```
ods pdf file = "/home/sedwards/UNC/B663_H4.pdf";
ods graphics on;

LIBNAME home "/home/sedwards/UNC/663/";
%LET filepath = /home/sedwards/UNC/663/;

/**** Question #1 *****
172 young adult males received a battery of pulmonary function tests.

Fit a model with average forced vital capacity (FVC) (in ml) as the outcome
with height, weight, body mass index, age, average treadmill elivation,
      average treadmill speed, temperature, barometric pressure, and humidity
      as predictors.

Consider the model -
  FVC = B0 + B1(height) + B2(weight) + B3(BMI) + B4(area) + B5(age) +
  B6(avtrel) + B7(avtrsp)
          + B8(avtrel)(avtrsp) + B9(temp) + B10(barm) + B11(hum) + e

***/
TITLE "QUESTION 1";
/* READ IN DATA & SET UP VARIABLES */
DATA filen;
    INFILE "&filepath.\FILEN.DAT";
    INPUT subject year cohort date days timsess height weight age area temp
    barm
            hum avtrel avtrsp avfvc;
    LABEL
    subject="subject id"
    year="year of study"
    cohort="Ozone Dosage Level Group"
    date="Date of Study, Julian Date"
    days="# Days After 12-31-79"
    timsess="Time of Session"
    height="Height (cm)"
    weight="Weight (kg)"
    age="Age (years)"
    area="Body Surface Area (M**2)"
    temp="Air Temperature (deg C)"
    barm="Barometric Pressure (mmHg)"
    hum="Relative Humidity %"
    avtrel="Average Treadmill Elevation (deg)"
    avtrsp="Average Speed of Treadmill (mph)"
    avfvc="Average Forced Vital Capacity (mL)";
RUN;

DATA filen;
    SET filen;

    int=avtrel*avtrsp;
    bmi=10000*weight/(height*height);
    tim2=timsess*timsess;
RUN;


PROC FREQ DATA=filen;
    TABLES height weight BMI area avtrel avtrsp int temp barm hum age / LIST
    MISSING;
RUN;

PROC FREQ DATA=filen;
    WHERE weight=.;
    TABLES weight*bmi / LIST MISSING;
RUN;

/***
```

```
(a) Examine the tolerances and variance inflation factors (VIF) from this
model.
    Do you think any collinearity is present based on the tolerance and VIF?
    Why or why not?
***/
PROC REG DATA=filen;
    MODEL avfvc = height weight BMI area age avtrel avtrsp int temp barm hum
    / TOL VIF;
    TITLE "Q1-A";
QUIT;

/***
(b) Conduct an eigenanalysis of the scaled SSCP and correlation matrices,
presenting a table formatted
    like Table 8.6.2.

  i) Does there appear to be collinarity with the intercept? Why or why not?
     If so which variables are suspect?

 ii) Does there appear to be any other collinearity? Why or why not?
     If so which variables are suspect?
***/
DATA B;
    SET filen;
    inter = 1;
RUN;
ods output Eigenvalues=EIa;
PROC PRINCOMP DATA=B NOINT;     /* SCALED SSCP MATRIX */
    VAR inter height weight BMI area age avtrel avtrsp int temp barm hum;
    TITLE "Q1-B";
RUN;

DATA EIa;
    IF _N_ = 1 THEN DO; SET EIa(RENAME=(eigenvalue=e1)); WHERE number = 1; END;
    SET EIa;
    CondIndex = sqrt(e1/eigenvalue);
RUN;
PROC PRINT DATA=EIa;    RUN;

ods output Eigenvalues=EIb;
PROC PRINCOMP DATA=B;           /* CORRELATION MATRIX */
    VAR inter height weight BMI area age avtrel avtrsp int temp barm hum;
RUN;
DATA EIb;
    IF _N_ = 1 THEN DO; SET EIb(RENAME=(eigenvalue=e1)); WHERE number = 1; END;
    SET EIb;
    CondIndex = sqrt(e1/eigenvalue);
RUN;
PROC PRINT DATA=EIb; RUN;


/**** Question #2 *****
Find the Box-Cox transformation of the simulated data (boxcox.dat) and
  compare the residual plots of the raw and transformed data.
