

**SAS Lab 12 For Statistics 514**

**Topics:**

Chapter 30. Latin Square and Related Designs

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*Attendance 12, 30.3 latin square;
*Drug response, inference;
DATA DRUGS;
  INPUT response age $ health & drug $;
DATALINES;
69  1  1  1
91  1  2  3
65  1  3  2
80  2  1  2
92  2  2  1
63  2  3  3
40  3  1  3
47  3  2  2
44  3  3  1
;
PROC GLM DATA=drugs;
  TITLE '30.3 latin square, drug response';
  CLASS health age drug;
  MODEL response = health age drug;
  MEANS health age drug;
  OUTPUT OUT=DRUGSout PREDICTED=PRED RESIDUAL=RESID;
RUN;
PROC PRINT DATA=drugsout;
  TITLE '30.3 residuals, latin square, drugs response';
  VAR health age drug response pred resid;
RUN;
PROC GPLOT DATA=drugsout;
  TITLE '30.3 residuals vs fitted, latin square, summary report';
  PLOT resid*pred;
RUN;
proc capability data=drugsout noprint graphics;
  title '30.6 normal probability plot for residuals';
  probplot resid;
run;
QUIT;
```

```
*Attendance 12,30.5 latin square;
*Drug response, regression approach for missing obs;
DATA DRUGS;
    INPUT response age $ health $ drug $ X1 X2 X3 X4 X5 X6;
DATALINES;
91    1    2    3 1 0 0 1 -1 -1
65    1    3    2 1 0 -1 -1 0 1
80    2    1    2 0 1 1 0 0 1
92    2    2    1 0 1 0 1 1 0
63    2    3    3 0 1 -1 -1 -1 -1
40    3    1    3 -1 -1 1 0 -1 -1
47    3    2    2 -1 -1 0 1 0 1
44    3    3    1 -1 -1 -1 -1 1 0
;
PROC REG DATA=DRUGS COVOUT OUTEST = COVEST;
    TITLE '30.5 latin square, full, missing obs';
    MODEL response = X1 X2 X3 X4 X5 X6;
RUN;
PROC REG DATA=DRUGS;
    TITLE '30.5 latin square, reduced, missing obs';
    MODEL response = X1 X2 X3 X4;
RUN;
PROC PRINT
    DATA = COVEST;
RUN;
QUIT;
```

```

*Attendance 12, 30.6 latin square;
*Drug response, replications, inference;
DATA DRUGS;
    INPUT response age $ health & drug $ replication $;
DATALINES;
69  1  1  1  1
91  1  2  3  1
65  1  3  2  1
80  2  1  2  1
92  2  2  1  1
63  2  3  3  1
40  3  1  3  1
47  3  2  2  1
44  3  3  1  1
68  1  1  1  2
80  1  2  3  2
40  1  3  2  2
89  2  1  2  2
95  2  2  1  2
43  2  3  3  2
62  3  1  3  2
68  3  2  2  2
49  3  3  1  2
;
PROC GLM DATA=drugs;
    TITLE '30.6 latin square, replications, drugs';
    CLASS health age drug;
    MODEL response = health age drug;
    OUTPUT OUT=drugsout PREDICTED=pred RESIDUAL=resid;
RUN;
PROC PRINT DATA=drugsout;
    TITLE '30.6 residuals, latin square, replication';
    VAR health age drug response pred resid;
RUN;
PROC GPLOT DATA=drugsout;
    TITLE '30.6 residuals vs fitted, latin square';
    PLOT resid*pred;
RUN;
proc capability data=drugsout noprint graphics;
    title '30.6 normal probability plot for residuals';
    probplot resid;
run;
QUIT;

```

```

*Attendance 12,30.7 crossover;
*Drug response, inference;
DATA DRUGS;
    INPUT response dose $ frequency & drug $ patient $;
DATALINES;
69  1  1  1  1
91  1  2  3  1
65  1  3  2  1
80  2  1  2  1
92  2  2  1  1
63  2  3  3  1
40  3  1  3  1
47  3  2  2  1
44  3  3  1  1
68  1  1  1  2
80  1  2  3  2
40  1  3  2  2
89  2  1  2  2
95  2  2  1  2
43  2  3  3  2
62  3  1  3  2
68  3  2  2  2
49  3  3  1  2
;
PROC GLM DATA=drugs;
    TITLE '30.7 latin square crossover, drugs';
    CLASS frequency dose drug patient;
    MODEL response = frequency dose drug patient(frequency);
    OUTPUT OUT=drugsout PREDICTED=pred RESIDUAL=resid;
RUN;
PROC PRINT DATA=drugsout;
    TITLE '30.7 residuals, latin square crossover';
    VAR frequency dose drug response pred resid;
RUN;
PROC GPLOT DATA=drugsout;
    TITLE '30.7 residuals vs fitted';
    PLOT resid*pred;
RUN;
proc capability data=drugsout noprint graphics;
    title '30.7 normal probability plot for residuals';
    probplot resid;
run;
QUIT;

```

