p"),xlab = "Time (days)",
+ ylab="Standardized Residuals")
> abline(h=0)
> title(main="Resids vs. Time, 3 Comp. Mamillary",sub="4 parameters")
>
> anova(m3acatLipo.nls,m3bcatLipo.nls)
Analysis of Variance Table

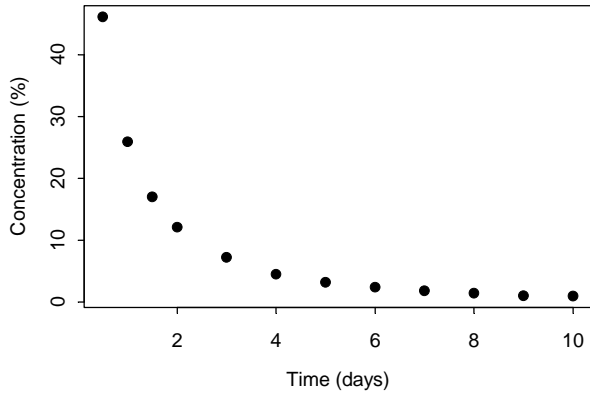
Model 1: conc ~ compmodel(J, c(th1, th2, th3, th4, th5), gamma0, time, 1)
Model 2: conc ~ compmodel(J, c(th1, th2, th3, th4), gamma0, time, 1)
  Res.Df Res.Sum Sq Df    Sum Sq F value Pr(>F)
1       7  0.043392
2       8  0.061963 -1 -0.018570  2.9957 0.1271
> anova(m3amamLipo.nls,m3bmamLipo.nls)
Analysis of Variance Table

Model 1: conc ~ compmodel(J, c(th1, th2, th3, th4, th5), gamma0, time, 1)
Model 2: conc ~ compmodel(J, c(th1, th2, th3, th4), gamma0, time, 1)
  Res.Df Res.Sum Sq Df    Sum Sq F value Pr(>F)
1       7  0.043392
2       8  0.050208 -1 -0.006815  1.0994 0.3292
> AIC(m3bcatLipo.nls,m3bmamLipo.nls)
      df      AIC
m3bcatLipo.nls  5 -19.13899
m3bmamLipo.nls  5 -21.66341
> #BIC(m3bcatLipo.nls,m3bmamLipo.nls)
>
> plot(Lipo$time, Lipo$conc, xlab = "Time (days)", ylab =
+ "Concentration (%)")
> title(main = "Concentration vs. Time w/ Fitted Curve")
> that <- coef(m3bmamLipo.nls)
> t0 <- seq(from=min(Lipo$time),to=max(Lipo$time),length=100)
> y0 <- compmodel(J,that,c(100,0,0),t0,1)
> lines(t0, y0, lty = 2)
>

