

from handout:

$$H_0: \mu_1 = \mu_2 = \mu_3$$

H_1 : Not all means are equal

p-value = .000 \therefore Reject H_0

①	②	③
36.75	46.58	60.25

Two-way ANOVA

Model:

$$Y_{ijk} = \mu + \tau_i + \beta_j + \tau\beta_{ij} + \epsilon_{ijk}$$

①

452

5-11

ANOVA

②

Source	SS	df	MS	F
Factor A	SSA	a-1	$\frac{SSA}{a-1}$	MSA/MSE
Factor B	SSB	b-1	$\frac{SSB}{b-1}$	MSB/MSE
AB inter.	SSAB	(a-1)(b-1)	$\frac{SSAB}{(a-1)(b-1)}$	MSAB/MSB
Error	SSE	d.f.	$\frac{SSE}{d.f.}$	—
Total	SST	n-1	—	—

$$H_0: \tau_i \equiv 0$$

H_1 : Not all $\tau_i = 0$

$$H_0: \beta_j \equiv 0$$

H_1 : Not all $\beta_j = 0$

$$H_0: \tau\beta_{ij} \equiv 0$$

H_1 : Not all $\tau\beta_{ij} = 0$

Multiple Regression handout: (3)

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \varepsilon_i$$

$$H_0: \beta_1 = \beta_2 = \beta_3 = 0$$

$$\hat{y} = 161.168 + .027 x_1 + 16.759 x_2 + 8.699 x_3$$

	C1	C2
	turnout	type
1	33	1
2	78	1
3	32	1
4	28	1
5	10	1
6	12	1
7	61	1
8	28	1
9	29	1
10	45	1
11	44	1
12	41	1
13	35	2
14	56	2
15	35	2
16	40	2
17	45	2
18	42	2
19	65	2
20	62	2
21	25	2
22	47	2
23	52	2
24	55	2
25	42	3
26	40	3
27	52	3
28	66	3
29	78	3
30	62	3
31	57	3
32	75	3
33	72	3
34	51	3
35	69	3
36	59	3

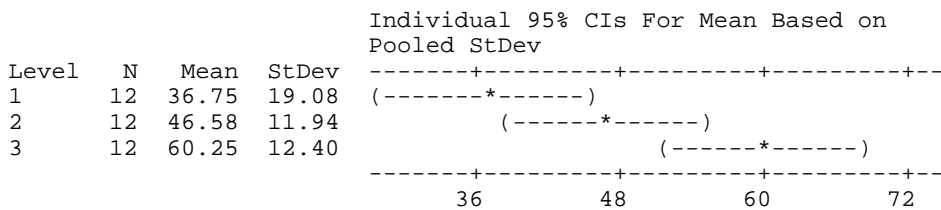
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Welcome to Minitab, press F1 for help.
Retrieving worksheet from file:
'C:\Documents and Settings\fountain\My
Documents\Class\543\anova_data.xls'
Worksheet was saved on Tue May 18 2010
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Results for: Sheet1

One-way ANOVA: turnout versus type

Source	DF	SS	MS	F	P
type	2	3343	1671	7.59	0.002
Error	33	7265	220		
Total	35	10608			

S = 14.84 R-Sq = 31.51% R-Sq(adj) = 27.36%

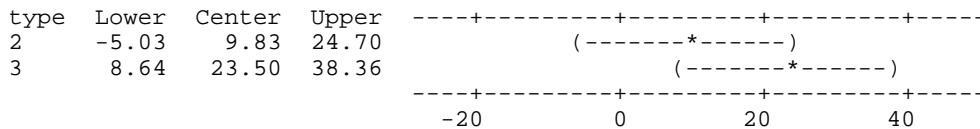


Pooled StDev = 14.84

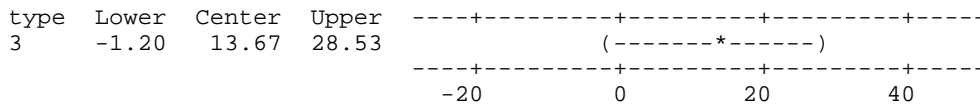
Tukey 95% Simultaneous Confidence Intervals
All Pairwise Comparisons among Levels of type

