

```

data bal;
input y group;
cards;
0 1
0 1
4 1
4 1
2 2
2 2
3 2
3 2
3 2
3 2
4 2
4 2
0 3
1 3
2 3
2 3
3 3
3 3
3 3
4 4
5 4
5 4
7 4
9 4

```

```

proc glm data=bal;class group;
model y = group;
output out=bal r=resid;
means group / hovtest welch;run;

```

The GLM Procedure
Class Level Information

Class	Levels	Values
group	4	1 2 3 4
Number of Observations Read		24
Number of Observations Used		24

Level of	-----y-----		
group	N	Mean	Std Dev
1	4	2.00000000	2.30940108
2	8	3.00000000	0.75592895
3	7	2.00000000	1.15470054
4	5	6.00000000	2.00000000

The GLM Procedure

Dependent Variable: y

Source	DF	Squares	Mean Square	F Value	Pr > F
Model	3	55.33333333	18.44444444	8.38	0.0008
Error	20	44.00000000	2.20000000		
Corrected Total	23	99.33333333			

	R-Square	Coeff Var	Root MSE	y Mean
	0.557047	46.83915	1.483240	3.166667

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	3	55.33333333	18.44444444	8.38	0.0008

Levene's Test for Homogeneity of y Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
group	3	45.6762	15.2254	4.94	0.0100
Error	20	61.6571	3.0829		

Welch's ANOVA for y

Source	DF	F Value	Pr > F
group	3.0000	4.84	0.0344
Error	7.7786		

```

data bal;set bal;
rsq=resid**2;run;
proc glm data=bal;class group;
model rsq = group;
means group;run;

```

The MEANS Procedure

----- group=1 -----				
Variable	N	Mean	Std Dev	Variance
y	4	2.000000	2.3094011	5.3333333
rsq	4	4.000000	0	3.365807E-29

----- group=2 -----				
Variable	N	Mean	Std Dev	Variance
y	8	3.000000	0.7559289	0.5714286
rsq	8	0.500000	0.5345225	0.2857143

----- group=3 -----				
Variable	N	Mean	Std Dev	Variance
y	7	2.000000	1.1547005	1.3333333
rsq	7	1.1428571	1.3451854	1.8095238

----- group=4 -----				
Variable	N	Mean	Std Dev	Variance
y	5	6.000000	2.000000	4.000000
rsq	5	3.200000	3.4928498	12.200000

Class Level Information

Class	Levels	Values
group	4	1 2 3 4
Number of Observations Read		24
Number of Observations Used		24

Dependent Variable: rsq

Source	DF	Squares	Sum of Mean Square	F Value	Pr > F
Model	3	45.6761905	15.2253968	4.94	0.0100
Error	20	61.6571429	3.0828571		
Corrected Total	23	107.3333333			

R-Square	0.425555	Coeff Var	95.77127	Root MSE	1.755807	rsq Mean	1.833333
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Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	3	45.67619048	15.22539683	4.94	0.0100

```

data bal;set bal;
cprsq=(n*prsq)/(n-1);w=1/cprsq; run;
proc reg data=bal;
model y = I1 I2 I3 ;
weight w;run;
proc glm data=bal;class group;
model y = group;
means group;
weight w;run;

```

The GLM Procedure

Class Level Information

Class	Levels	Values
group	4	1 2 3 4

Number of Observations Read 24
Number of Observations Used 24

Dependent Variable: y

Weight: w

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	17.01176471	5.67058824	5.67	0.0056
Error	20	20.00000000	1.00000000		
Corrected Total	23	37.01176471			

R-Square 0.459631
Coeff Var 34.55285
Root MSE 1.00000
y Mean 2.894118

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	3	17.01176471	5.67058824	5.67	0.0056

Level of group	N	Sum of Weights	-----y----- Mean	Std Dev
1	4	0.75	2.00000000	1.00000000
2	8	14.00	3.00000000	1.00000000
3	7	5.25	2.00000000	1.00000000
4	5	1.25	6.00000000	1.00000000

group	Weights	Meanj	Wj(Meanj)	$Wj(\text{Meanj} - M^*)^2$
1	0.75	2.00	1.50	$0.75(2-2.89)^2 = 0.59958$
2	14.00	3.00	42.00	$14.00(3-2.89)^2 = 0.15696$
3	5.25	2.00	10.50	$5.25(2-2.89)^2 = 4.19709$
4	1.25	6.00	7.50	$1.25(6-2.89)^2 = 12.05813$
Sum	21.25 = W*		$\frac{61.50}{21.25} = 2.894118 = M^*$	SSH = 17.01176

group	nj	Weights	$1-(Wj/W^*)$	$[1-(Wj/W^*)]^2/(nj-1)$
1	4	0.75	0.9647	0.31022
2	8	14.00	0.3412	0.01663
3	7	5.25	0.7529	0.09449
4	5	1.25	0.9412	0.22145
Sum		21.25 = W*		D = 0.64279

$$F = \frac{SSH/(J-1)[1 + \frac{2(J-2)D}{(J^2-1)}]}{3(1.17141)} = \frac{17.01176/3[1 + \frac{2(4-2)0.64279}{(4^2-1)}]}{3(1.17141)} = \frac{5.6705882}{1.17141} = 4.8408$$

$$dfe = (J^2-1)/3 D = 15/1.92837 = 7.7786$$