

# Lecture 27: Model Selection + Multiple Regression Conditions

Chapter 8.2-8.3

# Question for Today

Recall the Mario Kart analysis

Coefficients:

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	41.34	1.71	24.15	< 2e-16	***
condused	-5.13	1.05	-4.88	2.91e-06	***
stockPhotoyes	1.08	1.06	1.02	0.308	
duration	-0.03	0.19	-0.14	0.888	
wheels	7.29	0.55	13.13	< 2e-16	***

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Residual standard error: 4.901 on 136 degrees of freedom

Multiple R-squared: 0.719, Adjusted R-squared: 0.7108

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# Two Common Strategies

There are two **stepwise regression** methods that add/subtract one variable at a time:

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- ▶ Forward Selection

## Two Common Strategies

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The criteria used will be  $p$ -values.

# Backward Elimination

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Starting here:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	41.3415	1.7117	24.15	0.0000
cond_used	-5.1306	1.0511	-4.88	0.0000
stockPhotoyes	1.0803	1.0568	1.02	0.3085
duration	-0.0268	0.1904	-0.14	0.8882
wheels	7.2852	0.5547	13.13	0.0000

## Backward Elimination

Drop duration.

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	41.3415	1.7117	24.15	0.0000
cond_used	-5.1306	1.0511	-4.88	0.0000
stockPhotoyes	1.0803	1.0568	1.02	0.3085
duration	-0.0268	0.1904	-0.14	0.8882
wheels	7.2852	0.5547	13.13	0.0000



## Backward Elimination

Drop stockPhotoyes.

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	41.2245	1.4911	27.65	0.0000
cond_used	-5.1763	0.9961	-5.20	0.0000
stockPhotoyes	1.1177	1.0192	1.10	0.2747
wheels	7.2984	0.5448	13.40	0.0000

# Backward Elimination

Done.

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	42.3698	1.0651	39.78	0.0000
cond_used	-5.5848	0.9245	-6.04	0.0000
wheels	7.2328	0.5419	13.35	0.0000

# Forward Selection

# Criticisms of the Techniques

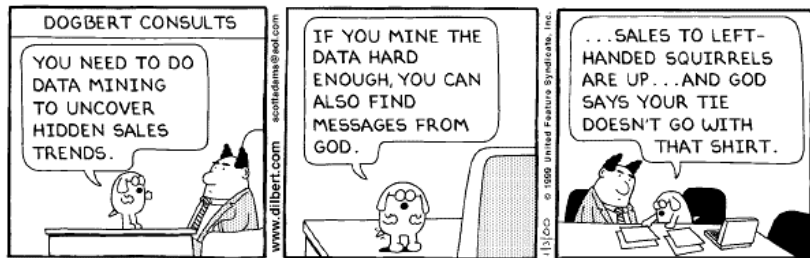
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# Criticisms of the Techniques

Critics regard stepwise regression as **data dredging**, where intense computation is used as a substitute for subject area expertise when deciding on a model.

**Data mining** involves automatically testing huge numbers of hypotheses about a single data set by exhaustively searching for combinations of variables that might show a correlation.

## Criticisms of the Techniques



# Assumptions of Multiple Regression

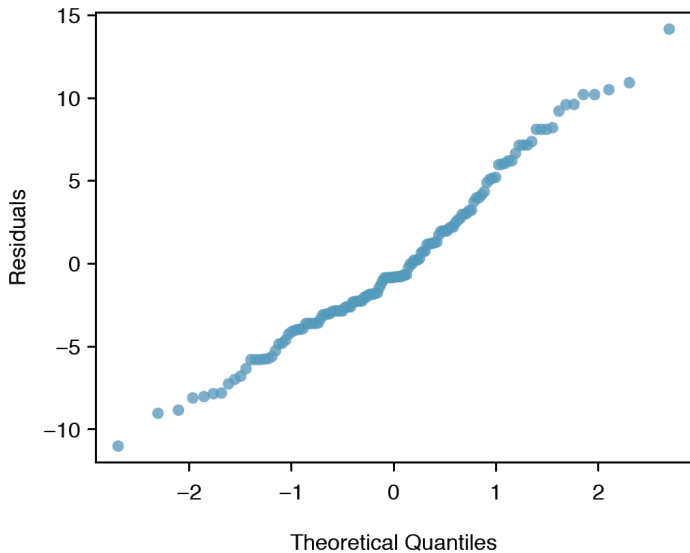
## Example Model

We investigate plots for the following model:

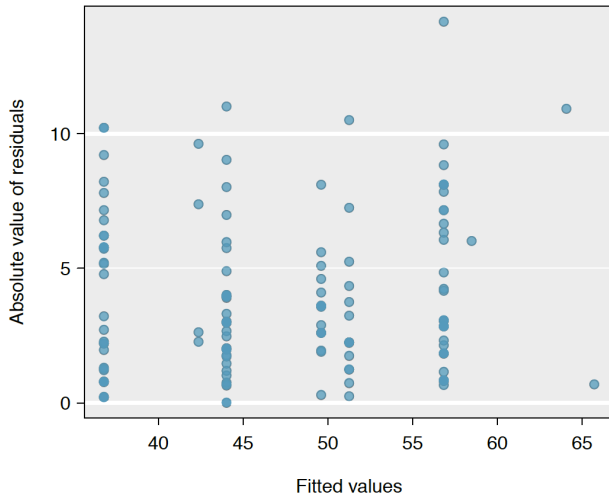
$$\widehat{\text{price}} = b_0 + b_1 \times \text{cond\_new} + b_2 \times \text{wheels}$$



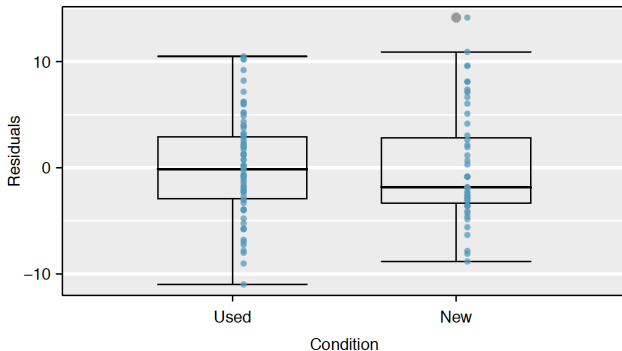
## Normal Probability Plot of Residuals



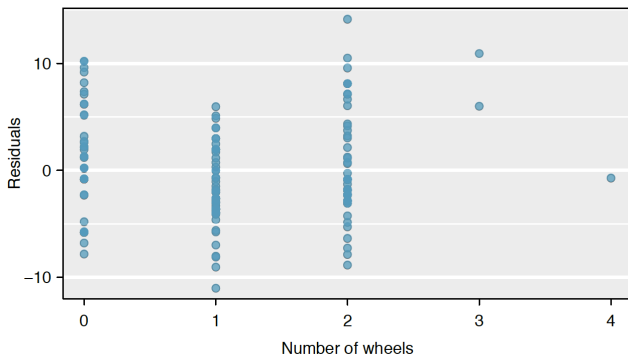
# Absolute Values of Residuals Against Fitted Values



# Residuals Against Each Predictor Variable: Condition



## Residuals Against Each Predictor Variable: Wheels



## Next Time

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We use **logistic regression**.