

SAS Lab 9 For Statistics 514**Topics:**

Chapter 27. Randomized Block Designs

```
*Attendance 9, randomized block design;
*prozac;
DATA PROZAC;
    INPUT PROZACYIELD BLENDBLOCK $ CATALYST $;
DATALINES;
82  1  1
88  1  2
92  1  3
94  1  4
84  2  1
90  2  2
96  2  3
97  2  4
85  3  1
92  3  2
96  3  3
100 3  4
87  4  1
95  4  2
99  4  3
102 4  4
90  5  1
97  5  2
101 5  3
103 5  4
;
PROC GLM DATA=PROZAC;
    TITLE 'RANDOMIZED BLOCK DESIGN, PROZAC YIELD';
    CLASS BLENDBLOCK CATALYST;
    MODEL PROZACYIELD = BLENDBLOCK CATALYST;
    OUTPUT OUT=PROZAC2 PREDICTED=YIELDPRED RESIDUALS=RESID;
RUN;
PROC GPLOT DATA=PROZAC2;
    TITLE 'TREATMENT MEANS PLOT, PROZAC YIELD';
    PLOT PROZACYIELD*CATALYST=BLENDBLOCK;
RUN;
QUIT;
```

```
*Attendance 9,27.3 RBD;
*prozac;
DATA PROZAC;
  INPUT PROZACYIELD BLENDBLOCK $ CATALYST $;
DATALINES;
82 1 1
88 1 2
92 1 3
94 1 4
84 2 1
90 2 2
96 2 3
97 2 4
85 3 1
92 3 2
96 3 3
100 3 4
87 4 1
95 4 2
99 4 3
102 4 4
90 5 1
97 5 2
101 5 3
103 5 4
;
PROC GLM DATA=PROZAC;
  TITLE 'randomized block design, prozac yield';
  CLASS BLENDBLOCK CATALYST;
  MODEL PROZACYIELD = BLENDBLOCK CATALYST;
RUN;
QUIT;
```

```
*Attendance 9,27.4 RBD, prozac, residuals;
DATA PROZAC;
  INPUT PROZACYIELD BLENDBLOCK $ CATALYST $;
DATALINES;
82 1 1
88 1 2
92 1 3
94 1 4
84 2 1
90 2 2
96 2 3
97 2 4
85 3 1
92 3 2
96 3 3
100 3 4
87 4 1
95 4 2
99 4 3
102 4 4
90 5 1
97 5 2
101 5 3
103 5 4
;
PROC GLM DATA=PROZAC;
  TITLE 'RANDOMIZED BLOCK DESIGN, PROZAC YIELD';
  CLASS BLENDBLOCK CATALYST;
  MODEL PROZACYIELD = BLENDBLOCK CATALYST;
  means blendblock catalyst;
  OUTPUT OUT=PROZAC2 PREDICTED=YIELDPRED RESIDUALS=RESID;
RUN;
PROC PRINT DATA=PROZAC2;
  TITLE 'list of prozac yield residuals';
  VAR BLENDBLOCK CATALYST PROZACYIELD YIELDPRED RESID;
RUN;
PROC GPLOT DATA=PROZAC2;
  title 'residual vs fitted, prozac';
  PLOT resid*yieldpred;
RUN;
proc capability data=prozac2 noprint graphics;
  title 'normal probability plot for residuals';
  probplot resid;
run;
QUIT;
```

```
*Attendance 9,27.4 RBD,prozac;
DATA PROZAC;
  INPUT PROZACYIELD BLENDBLOCK $ CATALYST $;
DATALINES;
82  1  1
88  1  2
92  1  3
94 1  4
84  2  1
90  2  2
96  2  3
97  2  4
85 3  1
92  3  2
96  3  3
100 3  4
87  4  1
95  4  2
99  4  3
102 4  4
90  5  1
97  5  2
101 5  3
103 5  4
;
PROC GLM DATA=PROZAC;
  title 'randomized block design, prozac';
  CLASS BLENDBLOCK CATALYST;