```

*Practice quiz 6, 30.6 latin square;
*summary report, residuals;
DATA HELPFULNESS;
    INPUT RATING EXECUTIVE $ MONTH $ REPORT $;
DATALINES;
21  1  1  4
8   1  2  1
17  1  3  3
9   1  4  2
16  1  5  5
5   2  1  1
10  2  2  5
3   2  3  2
12  2  4  3
15  2  5  4
20  3  1  3
10  3  2  2
15  3  3  5
22  3  4  4
12  3  5  1
4   4  1  2
17  4  2  4
3   4  3  1
9   4  4  5
10  4  5  3
17  5  1  5
16  5  2  3
20  5  3  4
7   5  4  1
11  5  5  2
;
PROC GLM DATA=HELPFULNESS noprint;
    TITLE '30.6 latin square, summary report';
    CLASS EXECUTIVE MONTH REPORT;
    MODEL RATING = EXECUTIVE MONTH REPORT;
    MEANS EXECUTIVE MONTH REPORT;
    OUTPUT OUT=HELPFULNESSout PREDICTED=PRED RESIDUAL=RESID;
RUN;
PROC PRINT DATA=HELPFULNESSout;
    TITLE '30.6 residuals, latin square, summary report';
    VAR EXECUTIVE MONTH REPORT RATING PRED RESID;
RUN;
PROC GPLOT DATA=HELPFULNESSout;
    TITLE '30.6 residuals vs fitted, latin square, summary report';
    PLOT RESID*PRED;
RUN;
proc capability data=helpfulnessout noprint graphics;
    title '30.6 normal probability plot for residuals';
    probplot resid;
run;
QUIT;

```

```
*Practice quiz 6, 30.7 latin square;
*summary report, inference;
DATA HELPFULNESS;
    INPUT rating executive $ month $ report $;
DATALINES;
21  1  1  4
8   1  2  1
17  1  3  3
9   1  4  2
16  1  5  5
5   2  1  1
10  2  2  5
3   2  3  2
12  2  4  3
15  2  5  4
20  3  1  3
10  3  2  2
15  3  3  5
22  3  4  4
12  3  5  1
4   4  1  2
17  4  2  4
3   4  3  1
9   4  4  5
10  4  5  3
17  5  1  5
16  5  2  3
20  5  3  4
7   5  4  1
11  5  5  2
;
PROC GLM DATA=HELPFULNESS;
    TITLE '30.7 latin square, summary report';
    CLASS executive month report;
    MODEL rating = executive month report;
    MEANS executive month report;
RUN;
QUIT;
```

```

*Practice quiz 6,30.8 latin square;
*summary report, efficiency;
DATA HELPFULNESS;
    INPUT RATING EXECUTIVE $ MONTH $ REPORT $;
DATALINES;
21  1  1  4
8   1  2  1
17  1  3  3
9   1  4  2
16  1  5  5
5   2  1  1
10  2  2  5
3   2  3  2
12  2  4  3
15  2  5  4
20  3  1  3
10  3  2  2
15  3  3  5
22  3  4  4
12  3  5  1
4   4  1  2
17  4  2  4
3   4  3  1
9   4  4  5
10  4  5  3
17  5  1  5
16  5  2  3
20  5  3  4
7   5  4  1
11  5  5  2
;
PROC GLM DATA=HELPFULNESS;
    TITLE '30.6 LATIN SQUARE, SUMMARY REPORT';
    CLASS EXECUTIVE MONTH REPORT;
    MODEL RATING = EXECUTIVE MONTH REPORT;
    MEANS EXECUTIVE MONTH REPORT;
    OUTPUT OUT=HELPFULNESS2 PREDICTED=HELPFULNESSPRED RESIDUAL=RESID;
RUN;
QUIT;

```