***/
TITLE "QUESTION 2";
/* READ IN DATA & SET UP VARIABLES */
DATA filen;
    INFILE "&filepath.BoxCox.dat";
    INPUT x y;
RUN;

/* BEST LAMBDA = 0.5 */
PROC TRANSREG DATA=filen SS2 DETAIL;
    TITLE "DEFAULTS";
    MODEL BOXCOX(y) = IDENTITY(x);
```

```
RUN;

PROC IML;
USE filen;
READ ALL VAR "y" INTO y;
lny=log(y);
n=nrow(y);
one=j(n,1,1);
avglog=lny`*one/n;
PRINT avglog;
geomean = exp(avglog);
PRINT geomean;
geomeany=geomean#one;
create gmean var {geomeany};
append from geomeany;
close gmean;
QUIT;
RUN;

DATA p1;
    MERGE gmean filen;

    y_5 = ((y**0.5)-1)/(0.5*(geomeany**(0.5-1)));
RUN;

ODS GRAPHICS ON;
PROC REG DATA=p1 PLOTS=ALL;
    MODEL y = x;
    TITLE "1-RAW";
QUIT;

PROC REG DATA=p1 PLOTS=ALL;
    MODEL y_5 = x;
    TITLE "1-TRANSFORMED";
QUIT;
ODS GRAPHICS OFF;


/**** Question #3 *****
Effect of dermal nicotine exposure in a population of Latino tobacco workers
  in North Carolina.
***/
TITLE "QUESTION 3";

/* READ IN DATA & SET UP VARIABLES */
DATA filen;
    INFILE "&filepath.\tobacco.dat";
    INPUT cotinine age bmi educ wet task lnnsmoke;

    ID = _N_;
    lnCot = LOG(cotinine);

    IF task=1 THEN t1=1; ELSE t1=0;
    IF task=2 THEN t2=1; ELSE t2=0;
    IF task=3 THEN t3=1; ELSE t3=0;
    IF task=4 THEN t4=1; ELSE t4=0;

    wet_0 = 1 - wet;
    wet_1 = wet;

    w0t1 = wet_0 AND t1;
    w0t2 = wet_0 AND t2;
    w0t3 = wet_0 AND t3;
    w0t4 = wet_0 AND t4;
    w1t1 = wet_1 AND t1;
    w1t2 = wet_1 AND t2;
```

```
191       w1t3 = wet_1 AND t3;
192       w1t4 = wet_1 AND t4;
193
194       lnsmkt1 = t1 * lnnsmoke;
195       lnsmkt2 = t2 * lnnsmoke;
196       lnsmkt3 = t3 * lnnsmoke;
197       lnsmkt4 = t4 * lnnsmoke;
198
199       one = 1;
200   RUN;
201
202   PROC MEANS DATA=filen;
203       VAR cotinine age bmi educ wet task lnnsmoke;
204   RUN;
205
206   PROC FREQ DATA=filen;
207       TABLES age educ wet task / LIST MISSING;
208   RUN;
209
210   PROC SORT DATA=filen; BY cotinine; RUN;
211   PROC PRINT DATA=filen (FIRSTOBS=664);   RUN;
212
213
214   /***
215   3A - ONE-WAY ANOVA - LOG(cotinine) = task
216     Are all cell means equal? - H0/df/p-value/decision/interpretation
217     Examine all pairwise comparisons using the Scheffe correction.
218       Summerize findings in a table - estimated mean diff/df/F/p-value/Scheffe
          CI for mean diff
219       Explain your findings in language the investigator can understand.
220     Create a table of parameter estimates and standard errors - cell mean
        coding / reference cell coding
221       - give interpretations of parameters in both
222       - provide C and theta matrices for testing avg. cotinine (task=1) > avg.