  MODEL PROZACYIELD = BLENDBLOCK CATALYST;
  means blendblock catalyst;
RUN;
QUIT;
```

```
*Attendance 9, 27.7 RBD, prozac;
DATA PROZAC;
  INPUT PROZACYIELD BLENDBLOCK $ CATALYST $;
DATALINES;
82  1  1
88  1  2
92  1  3
94 1  4
84  2  1
90  2  2
96  2  3
97  2  4
85 3  1
92  3  2
96  3  3
100 3  4
87  4  1
95  4  2
99  4  3
102 4  4
90  5  1
97  5  2
101  5  3
103 5  4
;
PROC GLM DATA=PROZAC;
  title 'randomized block design, prozac';
  CLASS BLENDBLOCK CATALYST;
  MODEL PROZACYIELD = BLENDBLOCK CATALYST;
  means blendblock catalyst;
RUN;
PROC GLM DATA=prozac;
  TITLE 'completely randomized design, prozac';
  CLASS catalyst;
  MODEL prozacyield = catalyst;
  OUTPUT OUT=prozacout PREDICTED=FATPRED RESIDUALS=RESID
         rstudent=stobsresid;
RUN;
QUIT;
```

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*Attendance 9, 27.8 RBD, prozac, regression;
DATA PROZAC;
  INPUT PROZACYIELD BLENDBLOCK $ CATALYST $;
    if blendblock = 1 then x1 = 1;
    if blendblock = 5 then x1 = -1;
    if blendblock ne 1 and blendblock ne 5 then x1 = 0;
    if blendblock = 2 then x2 = 1;
    if blendblock = 5 then x2 = -1;
    if blendblock ne 2 and blendblock ne 5 then x2 = 0;
    if blendblock = 3 then x3 = 1;
    if blendblock = 5 then x3 = -1;
    if blendblock ne 3 and blendblock ne 5 then x3 = 0;
    if blendblock = 4 then x4 = 1;
    if blendblock = 5 then x4 = -1;
    if blendblock ne 4 and blendblock ne 5 then x4 = 0;
    if catalyst = 1 then x5 = 1;
    if catalyst = 4 then x5 = -1;
    if catalyst ne 1 and catalyst ne 4 then x5 = 0;
    if catalyst = 2 then x6 = 1;
    if catalyst = 4 then x6 = -1;
    if catalyst ne 2 and catalyst ne 4 then x6 = 0;
    if catalyst = 3 then x7 = 1;
    if catalyst = 4 then x7 = -1;
    if catalyst ne 3 and catalyst ne 4 then x7 = 0;
  DATALINES;
82 1 1
88 1 2
92 1 3
94 1 4
84 2 1
90 2 2
96 2 3
97 2 4
85 3 1
92 3 2
96 3 3
100 3 4
87 4 1
95 4 2
99 4 3
102 4 4
90 5 1
97 5 2
101 5 3
103 5 4
;
PROC REG DATA=prozac;
  TITLE 'RBD, full regression';
  MODEL prozacyield = X1 X2 X3 X4 X5 X6 X7;
RUN;
PROC REG DATA=prozac;
  TITLE 'RBD, reduced regression, blocks only';
  MODEL prozacyield = X1 X2 X3 X4;
RUN;
QUIT;

```

```

*ATTENDANCE 9, RBD, PROZAC, COVARIANCE;
DATA PROZAC;
    INPUT PROZACYIELD TIME BLENDBLOCK $ CATALYST $ I1 I2 I3 I4 I5 I6 I7;
    DIFF = TIME - 10.5;
DATALINES;