Individual confidence level = 98.04%

type = 1 subtracted from:



type = 2 subtracted from:



	squarefo	bedrooms	baths	askingpr
1	3632	4	2.5	419
2	4889	6	5.0	399
3	3000	5	3.5	395
4	3669	4	3.5	379
5	2800	4	3.0	359
6	3600	5	3.5	349
7	2800	5	2.5	320
8	2257	3	3.0	299
9	2000	3	3.0	295
10	2455	3	2.5	290
11	2250	3	2.0	285
12	2938	3	2.0	269
13	2399	3	2.0	260

Correlations

Correlations

		SQUAREFO	BEDROOMS	BATHS	ASKINGPR
SQUAREFO	Pearson Correlation	1	.791**	.731**	.749**
	Sig. (2-tailed)	.	.001	.005	.003
	N	13	13	13	13
BEDROOMS	Pearson Correlation	.791**	1	.759**	.738**
	Sig. (2-tailed)	.001	.	.003	.004
	N	13	13	13	13
BATHS	Pearson Correlation	.731**	.759**	1	.669*
	Sig. (2-tailed)	.005	.003	.	.012
	N	13	13	13	13
ASKINGPR	Pearson Correlation	.749**	.738**	.669*	1
	Sig. (2-tailed)	.003	.004	.012	.
	N	13	13	13	13

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Regression

Variables Entered/Removed^b

Model	Variables Entered	Variables Removed	Method
1	BATHS, SQUAREFO, BEDROOMS	.	Enter

a. All requested variables entered.

b. Dependent Variable: ASKINGPR

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.790 ^a	.625	.500	38.191

a. Predictors: (Constant), BATHS, SQUAREFO, BEDROOMS

b. Dependent Variable: ASKINGPR

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21854.557	3	7284.852	4.995	.026 ^a
	Residual	13127.135	9	1458.571		
	Total	34981.692	12			

a. Predictors: (Constant), BATHS, SQUAREFO, BEDROOMS

b. Dependent Variable: ASKINGPR

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	161.168	45.497		3.542	.006
	SQUAREFO	.027	.024	.396	1.120	.292
	BEDROOMS	16.759	19.285	.322	.869	.407
	BATHS	8.699	21.402	.135	.406	.694

Coefficients^a

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	SQUAREFO	.334	2.996
	BEDROOMS	.303	3.295
	BATHS	.378	2.645

a. Dependent Variable: ASKINGPR

Collinearity Diagnostics^a

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	SQUAREFO	BEDROOMS	BATHS
1	1	3.928	1.000	.00	.00	.00	.00
	2	.042	9.725	.97	.03	.03	.09
	3	.018	14.646	.02	.37	.08	.86
	4	.013	17.678	.00	.60	.89	.06