          cotinine (task=234)
223   ***/
224   PROC GLM DATA=filen;
225       MODEL lnCot = t1 t2 t3 t4 / NOINT;
226       CONTRAST "Usual Overall Test" t1 1 t2 -1 t3  0 t4  0,
227                                     t1 1 t2 0  t3 -1 t4  0,
228                                     t1 1 t2 0  t3  0 t4 -1,
229                                     t1 0 t2 1  t3 -1 t4  0,
230                                     t1 0 t2 1  t3  0 t4 -1;
231
232       CONTRAST "t1 v t2" t1 1 t2 -1 t3  0 t4  0;
233       CONTRAST "t1 v t3" t1 1 t2  0 t3 -1 t4  0;
234       CONTRAST "t1 v t4" t1 1 t2  0 t3  0 t4 -1;
235       CONTRAST "t2 v t3" t1 0 t2  1 t3 -1 t4  0;
236       CONTRAST "t2 v t4" t1 0 t2  1 t3  0 t4 -1;
237       CONTRAST "t3 v t4" t1 0 t2  0 t3  1 t4 -1;
238
239       CONTRAST "T1 > AVG(T234)" t1 1 t2 -0.333333 t3 -0.333333 t4 -0.333333;
240
241       TITLE "CELL MEANS";
242   QUIT;
243
244   PROC GLM DATA=filen;
245       CLASS task(REF=LAST);
246       MODEL lnCot = task / SOLUTION;
247       TITLE "REF CELL - 1";
248   QUIT;
249
250   PROC GLM DATA=filen;
251       MODEL lnCot = one t1 t2 t3 / NOINT SOLUTION;
252       CONTRAST "Usual Overall Test" one 0 t1 1 t2 0 t3 0,
253                                     one 0 t1 0 t2 1 t3 0,
```

```
                                    one 0 t1 0 t2 0 t3 1;
    CONTRAST "T1 > AVG(T234)" one 0 t1 1 t2 -0.333333 t3 -0.333333;

    TITLE "REF CELL - 2";
QUIT;

PROC GLM DATA=filen;
    CLASS task;
    MODEL lnCot = task / NOINT;
    LSMEANS task / PDIFF ADJUST=SCHEFFE;
    MEANS task / SCHEFFE;

    TITLE "SCHEFFE";
QUIT;


/***
B - TWO-WAY ANOVA - LOG(cotinine) = task + wet

lnCot = mu + alpha i + beta j + gamma ij

i=2     j=4     ij=8

1 + 2 + 4 + 8 = 15

let wet=1 and task=4 be the reference
i=1
j=3     1 + 1 + 3 + 3 = 8

A(mu) + B(wet_0) + C(t1) + D(t2) + E(t3) + BC(w0t1) + BD (w0t2) + BE (w0t3)

now 4 parameters describe the dose effect

  Fit model with full interaction.
    - Interpret all parameter estimates.
    - Clearly state coding scheme used.
    - Discuss HILE-G assumptions.
