

```

dm'log;clear;output;clear';
options ps=512 ls=99 nocenter nodate nonumber
        nolabel FORMCHAR="|----|+|----+=|/\<>*" ;

*****;
*** McClave, Benson and Sincich - Statistics for Business and Economics ***;
*** 2005, 9th Ed. Pearson Prentice Hall. Upper Saddle River, NJ          ***;
*****;
*** LD50 doses for Mosquito larvae from various Carribean locations      ***;
*****;

TITLE1 'Example of Randomized Complete BLock Design (RBD)';

data mosquito; length location insecticide $ 12;
  infile 'Mosquito resistance.csv' missover DSD dlm="," firstobs=2;
  TITLE2 'LD50 doses for Mosquitos from various Carribean sites';
  LABEL Location = 'Site in the carribean'
        Insecticide = 'Name of insecticide'
        LD50 = 'Dose required to kill 50% of the mosquito larvae';
  input location $ insecticide $ ld50;
cards;
;

ODS PDF style=minimal body='Mosquito resistance.PDF' ;
proc sort data=mosquito; by Insecticide; run;
proc boxplot data=mosquito; plot LD50 * Insecticide; run;
ods PDF close;

ODS HTML style=minimal body='Mosquito resistance.html' ;

PROC PRINT DATA=mosquito; TITLE3 'LISTING OF DATA'; RUN;

PROC MIXED DATA=mosquito ORDER=DATA; CLASSES location insecticide;
  TITLE3 'Randomized block design with PROC MIXED';
  TITLE4 'Fitted with a single variance';
  MODEL LD50 = insecticide / outp=resids;
RUN;

PROC MIXED DATA=mosquito ORDER=DATA; CLASSES location insecticide;
  TITLE3 'Randomized block design with PROC MIXED';
  TITLE4 'Fitted with separate variances';
  MODEL LD50 = insecticide / outp=resids;
  RANDOM location / group=insecticide;
  lsmeans insecticide / adjust=tukey pdiff;
  ods output diffs=ppp lsmeans=mmm;
*ods listing exclude diffs lsmeans; *this line is inactive;
RUN;

TITLE4 'Post hoc adjustment with macro by Arnold Saxton';
* SAS Macro by Arnold Saxton: Saxton, A.M. 1998. A macro for          ;
* converting mean separation output to letter groupings in Proc Mixed.  ;
* In Proc. 23rd SAS Users Group Intl., SAS Institute, Cary, NC, pp1243-1246.;
%include 'C:\pdmix800.sas';
%pdmix800(ppp,mmm,alpha=0.05,sort=yes);
run;

proc univariate data=resids normal plot; var resid;
  TITLE4 'Univariate analysis of RESIDUALS';
  ods exclude Moments BasicMeasures ExtremeObs ExtremeLD50s
        Modes MissingLD50s Quantiles TestsForLocation;
  histogram resid / normal;
run;