a. Dependent Variable: ASKINGPR

Residuals Statistics^a

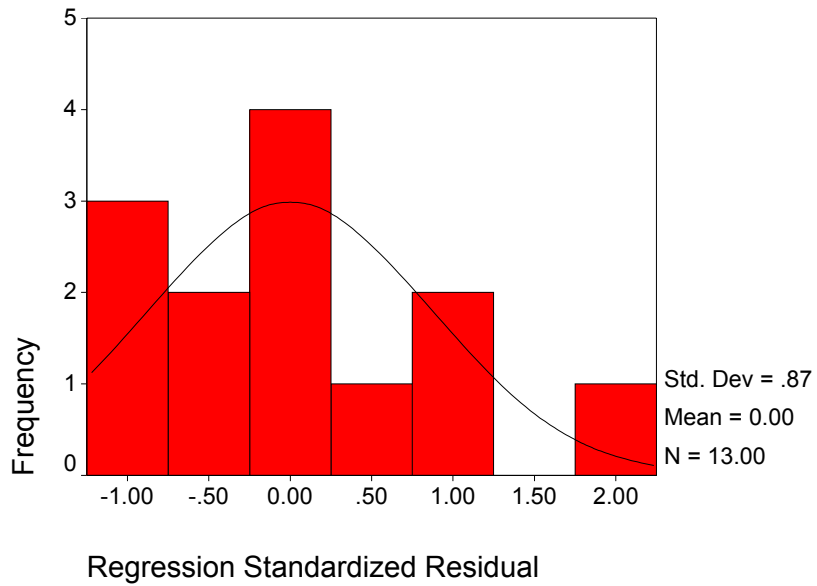
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	289.18	436.33	332.15	42.676	13
Std. Predicted Value	-1.007	2.441	.000	1.000	13
Standard Error of Predicted Value	11.998	31.019	20.478	5.648	13
Adjusted Predicted Value	288.61	508.69	337.34	59.477	13
Residual	-38.63	71.65	.00	33.075	13
Std. Residual	-1.012	1.876	.000	.866	13
Stud. Residual	-1.675	2.342	-.046	1.107	13
Deleted Residual	-109.69	111.67	-5.19	56.455	13
Stud. Deleted Residual	-1.904	3.533	.029	1.373	13
Mahal. Distance	.261	6.993	2.769	2.034	13
Cook's Distance	.000	1.360	.226	.402	13
Centered Leverage Value	.022	.583	.231	.170	13