```

*Practice quiz 6, 30.14 latin square;
*summary report, regression;
DATA HELPFULNESS;
    INPUT RATING EXECUTIVE $ MONTH $ REPORT $
           X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12;
DATALINES;
8   1   2   1 1 0 0 0 0 1 0 0 1 0 0 0
17  1   3   3 1 0 0 0 0 0 1 0 0 0 1 0
9   1   4   2 1 0 0 0 0 0 0 1 0 1 0 0
16  1   5   5 1 0 0 0 -1 -1 -1 -1 -1 -1 -1
5   2   1   1 0 1 0 0 1 0 0 0 1 0 0 0
10  2   2   5 0 1 0 0 0 1 0 0 -1 -1 -1 -1
3   2   3   2 0 1 0 0 0 0 1 0 0 1 0 0
12  2   4   3 0 1 0 0 0 0 0 1 0 0 1 0
15  2   5   4 0 1 0 0 -1 -1 -1 -1 0 0 0 1
20  3   1   3 0 0 1 0 1 0 0 0 0 0 1 0
10  3   2   2 0 0 1 0 0 1 0 0 0 1 0 0
15  3   3   5 0 0 1 0 0 0 1 0 -1 -1 -1 -1
22  3   4   4 0 0 1 0 0 0 0 1 0 0 0 1
12  3   5   1 0 0 1 0 -1 -1 -1 -1 1 0 0 0
4   4   1   2 0 0 0 1 1 0 0 0 0 1 0 0
17  4   2   4 0 0 0 1 0 1 0 0 0 0 0 1
3   4   3   1 0 0 0 1 0 0 1 0 1 0 0 0
9   4   4   5 0 0 0 1 0 0 0 1 -1 -1 -1 -1
17  5   1   5 -1 -1 -1 -1 1 0 0 0 -1 -1 -1 -1
16  5   2   3 -1 -1 -1 -1 0 1 0 0 0 0 1 0
20  5   3   4 -1 -1 -1 -1 0 0 1 0 0 0 0 1
7   5   4   1 -1 -1 -1 -1 0 0 0 1 1 0 0 0
11  5   5   2 -1 -1 -1 -1 -1 -1 -1 -1 0 1 0 0
;
PROC REG DATA=HELPFULNESS COVOUT OUTEST = COVEST;
    TITLE '30.14 latin square, full model, missing obs';
    MODEL RATING = X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12;
RUN;
PROC REG DATA=HELPFULNESS;
    TITLE '30.14 latin square, reduced (report) model, missing obs';
    MODEL RATING = X1 X2 X3 X4 X5 X6 X7 X8;
RUN;
PROC PRINT
    DATA = COVEST;
RUN;
QUIT;

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*Practice quiz 6, 30.15 latin square, replications;
*TV commercials, residuals;
DATA tv;
    INPUT points age education $ commercial $ replication $;
DATALINES;
83 1 1 4 1
86 1 1 4 2
64 1 2 1 1
69 1 2 1 2
78 1 3 3 1
75 1 3 3 2
76 1 4 2 1
74 1 4 2 2
70 2 1 2 1
76 2 1 2 2
81 2 2 3 1
75 2 2 3 2
64 2 3 1 1
60 2 3 1 2
87 2 4 4 1
81 2 4 4 2
67 3 1 3 1
74 3 1 3 2
67 3 2 2 1
61 3 2 2 2
76 3 3 4 1
81 3 3 4 2
64 3 4 1 1
57 3 4 1 2
56 4 1 1 1
60 4 1 1 2
72 4 2 4 1
67 4 2 4 2
63 4 3 2 1
67 4 3 2 2
64 4 4 3 1
66 4 4 3 2
;
PROC GLM DATA=tv noprint;
    TITLE '30.15 latin square, tv commercials';
    CLASS age education commercial;
    MODEL points = age education commercial;
    OUTPUT OUT=tvout PREDICTED=pred RESIDUAL=resid;
RUN;
PROC PRINT DATA=tvout;
    TITLE '30.15 residuals, latin square, replicated, tv';
    VAR age education commercial points pred resid;
RUN;
PROC GPLOT DATA=tvout;
    TITLE '30.15 residuals vs fitted, latin square, summary report';
    PLOT resid*pred;
RUN;
proc capability data=tvout noprint graphics;
    title '30.15 normal probability plot for residuals';
    probplot resid;
run;
QUIT;

```