82  1 1  1 1000100
88  15 1  2 1000010
92  13 1  3 1000001
94 9 1  4 1000-1-1-1
84  2 2  1 0100100
90  5 2  2 0100010
96  20 2  3 0100001
97 19 2  4 0100-1-1-1
85  17 3  1 0010100
92  16 3  2 0010010
96  8 3  3 0010001
100 3 3  4 0010-1-1-1
87  7 4  1 0001100
95  12 4  2 0001010
99  11 4  3 0001001
102 4 4  4 0001-1-1-1
90  6 5  1 -1-1-1-1100
97  10 5  2 -1-1-1-1010
101  14 5  3 -1-1-1-1001
103 18 5  4 -1-1-1-1-1-1
;
PROC REG DATA=PROZAC COVOUT OUTEST = COVEST;
    TITLE 'RBD, prozac, full model, covariance';
    MODEL PROZACYIELD = I1 I2 I3 I4 I5 I6 I7 DIFF;
RUN;
PROC REG DATA=PROZAC;
    TITLE 'RBD, prozac, reduced model, covariance';
    MODEL PROZACYIELD = I1 I2 I3 I4 DIFF;
RUN;
PROC PRINT
    DATA = COVEST;
RUN;
QUIT;

```



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*Attendance 9, 27.11 RBD, prozac, missing;
DATA PROZAC;
  INPUT PROZACYIELD BLENDBLOCK $ CATALYST $;
    if blendblock = 1 then x1 = 1;
    if blendblock = 5 then x1 = -1;
    if blendblock ne 1 and blendblock ne 5 then x1 = 0;
    if blendblock = 2 then x2 = 1;
    if blendblock = 5 then x2 = -1;
    if blendblock ne 2 and blendblock ne 5 then x2 = 0;
    if blendblock = 3 then x3 = 1;
    if blendblock = 5 then x3 = -1;
    if blendblock ne 3 and blendblock ne 5 then x3 = 0;
    if blendblock = 4 then x4 = 1;
    if blendblock = 5 then x4 = -1;
    if blendblock ne 4 and blendblock ne 5 then x4 = 0;
    if catalyst = 1 then x5 = 1;
    if catalyst = 4 then x5 = -1;
    if catalyst ne 1 and catalyst ne 4 then x5 = 0;
    if catalyst = 2 then x6 = 1;
    if catalyst = 4 then x6 = -1;
    if catalyst ne 2 and catalyst ne 4 then x6 = 0;
    if catalyst = 3 then x7 = 1;
    if catalyst = 4 then x7 = -1;
    if catalyst ne 3 and catalyst ne 4 then x7 = 0;
  DATALINES;
82 1 1
88 1 2
92 1 3
94 1 4
90 2 2
96 2 3
97 2 4
85 3 1
92 3 2
96 3 3
100 3 4
87 4 1
95 4 2
102 4 4
90 5 1
97 5 2
101 5 3
103 5 4
;
PROC REG DATA=prozac;
  TITLE 'RBD, full regression, missing obs';
  MODEL prozacyield = X1 X2 X3 X4 X5 X6 X7;
RUN;
PROC REG DATA=prozac;
  TITLE 'RBD, reduced regression, blocks only, missing obs';
  MODEL prozacyield = X1 X2 X3 X4;
RUN;
QUIT;

```

```

*Homework 7, 27.7 RANDOMIZED BLOCK DESIGN;
*fat in diet;
DATA FATINDIETS;
  INPUT FAT AGEBLOCK $ FATCONTENT;
DATALINES;
0.73 1 1
0.67 1 2
0.15 1 3
0.86 2 1
0.75 2 2
0.21 2 3
0.94 3 1
0.81 3 2