```

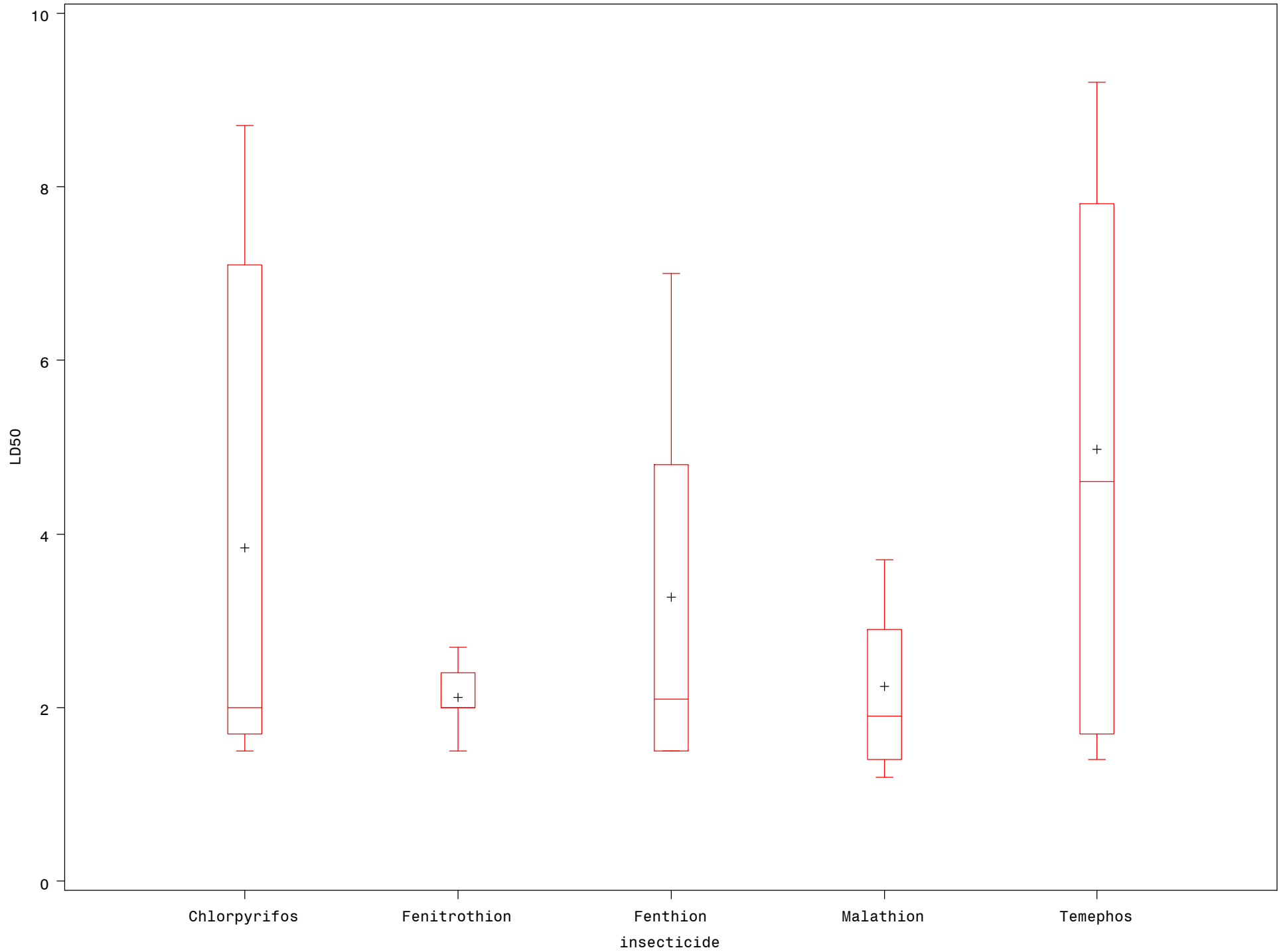
```
ods html close;
```

```
run;  
quit;
```

Example of Randomized Complete Block Design (RBD)
LD50 doses for Mosquitos from various Carribean sites
LISTING OF DATA

Obs	location	insecticide	LD50
1	Anguilla	Chlorpyrifos	1.5
2	Antigua	Chlorpyrifos	2.0
3	Dominica	Chlorpyrifos	4.1
4	Guyana	Chlorpyrifos	1.8
5	Jamaica	Chlorpyrifos	7.1
6	St. Lucia	Chlorpyrifos	8.7
7	Suriname	Chlorpyrifos	1.7
8	Anguilla	Fenitrothion	1.5
9	Antigua	Fenitrothion	2.0
10	Dominica	Fenitrothion	2.4
11	Guyana	Fenitrothion	2.2
12	Jamaica	Fenitrothion	2.0
13	St. Lucia	Fenitrothion	2.7
14	Suriname	Fenitrothion	2.0
15	Anguilla	Fenthion	1.8
16	Antigua	Fenthion	7.0
17	Dominica	Fenthion	4.2
18	Guyana	Fenthion	1.5
19	Jamaica	Fenthion	1.5
20	St. Lucia	Fenthion	4.8
21	Suriname	Fenthion	2.1
22	Anguilla	Malathion	1.2
23	Antigua	Malathion	2.9
24	Dominica	Malathion	1.4
25	Guyana	Malathion	1.9
26	Jamaica	Malathion	3.7
27	St. Lucia	Malathion	2.7
28	Suriname	Malathion	1.9
29	Anguilla	Temephos	4.6
30	Antigua	Temephos	9.2
31	Dominica	Temephos	7.8
32	Guyana	Temephos	1.7
33	Jamaica	Temephos	3.4
34	St. Lucia	Temephos	6.7
35	Suriname	Temephos	1.4

Example of Randomized Complete Block Design (RBD)
LD50 doses for Mosquitos from various Carribean sites



Example of Randomized Complete Block Design (RBD)
 LD50 doses for Mosquitos from various Carribean sites
 Randomized block design with PROC MIXED
 Fitted with a single variance

The Mixed Procedure

Model Information

Data Set	WORK.MOSQUITO
Dependent Variable	LD50
Covariance Structure	Diagonal
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Residual

Class Level Information

Class	Levels	Values
location	7	Anguilla Antigua Dominica Guyana Jamaica St. Lucia Suriname
insecticide	5	Chlorpyrifos Fenitrothion Fenthion Malathion Temephos