  Create a table of estimated mean log(cotinine) levels, standard errors, how
  each estaimated mean is obtained from the model parameters
***/
PROC FREQ DATA=filen;
    TABLES task*wet / MISSING NOROW NOCOL NOPERCENT;
    TITLE "Balanced Cells?";
RUN;

PROC GLM DATA=filen;
    MODEL lnCot = w0t1 w1t1 w0t2 w1t2 w0t3 w1t3 w0t4 w1t4 / NOINT SOLUTION;

    ESTIMATE "GRAND MEAN" w0t1 1 w1t1 1 w0t2 1 w1t2 1 w0t3 1 w1t3 1 w0t4 1
    w1t4 1 / DIVISOR=8;
    ESTIMATE "MARG MEAN: WET 0" w0t1 1 w1t1 0 w0t2 1 w1t2 0 w0t3 1 w1t3 0
    w0t4 1 w1t4 0 / DIVISOR=4;
    ESTIMATE "MARG MEAN: WET 1" w0t1 0 w1t1 1 w0t2 0 w1t2 1 w0t3 0 w1t3 1
    w0t4 0 w1t4 1 / DIVISOR=4;
    ESTIMATE "MARG MEAN: T1" w0t1 1 w1t1 1 w0t2 0 w1t2 0 w0t3 0 w1t3 0 w0t4 0
    w1t4 0 / DIVISOR=2;
    ESTIMATE "MARG MEAN: T2" w0t1 0 w1t1 0 w0t2 1 w1t2 1 w0t3 0 w1t3 0 w0t4 0
    w1t4 0 / DIVISOR=2;
    ESTIMATE "MARG MEAN: T3" w0t1 0 w1t1 0 w0t2 0 w1t2 0 w0t3 1 w1t3 1 w0t4 0
    w1t4 0 / DIVISOR=2;
    ESTIMATE "MARG MEAN: T4" w0t1 0 w1t1 0 w0t2 0 w1t2 0 w0t3 0 w1t3 0 w0t4 1
    w1t4 1 / DIVISOR=2;

    CONTRAST "MAIN EFFECT WET" w0t1 1 w1t1 -1 w0t2 1 w1t2 -1 w0t3 1 w1t3 -1
    w0t4 1 w1t4 -1;

```

```
311       CONTRAST "MAIN EFFECT TASK" w0t1 1 w1t1 1 w0t2 -1 w1t2 -1 w0t3  0 w1t3  0
          w0t4  0 w1t4  0,
312                                   w0t1 1 w1t1 1 w0t2  0 w1t2  0 w0t3 -1 w1t3 -1
                                      w0t4  0 w1t4  0,
313                                   w0t1 1 w1t1 1 w0t2  0 w1t2  0 w0t3  0 w1t3  0
                                      w0t4 -1 w1t4 -1;
314
315       CONTRAST "INTERACTION WET V TASK" w0t1 1 w1t1 -1 w0t2 -1 w1t2  1 w0t3  0
          w1t3  0 w0t4  0 w1t4  0,
316                                         w0t1 1 w1t1 -1 w0t2  0 w1t2  0 w0t3 -1
                                            w1t3  1 w0t4  0 w1t4  0,
317                                         w0t1 1 w1t1 -1 w0t2  0 w1t2  0 w0t3  0
                                            w1t3  0 w0t4 -1 w1t4  1;
318
319       TITLE "CELL MEAN";
320   QUIT;
321
322   PROC GLM DATA=filen;
323       MODEL lnCot = one wet_1 t2 t3 t4 w1t2 w1t3 w1t4 / NOINT SOLUTION;
324
325       ESTIMATE "GRAND MEAN" one 8 wet_1 4 t2 2 t3 2 t4 2 w1t2 1 w1t3 1 w1t4 1 /
          DIVISOR=8;
326       ESTIMATE "MARG MEAN: WET 0" one 4 wet_1 0 t2 1 t3 1 t4 1 w1t2 0 w1t3 0
          w1t4 0 / DIVISOR=4;
327       ESTIMATE "MARG MEAN: WET 1" one 4 wet_1 4 t2 1 t3 1 t4 1 w1t2 1 w1t3 1
          w1t4 1 / DIVISOR=4;
328       ESTIMATE "MARG MEAN: T1" one 2 wet_1 1 t2 0 t3 0 t4 0 w1t2 0 w1t3 0 w1t4
          0 / DIVISOR=2;
329       ESTIMATE "MARG MEAN: T2" one 2 wet_1 1 t2 2 t3 0 t4 0 w1t2 1 w1t3 0 w1t4
          0 / DIVISOR=2;