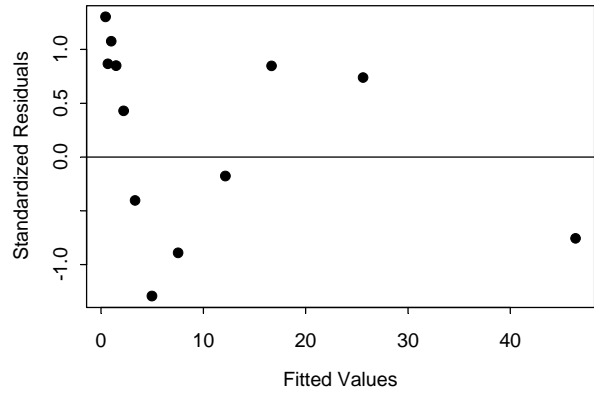
```

Plots from lipo1.R:

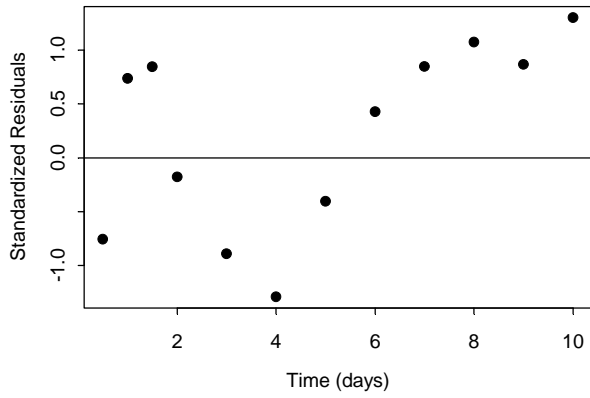
Lipoprotein Data - Concentration vs. Time



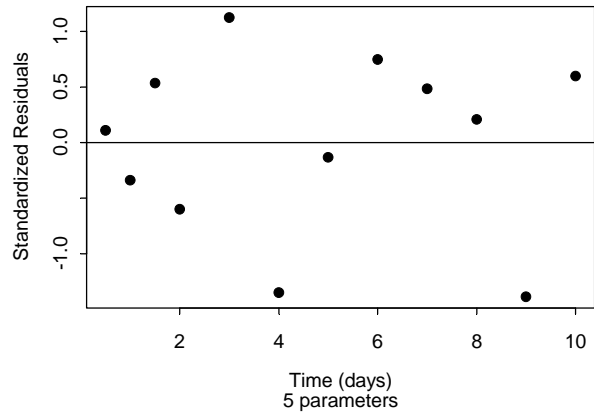
Residuals vs. Fitteds, 2 Comp. Model



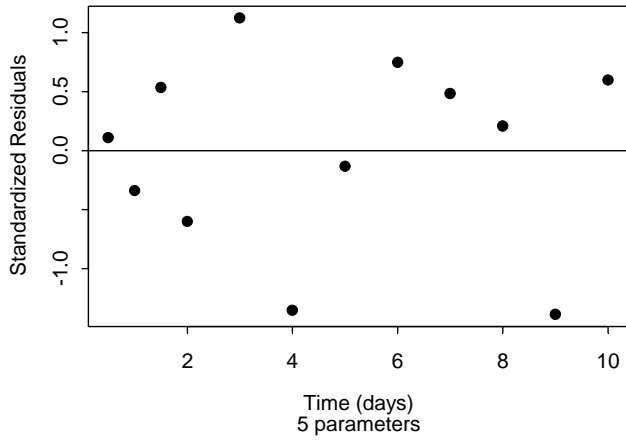
Residuals vs. Time, 2 Comp. Model



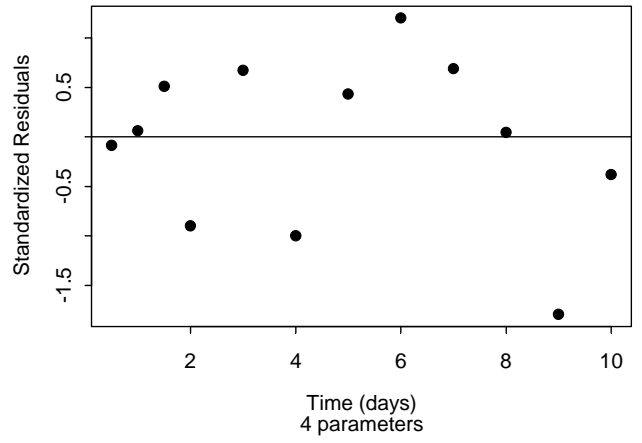
Resids vs. Time, 3 Comp. Catenary



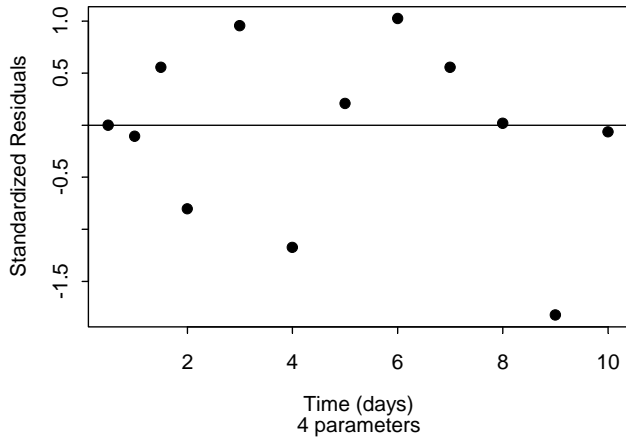
Resids vs. Time, 3 Comp. Mamillary



Resids vs. Time, 3 Comp. Catenary



Resids vs. Time, 3 Comp. Mamillary



Concentration vs. Time w/ Fitted Curve