0.26 3 3
1.4 4 1
1.32 4 2
0.75 4 3
1.62 5 1
1.41 5 2
0.78 5 3
;
PROC GLM DATA=FATINDIETS;
  TITLE '27-7(a,d) randomized block design, fat in diets';
  CLASS AGEBLOCK FATCONTENT;
  MODEL FAT = AGEBLOCK FATCONTENT;
  means ageblock fatcontent;
  OUTPUT OUT=fatout PREDICTED=FATPRED RESIDUALS=RESID
    rstudent=stobsresid;
RUN;
PROC PRINT DATA=fatout;
  TITLE '27-7(b) predicted, residuals, fat in diets';
  VAR ageblock fatcontent fat fatpred resid;
RUN;
PROC GPLOT DATA=fatout;
  TITLE '27-7(b), standardized residual vs fitted, fat in diets';
  PLOT stobsresid*fatpred;
RUN;
proc capability data=fatout noprint graphics;
  title '27-7(b) normal probability plot for residuals';
  probplot resid;
run;
PROC GPLOT DATA=fatindiets;
  TITLE '27-7(c), treatment blocks plot';
  PLOT fat*fatcontent=ageblock;
RUN;
QUIT;

```

```
*Homework 7, 27.8 RANDOMIZED BLOCK DESIGN;
*FAT IN DIETS;
DATA FATINDIETS;
  INPUT FAT AGEBLOCK $ FATCONTENT;
DATALINES;
0.73  1    1
0.67  1    2
0.15  1    3
0.86  2    1
0.75  2    2
0.21  2    3
0.94  3    1
0.81  3    2
0.26  3    3
1.4   4    1
1.32  4    2
0.75  4    3
1.62  5    1
1.41  5    2
0.78  5    3
;
PROC GLM DATA=FATINDIETS;
  TITLE '27-8(a) randomized block design, fat in diets';
  CLASS AGEBLOCK FATCONTENT;
  MODEL FAT = AGEBLOCK FATCONTENT;
  means ageblock fatcontent;
  OUTPUT OUT=fatout PREDICTED=FATPRED RESIDUALS=RESID
         rstudent=stobsresid;
RUN;
QUIT;
```

```
*Homework 7, 27.8 RANDOMIZED BLOCK DESIGN;
*FAT IN DIETS;
DATA FATINDIETS;
    INPUT FAT AGEBLOCK $ FATCONTENT;
DATALINES;
0.73  1  1
0.67  1  2
0.15  1  3
0.86  2  1
0.75  2  2
0.21  2  3
0.94  3  1
0.81  3  2
0.26  3  3
1.4   4  1
1.32  4  2
0.75  4  3
1.62  5  1
1.41  5  2
0.78  5  3
;
PROC GLM DATA=FATINDIETS;
    TITLE '27-17 randomized block design, fat in diets';
    CLASS AGEBLOCK FATCONTENT;
    MODEL FAT = AGEBLOCK FATCONTENT;
    OUTPUT OUT=fatout PREDICTED=FATPRED RESIDUALS=RESID
            rstudent=stobsresid;
RUN;
PROC GLM DATA=FATINDIETS;
    TITLE '27-17 completely randomized design, fat in diets';
    CLASS FATCONTENT;
    MODEL FAT = FATCONTENT;
    OUTPUT OUT=fatout PREDICTED=FATPRED RESIDUALS=RESID
            rstudent=stobsresid;
RUN;
QUIT;
```

```
*Homework 7, 27.20 RBD, regression;
DATA FATINDIETS;
  INPUT FAT AGEBLOCK $ FATCONTENT X1 X2 X3 X4 X5 X6;
DATALINES;
0.73 1 1 1 0 0 0 1 0
0.67 1 2 1 0 0 0 0 1