330       ESTIMATE "MARG MEAN: T3" one 2 wet_1 1 t2 0 t3 2 t4 0 w1t2 0 w1t3 1 w1t4
          0 / DIVISOR=2;
331       ESTIMATE "MARG MEAN: T4" one 2 wet_1 1 t2 0 t3 0 t4 2 w1t2 0 w1t3 0 w1t4
          1 / DIVISOR=2;
332
333       CONTRAST "MAIN EFFECT WET" one 0 wet_1 4 t2 0 t3 0 t4 0 w1t2 1 w1t3 1
          w1t4 1;
334
335       CONTRAST "MAIN EFFECT TASK" one 0 wet_1 0 t2 2 t3 0 t4 0 w1t2 1 w1t3 0
          w1t4 0,
336                                   one 0 wet_1 0 t2 0 t3 2 t4 0 w1t2 0 w1t3 1
                                      w1t4 0,
337                                   one 0 wet_1 0 t2 0 t3 0 t4 2 w1t2 0 w1t3 0
                                      w1t4 1;
338
339       CONTRAST "INTERACTION WET V TASK" one 0 wet_1 0 t2 0 t3 0 t4 0 w1t2 1
          w1t3 0 w1t4 0,
340                                         one 0 wet_1 0 t2 0 t3 0 t4 0 w1t2 0
                                            w1t3 1 w1t4 0,
341                                         one 0 wet_1 0 t2 0 t3 0 t4 0 w1t2 0
                                            w1t3 0 w1t4 1;
342
343       TITLE "REF CELL";
344   QUIT;
345
346   ODS GRAPHICS ON;
347   PROC REG DATA=filen PLOTS=ALL;
348       MODEL lnCot = one wet_1 t2 t3 t4 w1t2 w1t3 w1t4 / NOINT;
349       TITLE "3-B";
350       OUTPUT OUT=B PREDICTED=y_hat RSTUDENT=r_i;
351   QUIT;
352
353   PROC UNIVARIATE DATA=B PLOT NORMAL;
354       CLASS wet task;
355       VAR r_i;
356       QQPLOT r_i / NORMAL;
```

```
357       HISTOGRAM r_i / NORMAL;
358       TITLE "3-B";
359   RUN;
360
361   PROC MEANS DATA=B STD;
362       CLASS y_hat;
363       VAR r_i;
364       OUTPUT OUT=B_2 STD(r_i)=sd;
365   RUN;
366
367   PROC SGPLOT DATA=B_2;
368       SCATTER X=y_hat Y=sd;
369       label sd="Within Group Sample SDs";
370       TITLE "Within Group Residuals";
371   RUN;
372
373   ODS GRAPHICS OFF;
374
375
376   /***
377   C - FULL MODEL IN EVERY CELL - LOG(cotinine) = task + lnnsmoke - categorical
      & continuous
378
379     Fit full model in every cell.
380       - Interpret all parameter estimates.
381     Report test for whether task is related to cotinine levels.
382       - If sig, report step-down tests to determine exactly where differences
          lie.
383       - State H0 & Give justification for which test is used and why.
384   ***/
385   PROC MEANS DATA=filen;
386       VAR lnnsmoke;           /* mean = 0.5960 */
387   RUN;
388
389   PROC GLM DATA=filen;
390       MODEL lnCot = t1 t2 t3 t4 lnsmkt1 lnsmkt2 lnsmkt3 lnsmkt4 / NOINT SOLUTION;
391
392       ESTIMATE "ADJ CELL MEAN: T1" t1 1 t2 0 t3 0 t4 0 lnsmkt1 0.5960 lnsmkt2 0
          lnsmkt3 0 lnsmkt4 0;
393       ESTIMATE "ADJ CELL MEAN: T2" t1 0 t2 1 t3 0 t4 0 lnsmkt1 0 lnsmkt2 0.5960
          lnsmkt3 0 lnsmkt4 0;