a. Dependent Variable: ASKINGPR

Charts

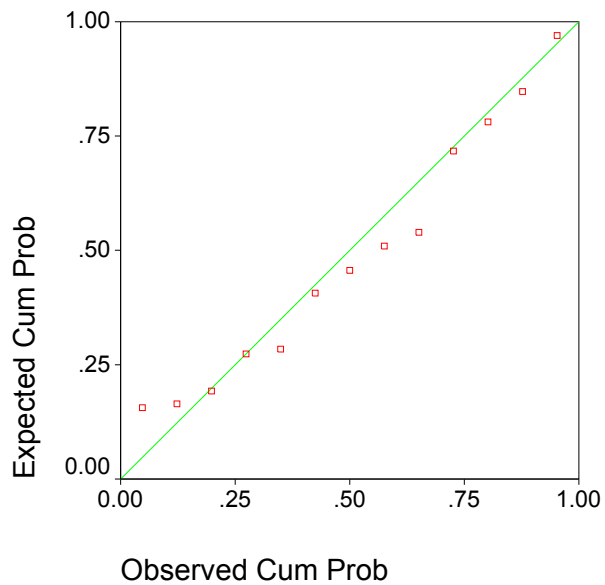
Histogram

Dependent Variable: ASKINGPR



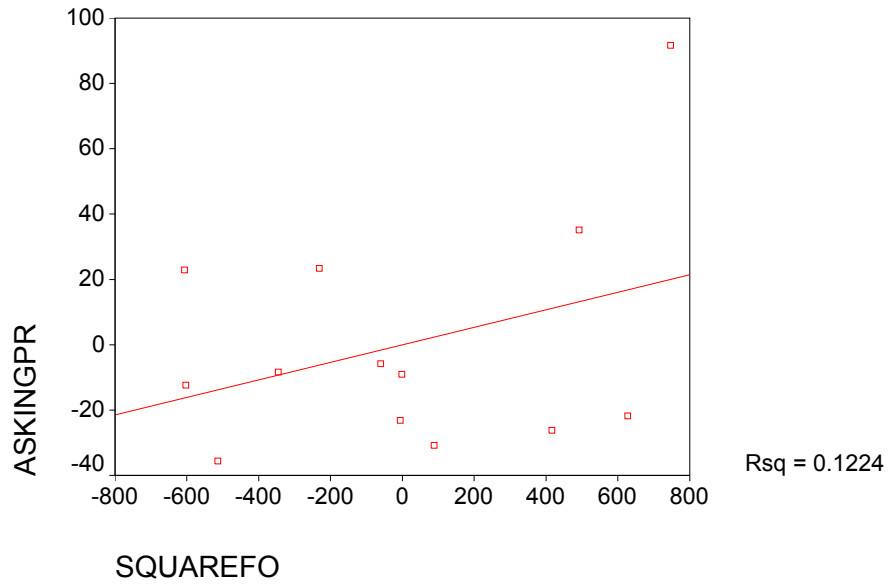
Normal P-P Plot of Regression Sta

Dependent Variable: ASKINGPR



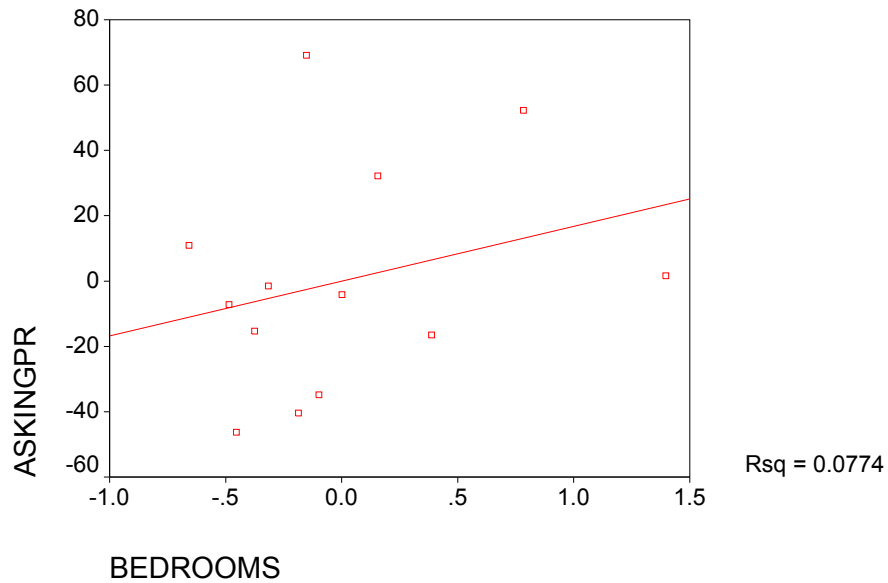
Partial Regression Plot

Dependent Variable: ASKINGPR



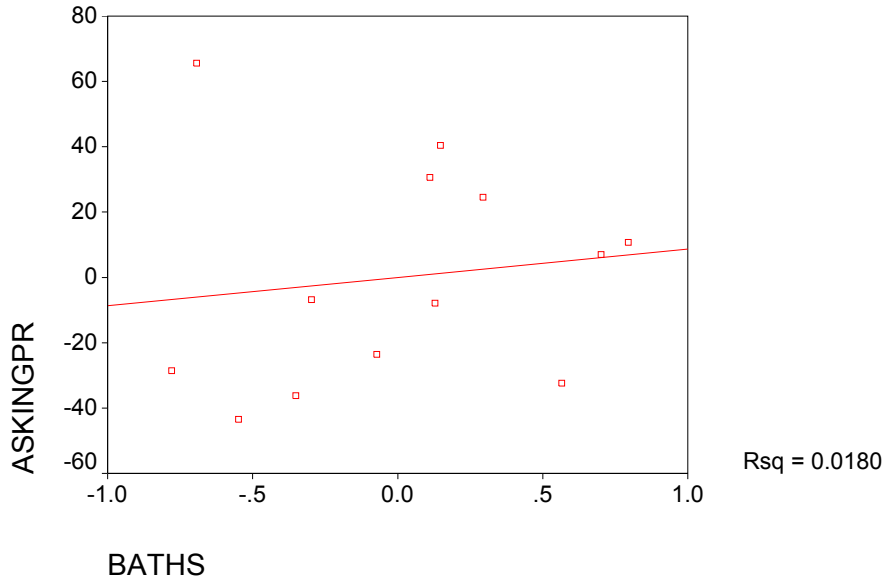
Partial Regression Plot

Dependent Variable: ASKINGPR



Partial Regression Plot

Dependent Variable: ASKINGPR



Regression

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	SQUAREFO		Stepwise (Criteria: Probability of-F-to-enter <= .050, Probability of-F-to-remove >= .100).

