



# Cornell University Cornell Statistical Consulting Unit

## Specifying Linear Mixed Models in Statistical Packages

The following table provides the basic syntax to perform mixed models in Stata, R, SAS, SPSS and JMP. There are some minor differences in the estimation procedures between the five programs. For instance, Stata will estimate the random effects using maximum likelihood instead of restricted maximum likelihood. When estimating random slopes, JMP will center the variable. However, these subtle differences can be overcome by using options. Also, some of the software have limitations calculating certain models: current editions of JMP and R's nlme package cannot estimate generalized linear mixed models.

The following table uses the options to produce identical results among the five programs. For ease, we model a continuous dependent variable with one independent variable. Let  $x$  represent an independent variable,  $y$  the dependent variable, and both  $z_1$  and,  $z_2$  be random effects.

	Stata	R
Random Intercept	<code>mixed y x    z1, reml</code>	<code>lmer(y~x+(1 z1)) [lme4]</code>  <code>lme(y~x, random=~1 z1) [nlme]</code>
Nested Random Effects ( $z_2$ nested in $z_1$ )	<code>mixed y x    z1: z2, reml</code>	<code>lmer(y~x+(1 z1/z2)) [lme4]</code>  <code>lme(y~x, random=~1 z1/z2) [nlme]</code>
Crossed Random Effects	<code>mixed y x    _all: R.z1    _all: R.z2, reml</code>  <code>mixed y x    _all: R.z1 .z2, reml</code>	<code>lmer(y~x(1 z1)+(1 z2),) [lme4]</code>
Random intercept and random slope	<code>mixed y x    z1: x, covariance(unstructured) reml</code>	<code>lmer(y~x+(1+x z1)) [lme4]</code>

	SPSS	SAS
Random Intercept	<pre>MIXED y WITH x /FIXED=x   SSTYPE(3) /METHOD=REML /RANDOM=INTERCEPT   SUBJECT(z1) COVTYPE(VC).  MIXED y WITH x BY z1 /FIXED=x   SSTYPE(3) /METHOD=REML /RANDOM=z1   COVTYPE(VC).</pre>	<pre>proc mixed data=; class z1; model y=x/ solution; random intercept/ subject= z1; run;  proc mixed data=data; class z1; model y=x/ solution; random z1; run;</pre>
Nested Random Effects (z <sub>2</sub> nested in z <sub>1</sub> )	<pre>MIXED y WITH x BY z1 z2 /FIXED=x   SSTYPE(3) /METHOD=REML /RANDOM= z1 z2(z1)   COVTYPE(VC).</pre>	<pre>proc mixed data=; class z1 z2; model y=x/solution; random z1 z2; run;</pre>
Crossed Random Effects	<pre>MIXED y WITH x BY z1 z2 /FIXED=   SSTYPE(3) /METHOD=REML /PRINT=SOLUTION /RANDOM= z1 z2   COVTYPE(VC).</pre>	<pre>proc mixed data=; class z1 z2; model y=x/ solution; random intercept/ subject= z1; random intercept/ subject= z2 ; run;</pre>
Random intercept and random slope	<pre>MIXED y With x /FIXED=x   SSTYPE(3) /METHOD=REML /PRINT=SOLUTION /RANDOM=INTERCEPT x   SUBJECT(z1) COVTYPE(UN).</pre>	<pre>Proc mixed data=; class z1; model y=x/ solution; random intercept x/ subject= z1 type=UN; run;</pre>

	JMP	
Random Intercept	<u>Role Variable :</u> $Y=y$ <u>Model Effects :</u> $x$ $z_1$ &Random	Click <b>Analyze &gt; Fit model</b>  Add " $y$ ", " $x$ ", and " $z_1$ "  Select " $z_1$ " and click <b>Attributes &gt; Random Effects</b>
Nested Random Effects ( $z_2$ nested in $z_1$ )	<u>Role Variable:</u> $Y=y$ <u>Model Effects :</u> $x$ $z_2[z_1]$ &Random $z_1$ & Random	Click <b>Analyze &gt; Fit model</b>  Add " $y$ ", " $x$ ", " $z_1$ ", and " $z_2$ "  Select, " $z_2$ " from <b>Model Effects</b> and " $z_1$ " from <b>Column</b> and then click "Nest"  Select $z_2[z_1]$ and $z_1$ from Model effects, and then click <b>Attributes &gt; Random Effects</b>
Crossed Random Effects	<u>Role Variable :</u> $Y=y$ <u>Model Effects :</u> $x$ $z_1$ &Random $z_2$ &Random	Click <b>Analyze &gt; Fit model</b>  Add " $y$ " " $x$ ", " $z_1$ ", and " $z_2$ "  Select " $z_1$ ", and " $z_2$ " and click <b>Attributes &gt; Random Effects</b>
Random intercept and random slope	<u>Role Variable:</u> $Y=y$ <u>Fixed effects:</u> $x$ <u>Random effects:</u> Intercept[ $z_1$ ]&Random coefficients(1) $x[z_1]$ &Random coefficients(1)	Click <b>Analyze &gt; Fit Model</b>  Under <b>Personality</b> (at upper right), choose <b>mixed model</b>  Click the <b>red triangle</b> next to the title, Model Specification, and <i>uncheck</i> <b>Center Polynomials</b>  Under <b>Fixed Effects</b> , add $x$  In <b>Random Effects</b> , add " $x$ " and then select " $z_1$ " from <b>Columns</b> and " $x$ " from <b>Random Effects</b> and click "Nest Random Coefficients"