394       ESTIMATE "ADJ CELL MEAN: T3" t1 0 t2 0 t3 1 t4 0 lnsmkt1 0 lnsmkt2 0
          lnsmkt3 0.5960 lnsmkt4 0;
395       ESTIMATE "ADJ CELL MEAN: T4" t1 0 t2 0 t3 0 t4 1 lnsmkt1 0 lnsmkt2 0
          lnsmkt3 0 lnsmkt4 0.5960;
396
397       ESTIMATE "MEAN OF ADJ CELL MEANS" t1 1 t2 1 t3 1 t4 1 lnsmkt1 0.5960
          lnsmkt2 0.5960 lnsmkt3 0.5960 lnsmkt4 0.5960 / DIVISOR=4;
398       ESTIMATE "MEAN INTERCEPT" t1 1 t2 1 t3 1 t4 1 lnsmkt1 0 lnsmkt2 0 lnsmkt3
          0 lnsmkt4 0 / DIVISOR=4;
399       ESTIMATE "MEAN SLOPE" t1 0 t2 0 t3 0 t4 0 lnsmkt1 1 lnsmkt2 1 lnsmkt3 1
          lnsmkt4 1 / DIVISOR=4;
400
401       CONTRAST "TEST OF COINCIDENCE" t1 1 t2 -1 t3  0 t4  0 lnsmkt1  0 lnsmkt2
          0 lnsmkt3  0 lnsmkt4  0,
402                                      t1 1 t2  0 t3 -1 t4  0 lnsmkt1  0 lnsmkt2
                                         0 lnsmkt3  0 lnsmkt4  0,
403                                      t1 1 t2  0 t3  0 t4 -1 lnsmkt1  0 lnsmkt2
                                         0 lnsmkt3  0 lnsmkt4  0,
404                                      t1 0 t2  0 t3  0 t4  0 lnsmkt1  1 lnsmkt2
                                         -1 lnsmkt3  0 lnsmkt4  0,
405                                      t1 0 t2  0 t3  0 t4  0 lnsmkt1  1 lnsmkt2
                                         0 lnsmkt3 -1 lnsmkt4  0,
406                                      t1 0 t2  0 t3  0 t4  0 lnsmkt1  1 lnsmkt2
                                         0 lnsmkt3  0 lnsmkt4 -1;
407
```

```
408       CONTRAST "STEPDOWN: EQUAL INTERCEPTS"
409                                    t1 1 t2 -1 t3  0 t4  0 lnsmkt1  0 lnsmkt2
                                       0 lnsmkt3  0 lnsmkt4  0,
410                                    t1 1 t2  0 t3 -1 t4  0 lnsmkt1  0 lnsmkt2
                                       0 lnsmkt3  0 lnsmkt4  0,
411                                    t1 1 t2  0 t3  0 t4 -1 lnsmkt1  0 lnsmkt2
                                       0 lnsmkt3  0 lnsmkt4  0;
412       CONTRAST "STEPDOWN: EQUAL SLOPES"
413                                    t1 0 t2  0 t3  0 t4  0 lnsmkt1  1 lnsmkt2
                                       -1 lnsmkt3  0 lnsmkt4  0,
414                                    t1 0 t2  0 t3  0 t4  0 lnsmkt1  1 lnsmkt2
                                       0 lnsmkt3 -1 lnsmkt4  0,
415                                    t1 0 t2  0 t3  0 t4  0 lnsmkt1  1 lnsmkt2
                                       0 lnsmkt3  0 lnsmkt4 -1;
416
417       CONTRAST "PAIRWISE INTERCEPTS T1 V T2" t1 1 t2 -1 t3  0 t4  0 lnsmkt1  0
          lnsmkt2  0 lnsmkt3  0 lnsmkt4  0;
418       CONTRAST "PAIRWISE INTERCEPTS T1 V T3" t1 1 t2  0 t3 -1 t4  0 lnsmkt1  0
          lnsmkt2  0 lnsmkt3  0 lnsmkt4  0;
