data ee;

input Station$ Intensities;

cards;

1 20

1 1050

1 3200

1 5600

1 50

2 4300

2 70

2 2560

2 3650

2 80

3 100

3 7700

3 8500

3 2960

3 3340

run;

/\* Station = random effect

y(ij) = mu + tao(i) + epsi

epsi ~iid~ N(0, sigma(epsi)^2)

tao(i) ~iid~ N(0, sigma(tao)^2)

Therefore, our hypotheses are:

H0: sigma(tao)^2 = 0

Ha: sigma(tao)^2 > 0 \*/

proc glm data=ee;

class station;

random station;

model intensities=station/solution;

Run;

data random;

do mode = 'I', 'C', 'S';

   do temperature = 1 to 4;

      do rep = 1 to 2;

          input y @@;

          output;

      end;

   end;

end;

cards;

12 16 15 19 31 39 53 55 15 19 17 17 30 34 51 49 11 17 24 22 33 37 61 67

run;

proc glm data=random;

class mode temperature;

model y = mode|temperature;

random temperature mode\*temperature/test;

/\* same randomness table produced regardless of whether or not

mode\*temperature is classified as random, though this varies by version \*/

/\* the "/test" part divides MSA and MSB correctly by MSAB \*/

run;

/\* below this doesn't work \*/

proc mixed data=random;

class mode temperature;

model y = mode|temperature;

random temperature mode\*temperature;

Run;

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **Type III SS** | **Mean Square** | **F Value** | **Pr > F** |
| **location** | 4 | 3.811500 | 0.952875 | 0.71 | 0.6020 |
| **chemical** | 3 | 180.132750 | 60.044250 | 44.59 | <.0001 |
| **Error** | 12 | 16.158500 | 1.346542 |  |  |
| **Error: MS(location\*chemical)** | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **Type III SS** | **Mean Square** | **F Value** | **Pr > F** |
| **location\*chemical** | 12 | 16.158500 | 1.346542 | 3.89 | 0.0037 |
| **Error: MS(Error)** | 20 | 6.925000 | 0.346250 |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **Sum of Squares** | **Mean Square** | **F Value** | **Pr > F** |
| **Model** | 19 | 200.1027500 | 10.5317237 | 30.42 | <.0001 |
| **Error** | 20 | 6.9250000 | 0.3462500 |  |  |
| **Corrected Total** | 39 | 207.0277500 |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **Type III SS** | **Mean Square** | **F Value** | **Pr > F** |
| **operator** | 2 | 160.333333 | 80.166667 | 10.77 | 0.0103 |
| **machine** | 3 | 12.458333 | 4.152778 | 0.56 | 0.6619 |
| **Error** | 6 | 44.666667 | 7.444444 |  |  |
| **Error: MS(operator\*machine)** | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **Type III SS** | **Mean Square** | **F Value** | **Pr > F** |
| **operator\*machine** | 6 | 44.666667 | 7.444444 | 1.96 | 0.1507 |
| **Error: MS(Error)** | 12 | 45.500000 | 3.791667 |  |  |

data ants;

input location$ chemical$ kill;

cards;

1 1 7.2

1 1 9.6

1 2 4.2

1 2 3.5

1 3 9.5

1 3 9.3

1 4 5.4

1 4 3.9

2 1 8.5

2 1 9.6

2 2 2.9

2 2 3.3

2 3 8.8

2 3 9.2

2 4 6.3

2 4 6.0

3 1 9.1

3 1 8.6

3 2 1.8

3 2 2.4

3 3 7.6

3 3 7.1

3 4 6.1

3 4 5.6

4 1 8.2

4 1 9.0

4 2 3.6

4 2 4.4

4 3 7.3

4 3 7.0

4 4 5.0

4 4 5.4

5 1 7.8

5 1 8.0

5 2 3.7

5 2 3.9

5 3 9.2

5 3 8.3

5 4 6.5

5 4 6.9

run;

proc glm data=ants;

class location chemical;

model kill=location|chemical;

random location location\*chemical/test;

/\* the "/test" part divides MSA and MSB correctly by MSAB \*/

Run;

data mech;

input operator machine strength;

cards;

1 1 204

1 1 205

1 2 205

1 2 210

1 3 203

1 3 204

1 4 205

1 4 203

2 1 205

2 1 207

2 2 205

2 2 206

2 3 206

2 3 204

2 4 209

2 4 207

3 1 211

3 1 209

3 2 207

3 2 210

3 3 209

3 3 214

3 4 215

3 4 212

run;

proc glm data=mech;

class operator machine;

model strength = operator|machine;

random operator operator\*machine/test;

Run;