0.15 1 3 1 0 0 0 -1 -1
0.86 2 1 0 1 0 0 1 0
0.75 2 2 0 1 0 0 0 1
0.21 2 3 0 1 0 0 -1 -1
0.94 3 1 0 0 1 0 1 0
0.81 3 2 0 0 1 0 0 1
0.26 3 3 0 0 1 0 -1 -1
1.4 4 1 0 0 0 1 1 0
1.32 4 2 0 0 0 1 0 1
0.75 4 3 0 0 0 1 -1 -1
1.62 5 1 -1 -1 -1 -1 1 0
1.41 5 2 -1 -1 -1 -1 0 1
0.78 5 3 -1 -1 -1 -1 -1 -1
;
PROC REG DATA=FATINDIETS;
  TITLE '27.20(b) RBD, full regression';
  MODEL FAT = X1 X2 X3 X4 X5 X6;
RUN;
PROC REG DATA=FATINDIETS;
  TITLE '27.20(c) RBD, reduced regression, blocks only';
  MODEL FAT = X1 X2 X3 X4;
RUN;
QUIT;
```

```

*Homework 7, 27.22 RBD, covariance;
DATA FATINDIETS;
  INPUT FAT WEIGHT AGEBLOCK $ FATCONTENT I1 I2 I3 I4 I5 I6;
  DIFF = WEIGHT - 104.46667;
DATALINES;
0.73 94 1 1 1 0 0 0 1 0
0.67 96 1 2 1 0 0 0 0 1
0.15 101 1 3 1 0 0 0 -1 -1
0.86 97 2 1 0 1 0 0 1 0
0.75 102 2 2 0 1 0 0 0 1
0.21 99 2 3 0 1 0 0 -1 -1
0.94 105 3 1 0 0 1 0 1 0
0.81 100 3 2 0 0 1 0 0 1
0.26 106 3 3 0 0 1 0 -1 -1
1.4 108 4 1 0 0 0 1 1 0
1.32 107 4 2 0 0 0 1 0 1
0.75 112 4 3 0 0 0 1 -1 -1
1.62 118 5 1 -1 -1 -1 -1 1 0
1.41 115 5 2 -1 -1 -1 -1 0 1
0.78 107 5 3 -1 -1 -1 -1 -1 -1
;
PROC REG DATA=FATINDIETS COVOUT OUTEST = COVEST;
  TITLE '27.22(b) RBD, covariance, full model';
  MODEL FAT = I1 I2 I3 I4 I5 I6 DIFF;
RUN;
PROC REG DATA=FATINDIETS;
  TITLE '27.22(c,e) RBD, covariance, reduced model';
  MODEL FAT = I1 I2 I3 I4 DIFF;
RUN;
PROC PRINT
  DATA = COVEST;
RUN;
PROC GLM DATA=PROZAC;
  TITLE 'randomized block design, anova';
  CLASS BLENDBLOCK CATALYST;
  MODEL PROZACYIELD = BLENDBLOCK CATALYST;
RUN;
QUIT;

```

```
*Homework 7, 27.26 RBD, missing values;
DATA FATINDIETS;
  INPUT FAT WEIGHT AGEBLOCK $ FATCONTENT I1 I2 I3 I4 I5 I6;
DATALINES;
0.73 941    1 1 0 0 0 1 0
0.67 961    2 1 0 0 0 0 1
0.86 972    1 0 1 0 0 1 0
0.75 102    2    2 0 1 0 0 0 1
0.21 992    3 0 1 0 0 -1 -1
0.94 105    3    1 0 0 1 0 1 0
0.81 100    3    2 0 0 1 0 0 1
0.26 106    3    3 0 0 1 0 -1 -1
1.4   108 4 1 0 0 0 1 1 0
1.32 107    4    2 0 0 0 1 0 1
0.75 112    4    3 0 0 0 1 -1 -1
1.41 115    5    2 -1 -1 -1 -1 0 1
0.78 107    5    3 -1 -1 -1 -1 -1 -1
;
PROC REG DATA=FATINDIETS COVOUT OUTEST = COVEST;
  TITLE '27.26(a,d) RBD, full model, missing values';
  MODEL FAT = I1 I2 I3 I4 I5 I6;
RUN;
PROC REG DATA=FATINDIETS;
  TITLE '27.26(b,c) RBD, reduced model, missing values';
  MODEL FAT = I1 I2 I3 I4;
RUN;
PROC PRINT
  DATA = COVEST;
RUN;
QUIT;
```