```

*Practice quiz 6, 30.16 latin square, replications;
*TV commercials, inference;
DATA tv;
  INPUT points age education $ commercial $ replication $;
    if commercial = 1 then volume = 2;
    if commercial = 1 then product = 1;
    if commercial = 2 then volume = 1;
    if commercial = 2 then product = 1;
    if commercial = 3 then volume = 2;
    if commercial = 3 then product = 2;
    if commercial = 4 then volume = 1;
    if commercial = 4 then product = 2;
  DATALINES;
83 1 1 4 1
86 1 1 4 2
64 1 2 1 1
69 1 2 1 2
78 1 3 3 1
75 1 3 3 2
76 1 4 2 1
74 1 4 2 2
70 2 1 2 1
76 2 1 2 2
81 2 2 3 1
75 2 2 3 2
64 2 3 1 1
60 2 3 1 2
87 2 4 4 1
81 2 4 4 2
67 3 1 3 1
74 3 1 3 2
67 3 2 2 1
61 3 2 2 2
76 3 3 4 1
81 3 3 4 2
64 3 4 1 1
57 3 4 1 2
56 4 1 1 1
60 4 1 1 2
72 4 2 4 1
67 4 2 4 2
63 4 3 2 1
67 4 3 2 2
64 4 4 3 1
66 4 4 3 2
;
PROC GLM DATA=tv;
  TITLE '30.16(b,c) latin square, replications, tv commercials';
  CLASS age education commercial;
  MODEL points = age education commercial;
  MEANS age education commercial;
  OUTPUT OUT=tvout PREDICTED=pred RESIDUAL=resid;
RUN;
PROC GLM DATA=tv;
  TITLE '30.15(b,c) latin square, commercial broken into volume/product';
  CLASS age education volume product;
  MODEL points = age education volume product volume*product;
  OUTPUT OUT=tvout PREDICTED=pred RESIDUAL=resid;
RUN;
QUIT;

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```

*Practice quiz 6, 30.17 latin square crossover;
*Recall decay, residuals;
DATA recall;
  INPUT trips pattern $ timeperiod $ questionnaire $ subject $;
  DATALINES;
40  1  1  3  1
35  1  1  3  2
31  1  1  3  3
18  1  2  1  1
25  1  2  1  2
22  1  2  1  3
30  1  3  2  1
37  1  3  2  2
28  1  3  2  3
10  2  1  2  1
18  2  1  2  2
15  2  1  2  3
43  2  2  3  1
49  2  2  3  2
48  2  2  3  3
33  2  3  1  1
37  2  3  1  2
29  2  3  1  3
7   3  1  1  1
11  3  1  1  2
19  3  1  1  3
19  3  2  2  1
24  3  2  2  2
21  3  2  2  3
59  3  3  3  1
51  3  3  3  2
62  3  3  3  3
;
PROC GLM DATA=recall noprint;
  TITLE '30.17 latin square crossover, recall decay';
  CLASS pattern timeperiod questionnaire subject;
  MODEL trips = pattern timeperiod questionnaire subject(pattern);
  OUTPUT OUT=recallout PREDICTED=pred RESIDUAL=resid;
RUN;
PROC PRINT DATA=recallout;
  TITLE '30.17 residuals, latin square crossover, recall decay';
  VAR pattern timeperiod questionnaire trips pred resid;
RUN;
PROC GPLOT DATA=recallout;
  TITLE '30.17 residuals vs fitted, latin square crossover';
  PLOT resid*pred;
RUN;
proc capability data=recallout noprint graphics;
  title '30.17 normal probability plot for residuals';
  probplot resid;
run;
QUIT;

```

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*Practice quiz 6,30.18 latin square crossover;
*Recall decay, inference;
DATA recall;
  INPUT trips pattern $ timeperiod $ questionnaire $ subject $;
DATALINES;
40  1    1    3    1
35  1    1    3    2
31  1    1    3    3
18  1    2    1    1
25  1    2    1    2
22  1    2    1    3
30  1    3    2    1
37  1    3    2    2
28  1    3    2    3
10  2    1    2    1
18  2    1    2    2
15  2    1    2    3
43  2    2    3    1
49  2    2    3    2
48  2    2    3    3
33  2    3    1    1
37  2    3    1    2
29  2    3    1    3
7   3    1    1    1
11  3    1    1    2
19  3    1    1    3
19  3    2    2    1
24  3    2    2    2
21  3    2    2    3
59  3    3    3    1
51  3    3    3    2
62  3    3    3    3
;
PROC GLM DATA=recall;
  TITLE '30.17 latin square crossover, recall decay';
  CLASS pattern timeperiod questionnaire subject;
  MODEL trips = pattern timeperiod questionnaire subject(pattern);
  means pattern timeperiod questionnaire;
  OUTPUT OUT=recallout PREDICTED=pred RESIDUAL=resid;
RUN;
QUIT;

```