419       CONTRAST "PAIRWISE INTERCEPTS T1 V T4" t1 1 t2  0 t3  0 t4 -1 lnsmkt1  0
          lnsmkt2  0 lnsmkt3  0 lnsmkt4  0;
420       CONTRAST "PAIRWISE INTERCEPTS T2 V T3" t1 0 t2  1 t3 -1 t4  0 lnsmkt1  0
          lnsmkt2  0 lnsmkt3  0 lnsmkt4  0;
421       CONTRAST "PAIRWISE INTERCEPTS T2 V T4" t1 0 t2  1 t3  0 t4 -1 lnsmkt1  0
          lnsmkt2  0 lnsmkt3  0 lnsmkt4  0;
422       CONTRAST "PAIRWISE INTERCEPTS T3 V T4" t1 0 t2  0 t3  1 t4 -1 lnsmkt1  0
          lnsmkt2  0 lnsmkt3  0 lnsmkt4  0;
423
424       CONTRAST "PAIRWISE SLOPES T1 V T2" t1 0 t2  0 t3  0 t4  0 lnsmkt1  1
          lnsmkt2 -1 lnsmkt3  0 lnsmkt4  0;
425       CONTRAST "PAIRWISE SLOPES T1 V T3" t1 0 t2  0 t3  0 t4  0 lnsmkt1  1
          lnsmkt2  0 lnsmkt3 -1 lnsmkt4  0;
426       CONTRAST "PAIRWISE SLOPES T1 V T4" t1 0 t2  0 t3  0 t4  0 lnsmkt1  1
          lnsmkt2  0 lnsmkt3  0 lnsmkt4 -1;
427       CONTRAST "PAIRWISE SLOPES T2 V T3" t1 0 t2  0 t3  0 t4  0 lnsmkt1  0
          lnsmkt2  1 lnsmkt3 -1 lnsmkt4  0;
428       CONTRAST "PAIRWISE SLOPES T2 V T4" t1 0 t2  0 t3  0 t4  0 lnsmkt1  0
          lnsmkt2  1 lnsmkt3  0 lnsmkt4 -1;
429       CONTRAST "PAIRWISE SLOPES T3 V T4" t1 0 t2  0 t3  0 t4  0 lnsmkt1  0
          lnsmkt2  0 lnsmkt3  1 lnsmkt4 -1;
430
431       CONTRAST "EQUAL ADJ CELL MEANS" t1 1 t2 -1 t3  0 t4  0 lnsmkt1  0.5960
          lnsmkt2  -0.5960 lnsmkt3  0 lnsmkt4  0,
432                                     t1 1 t2  0 t3 -1 t4  0 lnsmkt1  0.5960
                                        lnsmkt2  0 lnsmkt3  -0.5960 lnsmkt4  0,
433                                     t1 1 t2  0 t3  0 t4 -1 lnsmkt1  0
                                        lnsmkt2  0 lnsmkt3  0 lnsmkt4  -0.5960;
434       CONTRAST "PAIRWISE ADJ T1 V T2" t1 1 t2 -1 t3  0 t4  0 lnsmkt1  0.5960
          lnsmkt2  -0.5960 lnsmkt3 0 lnsmkt4  0;
435       CONTRAST "PAIRWISE ADJ T1 V T3" t1 1 t2  0 t3 -1 t4  0 lnsmkt1  0.5960
          lnsmkt2  0 lnsmkt3 -0.5960 lnsmkt4  0;
436       CONTRAST "PAIRWISE ADJ T1 V T4" t1 1 t2  0 t3  0 t4 -1 lnsmkt1  0.5960
          lnsmkt2  0 lnsmkt3  0 lnsmkt4 -0.5960;
437       CONTRAST "PAIRWISE ADJ T2 V T3" t1 0 t2  1 t3 -1 t4  0 lnsmkt1  0
          lnsmkt2  0.5960 lnsmkt3 -0.5960 lnsmkt4  0;
438       CONTRAST "PAIRWISE ADJ T2 V T4" t1 0 t2  1 t3  0 t4 -1 lnsmkt1  0
          lnsmkt2  0.5960 lnsmkt3  0 lnsmkt4 -0.5960;
439       CONTRAST "PAIRWISE ADJ T3 V T4" t1 0 t2  0 t3  1 t4 -1 lnsmkt1  0
          lnsmkt2  0 lnsmkt3  0.5960 lnsmkt4 -0.5960;
440
441       TITLE "3-C CELL MEANS";
442   QUIT;
443
444   PROC GLM DATA=filen;
445       CLASS task;
446       MODEL lnCot = task lnnsmoke / NOINT;
```

```
447       MEANS task / SCHEFFE;
448       LSMEANS task / PDIFF ADJUST=SCHEFFE;
449       TITLE "SCHEFFE";
450   QUIT;
451
452
```