

```
t.test(m$y1,m$y2,paired=TRUE)
```

Paired t-test

```
data: m$y1 and m$y2
t = 0.55539, df = 944, p-value = 0.5788
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.06434363  0.11513728
sample estimates:
mean of the differences
      0.02539683
```

```
> t.test(m$y1,m$y2)
```

Welch Two Sample t-test

```
data: m$y1 and m$y2
t = 0.38647, df = 1887.5, p-value = 0.6992
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.1034859  0.1542796
sample estimates:
mean of x mean of y
  6.304762  6.279365
```

```
> fit=lm(y~tm+ap+ta+tx+c,d)
> summary(fit)
```

Call:

```
lm(formula = y ~ tm + ap + ta + tx + c, data = d)
```

Residuals:

Min	1Q	Median	3Q	Max
-2.91151	-0.29215	-0.02047	0.25583	2.99790

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.095831	0.118748	0.807	0.420
tm	0.019482	0.016694	1.167	0.243
ap	0.138149	0.013197	10.468	<2e-16 ***
ta	0.566629	0.013575	41.740	<2e-16 ***
tx	0.271685	0.012972	20.944	<2e-16 ***
c	-0.001603	0.018309	-0.088	0.930

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

Residual standard error: 0.5959 on 1884 degrees of freedom

Multiple R-squared: 0.8263, Adjusted R-squared: 0.8259

F-statistic: 1793 on 5 and 1884 DF, p-value: < 2.2e-16

```
> AIC(fit)
```

```
[1] 3414.845
```

```
> anova(lm(y~b+a,d))
```

Analysis of Variance Table

Response: y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
b	3	1.2	0.391	0.1989	0.8972
a	4	148.8	37.208	18.9114	2.936e-15 ***
Residuals	1882	3702.8	1.967		

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

```
> anova(lm(y~b+a+dc,d))
```

Analysis of Variance Table

Response: y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
b	3	1.2	0.391	0.2005	0.896077
a	4	148.8	37.208	19.0661	2.204e-15 ***
dc	8	45.7	5.706	2.9241	0.003017 **
Residuals	1874	3657.1	1.952		

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

```
> t.test(a1$y,a2$y,alternative="less")
```

Welch Two Sample t-test

data: a1\$y and a2\$y

t = -2.3469, df = 1149.2, p-value = 0.00955

alternative hypothesis: true difference in means is less than 0

95 percent confidence interval:

-Inf -0.05633864

sample estimates:

mean of x mean of y

6.052478 6.241176

```
> t.test(a2$y,a3$y,alternative="less")
```

Welch Two Sample t-test

data: a2\$y and a3\$y

t = 0.84219, df = 208.59, p-value = 0.7997

alternative hypothesis: true difference in means is less than 0

95 percent confidence interval:

-Inf 0.3388753

sample estimates:

mean of x mean of y

6.241176 6.126761

```
> t.test(a3$y,a4$y,alternative="less")
```

Welch Two Sample t-test

data: a3\$y and a4\$y

t = -2.5154, df = 266.19, p-value = 0.006239

alternative hypothesis: true difference in means is less than 0

95 percent confidence interval:

-Inf -0.1271618

sample estimates:

mean of x mean of y

6.126761 6.496622

```
> t.test(a4$y,a5$y,alternative="less")
```

Welch Two Sample t-test

data: a4\$y and a5\$y

t = -3.2965, df = 536.93, p-value = 0.0005219

alternative hypothesis: true difference in means is less than 0

95 percent confidence interval:

-Inf -0.1970673

sample estimates:

mean of x mean of y

6.496622 6.890625

```
> fit2=lm(y~b+a+dc,d)
```

```
> summary(fit2)
```

Call:

```
lm(formula = y ~ b + a + dc, data = d)
```

Residuals:

Min	1Q	Median	3Q	Max
-4.7757	-0.9331	0.0133	0.9543	3.1774

Coefficients: (1 not defined because of singularities)

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	5.720356	0.131783	43.407	< 2e-16	***
bbrand b	-0.002381	0.096400	-0.025	0.980298	
bbrand c	0.146024	0.162598	0.898	0.369266	
bbrand d	0.102214	0.162598	0.629	0.529667	
aage2	0.213963	0.082064	2.607	0.009199	**
aage3	0.115235	0.130167	0.885	0.376116	
aage4	0.503513	0.098537	5.110	3.55e-07	***
aage5	0.887742	0.103943	8.541	< 2e-16	***
dcd day 10	0.169283	0.142059	1.192	0.233554	
dcd day 2	0.169946	0.160588	1.058	0.290068	
dcd day 3	0.303225	0.161135	1.882	0.060017	.
dcd day 4	0.326283	0.151006	2.161	0.030842	*
dcd day 5	0.522798	0.150095	3.483	0.000507	***
dcd day 6	0.184160	0.136251	1.352	0.176657	
dcd day 7	0.223093	0.132219	1.687	0.091712	.
dcd day 8	0.442943	0.139932	3.165	0.001573	**
dcd day 9	NA	NA	NA	NA	

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

Residual standard error: 1.397 on 1874 degrees of freedom

Multiple R-squared: 0.05078, Adjusted R-squared: 0.04319

F-statistic: 6.684 on 15 and 1874 DF, p-value: 3.111e-14

>

>

```
> a=lmer(formula = y ~ b + a + (1 | d), data = d)
```

```
> summary(a)
```

Linear mixed model fit by REML ['lmerMod']

Formula: y ~ b + a + (1 | d)

Data: d

REML criterion at convergence: 6653.9

Scaled residuals:

Min	1Q	Median	3Q	Max
-3.4438	-0.6862	-0.0141	0.6818	2.2227

Random effects:

Groups	Name	Variance	Std.Dev.
d	(Intercept)	0.02042	0.1429
Residual		1.95156	1.3970

Number of obs: 1890, groups: d, 10

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	5.999422	0.105101	57.08
bbrand b	-0.002381	0.096401	-0.02
bbrand c	0.077628	0.129179	0.60
bbrand d	0.033818	0.129179	0.26
aage2	0.205903	0.081946	2.51
aage3	0.103431	0.129779	0.80
aage4	0.485163	0.098210	4.94
aage5	0.873768	0.103710	8.43

Correlation of Fixed Effects:

	(Intr)	bbrndb	bbrndc	bbrndd	aage2	aage3	aage4
bbrand b	-0.459						
bbrand c	-0.674	0.373					
bbrand d	-0.674	0.373	0.777				
aage2	-0.349	0.000	0.018	0.018			
aage3	-0.243	0.000	0.037	0.037	0.274		
aage4	-0.322	0.000	0.052	0.052	0.364	0.237	
aage5	-0.322	0.000	0.072	0.072	0.345	0.226	0.302

> AIC(a)
[1] 6673.888