a. Dependent Variable: ASKINGPR

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.749 ^a	.562	.522	37.333

a. Predictors: (Constant), SQUAREFO

b. Dependent Variable: ASKINGPR

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19650.762	1	19650.762	14.099	.003 ^a
	Residual	15330.931	11	1393.721		
	Total	34981.692	12			

a. Predictors: (Constant), SQUAREFO

b. Dependent Variable: ASKINGPR

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	181.066	41.548		4.358	.001
	SQUAREFO	.051	.014	.749	3.755	.003

Coefficients^a

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	SQUAREFO	1.000	1.000

a. Dependent Variable: ASKINGPR

Excluded Variables^b

Model		Beta In	t	Sig.	Partial Correlation
1	BEDROOMS	.387 ^a	1.212	.253	.358
	BATHS	.260 ^a	.880	.399	.268

Excluded Variables^b

		Collinearity Statistics		
		Tolerance	VIF	Minimum Tolerance
1	BEDROOMS	.374	2.675	.374
	BATHS	.466	2.148	.466

a. Predictors in the Model: (Constant), SQUAREFO

b. Dependent Variable: ASKINGPR

Collinearity Diagnostics^a

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions	
				(Constant)	SQUAREFO
1	1	1.968	1.000	.02	.02
	2	.032	7.899	.98	.98

a. Dependent Variable: ASKINGPR

Residuals Statistics^a

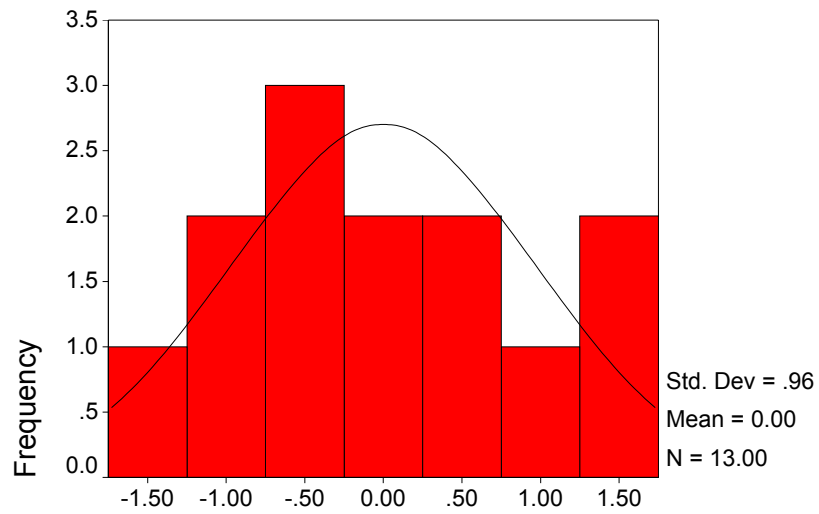
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	282.60	429.27	332.15	40.467	13
Std. Predicted Value	-1.225	2.400	.000	1.000	13
Standard Error of Predicted Value	10.359	27.859	13.963	4.591	13
Adjusted Predicted Value	279.46	467.30	334.70	48.165	13
Residual	-61.22	61.63	.00	35.743	13
Std. Residual	-1.640	1.651	.000	.957	13
Stud. Residual	-1.707	1.718	-.026	1.039	13
Deleted Residual	-68.30	66.77	-2.55	43.156	13
Stud. Deleted Residual	-1.898	1.916	-.020	1.112	13
Mahal. Distance	.001	5.759	.923	1.515	13
Cook's Distance	.000	.932	.121	.251	13
Centered Leverage Value	.000	.480	.077	.126	13

a. Dependent Variable: ASKINGPR

Charts

Histogram

Dependent Variable: ASKINGPR



Regression Standardized Residual

Normal P-P Plot of Regression Sta

Dependent Variable: ASKINGPR