Dimensions

Covariance Parameters	1
Columns in X	6
Columns in Z	0
Subjects	1
Max Obs Per Subject	35

Number of Observations

Number of Observations Read	35
Number of Observations Used	35
Number of Observations Not Used	0

Covariance Parameter

Estimates

Cov Parm	Estimate
Residual	4.6470

FitStatistics

-2 Res Log Likelihood	141.0
AIC (smaller is better)	143.0
AICC (smaller is better)	143.1
BIC (smaller is better)	144.4

Type 3 Tests of Fixed Effects

Effect	Num	Den	F Value	Pr > F
	DF	DF		
insecticide	4	30	2.11	0.1038

Example of Randomized Complete Block Design (RBD)
 LD50 doses for Mosquitos from various Carribean sites
 Randomized block design with PROC MIXED
 Fitted with separate variances

The Mixed Procedure

Model Information

Data Set	WORK.MOSQUITO
Dependent Variable	LD50
Covariance Structure	Variance Components
Group Effect	insecticide
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information

Class	Levels	Values
location	7	Anguilla Antigua Dominica Guyana Jamaica St. Lucia Suriname
insecticide	5	Chlorpyrifos Fenitrothion Fenthion Malathion Temephos

Dimensions

Covariance Parameters	6
Columns in X	6
Columns in Z	35
Subjects	1
Max Obs Per Subject	35

Number of Observations

Number of Observations Read	35
Number of Observations Used	35
Number of Observations Not Used	0

Iteration History

Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	140.95282566	
1	4	122.72862737	0.05759997
2	1	120.12006683	0.04194219
3	1	118.32705518	0.02336129
4	1	117.38843563	0.00838211
5	1	117.07462557	0.00135758
6	1	117.02811730	0.00004595
7	1	117.02666111	0.00000006
8	1	117.02665910	0.00000000

Convergence criteria met.

Covariance Parameter Estimates

Cov Parm	Group		Estimate
location	insecticide	Chlorpyrifos	8.5114
location	insecticide	Fenitrothion	0
location	insecticide	Fenthion	4.3443
location	insecticide	Malathion	0.6581
location	insecticide	Temephos	9.0143
Residual			0.1414

FitStatistics

-2 Res Log Likelihood	117.0
AIC (smaller is better)	127.0
AICC (smaller is better)	129.5
BIC (smaller is better)	126.8

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
insecticide	4	30	2.55	0.0596

Least Squares Means

Effect	insecticide	Estimate	Standard Error	DF	t Value	Pr > t
insecticide	Chlorpyrifos	3.8429	1.1118	30	3.46	0.0017
insecticide	Fenitrothion	2.1143	0.1421	30	14.87	<.0001
insecticide	Fenthion	3.2714	0.8005	30	4.09	0.0003
insecticide	Malathion	2.2429	0.3380	30	6.64	<.0001
insecticide	Temephos	4.9714	1.1437	30	4.35	0.0001

Differences ofLeast Squares Means

Effect	insecticide	_insecticide	Estimate	Standard Error	DF	t Value	Pr > t	Adjustment
insecticide	Chlorpyrifos	Fenitrothion	1.7286	1.1209	30	1.54	0.1335	Tukey-Kramer
insecticide	Chlorpyrifos	Fenthion	0.5714	1.3700	30	0.42	0.6796	Tukey-Kramer
insecticide	Chlorpyrifos	Malathion	1.6000	1.1620	30	1.38	0.1787	Tukey-Kramer
insecticide	Chlorpyrifos	Temephos	-1.1286	1.5950	30	-0.71	0.4847	Tukey-Kramer
insecticide	Fenitrothion	Fenthion	-1.1571	0.8130	30	-1.42	0.1650	Tukey-Kramer
insecticide	Fenitrothion	Malathion	-0.1286	0.3666	30	-0.35	0.7283	Tukey-Kramer
insecticide	Fenitrothion	Temephos	-2.8571	1.1525	30	-2.48	0.0190	Tukey-Kramer
insecticide	Fenthion	Malathion	1.0286	0.8689	30	1.18	0.2458	Tukey-Kramer
insecticide	Fenthion	Temephos	-1.7000	1.3960	30	-1.22	0.2328	Tukey-Kramer
insecticide	Malathion	Temephos	-2.7286	1.1926	30	-2.29	0.0294	Tukey-Kramer

Differences ofLeast Squares Means

Effect	insecticide	_insecticide	Adj P
insecticide	Chlorpyrifos	Fenitrothion	0.5443
insecticide	Chlorpyrifos	Fenthion	0.9933
insecticide	Chlorpyrifos	Malathion	0.6466
insecticide	Chlorpyrifos	Temephos	0.9532
insecticide	Fenitrothion	Fenthion	0.6180
insecticide	Fenitrothion	Malathion	0.9966
insecticide	Fenitrothion	Temephos	0.1225
insecticide	Fenthion	Malathion	0.7604
insecticide	Fenthion	Temephos	0.7413
insecticide	Malathion	Temephos	0.1768

