```
/* import data */

PROC IMPORT DATAFILE="/home/u63048916/STAT571B/Homework/Homework 3/Q4-23.csv"
    DBMS=CSV
    OUT=mont4_23
    REPLACE;
    GETNAMES=YES;
RUN;

proc glm data=mont4_23;
class Order Operator Method;
model Time = Order Operator Method;
means Method/ alpha=0.05 lines tukey;
means Order Operator;
output out=diag r=res p=pred;
Run;

/* check normality */
proc univariate data=diag normal;
var res;
qqplot res / normal (mu=est sigma=est);
Run;

/* check outliers */
data outlier;
set diag;
stdres=res/1.322876;
run;

proc print data=outlier;
run;

/* check constant variance using graph*/
title 'residual plot: res vs predicted value ';
proc sgplot data=diag;
scatter x=pred y=res;
refline 0;
run;

title 'residual plot: res vs Order ';
proc sgplot data=diag;
scatter x=Order y=res;
refline 0;
run;

title 'residual plot: res vs Operator ';
proc sgplot data=diag;
scatter x=Operator y=res;
refline 0;
run;

title 'residual plot: res vs Method ';
proc sgplot data=diag;
scatter x=Method y=res;
refline 0;
run;
```

**4.23.** An industrial engineer is investigating the effect of four assembly methods ($A$, $B$, $C$, $D$) on the assembly time for a color television component. Four operators are selected for the study. Furthermore, the engineer knows that each assembly method produces such fatigue that the time required for the last assembly may be greater than the time required for the first, regardless of the method. That is, a trend develops in the required assembly time. To account for this source of variability, the engineer uses the Latin square design shown below. Analyze the data from this experiment ($\alpha = 0.05$) and draw appropriate conclusions.

| Order of Assembly | Operator | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 1 | $C = 10$ | $D = 14$ | $A = 7$ | $B = 8$ |
| 2 | $B = 7$ | $C = 18$ | $D = 11$ | $A = 8$ |
| 3 | $A = 5$ | $B = 10$ | $C = 11$ | $D = 9$ |
| 4 | $D = 10$ | $A = 10$ | $B = 12$ | $C = 14$ |