Example of Randomized Complete BLock Design (RBD)

LD50 doses for Mosquitos from various Carribean sites

Randomized block design with PROC MIXED

Post hoc adjustment with macro by Arnold Saxton

Effect=insecticide ADJUSTMENT=Tukey-Kramer(P<0.05) bygroup=1

Obs	insecticide	Estimate	StdErr	MSGROUP
1	Temephos	4.9714	1.1437	A
2	Chlorpyrifos	3.8429	1.1118	A
3	Fenthion	3.2714	0.8005	A
4	Malathion	2.2429	0.3380	A
5	Fenitrothion	2.1143	0.1421	A

Example of Randomized Complete Block Design (RBD)
 LD50 doses for Mosquitos from various Carribean sites
 Randomized block design with PROC MIXED
 Univariate analysis of RESIDUALS

The UNIVARIATE Procedure
 Variable: Resid

Tests for Normality

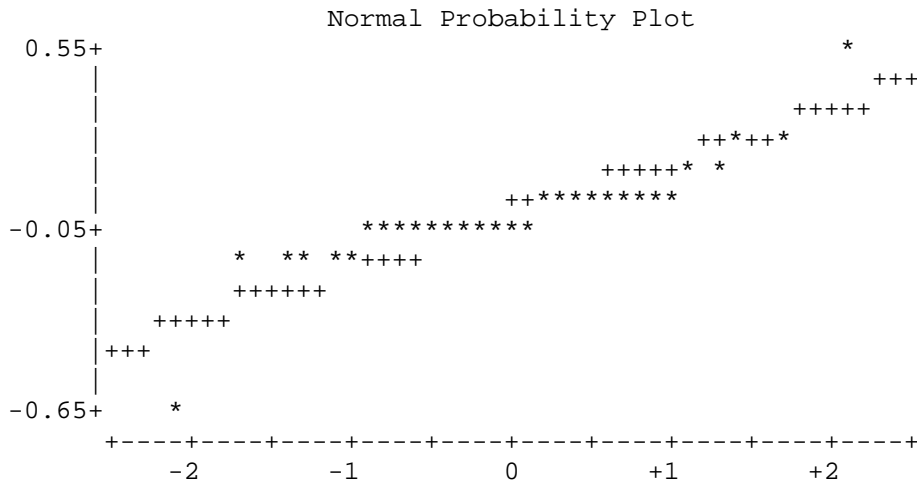
Test	--Statistic--	-----p Value-----
Shapiro-Wilk	W 0.824681	Pr < W <0.0001
Kolmogorov-Smirnov	D 0.193724	Pr > D <0.0100
Cramer-von Mises	W-Sq 0.343534	Pr > W-Sq <0.0050
Anderson-Darling	A-Sq 2.028074	Pr > A-Sq <0.0050

```

Stem Leaf  Boxplot
  5 9                1  *
  4
  3
  2 69              2  0
  1 22              2  |
  0 0334557889     10 +---+---+
 -0 66666554443321 14 *-----*
 -1 85111          5  |
 -2
 -3
 -4
 -5
 -6 1              1  *

```

-----+-----+-----+-----+
 Multiply Stem.Leaf by 10**⁻¹



Example of Randomized Complete Block Design (RBD)
 LD50 doses for Mosquitos from various Carribean sites
 Randomized block design with PROC MIXED
 Univariate analysis of RESIDUALS

The UNIVARIATE Procedure
 Fitted Normal Distribution for Resid

Parameters for Normal Distribution

Parameter	Symbol	Estimate
Mean	Mu	0
Std Dev	Sigma	0.175935

Goodness-of-Fit Tests for Normal Distribution

Test	-----Statistic-----	-----p Value-----
Kolmogorov-Smirnov	D 0.19372386	Pr > D <0.010
Cramer-von Mises	W-Sq 0.34353402	Pr > W-Sq <0.005
Anderson-Darling	A-Sq 2.02807355	Pr > A-Sq <0.005

Quantiles for Normal Distribution

Percent	-----Quantile-----	
	Observed	Estimated
1.0	-0.61429	-0.40929
5.0	-0.18447	-0.28939
10.0	-0.11429	-0.22547
25.0	-0.05585	-0.11867
50.0	-0.03012	0.00000
75.0	0.06532	0.11867
90.0	0.11756	0.22547
95.0	0.28571	0.28939
99.0	0.58571	0.40929