

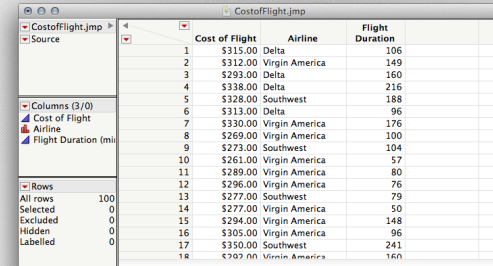
Analysis of Variance and Linear Models in JMP



● 1

CostOfFlight 

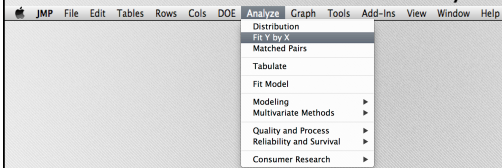
Hypothetical Data for Cost of Flights



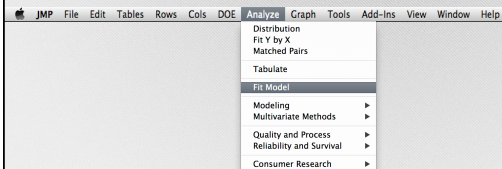
	Cost of Flight	Airline	Flight Duration
1	\$315.00	Delta	106
2	\$312.00	Virgin America	149
3	\$293.00	Delta	160
4	\$338.00	Delta	216
5	\$328.00	Southwest	188
6	\$313.00	Delta	96
7	\$330.00	Virgin America	176
8	\$269.00	Virgin America	100
9	\$273.00	Southwest	104
10	\$261.00	Virgin America	57
11	\$289.00	Virgin America	80
12	\$296.00	Virgin America	76
13	\$277.00	Southwest	79
14	\$277.00	Virgin America	50
15	\$294.00	Virgin America	148
16	\$305.00	Virgin America	96
17	\$350.00	Southwest	241
18	\$292.00	Virgin America	160

● 2

Platform: Fit Y by X

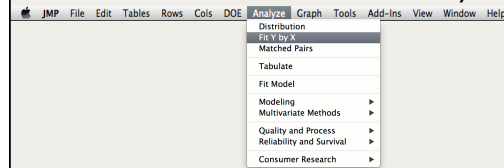


Platform: Fit Model

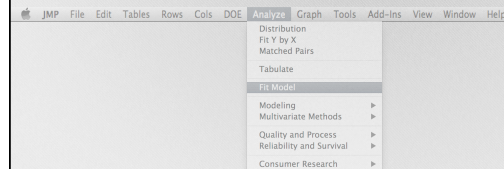


● 3

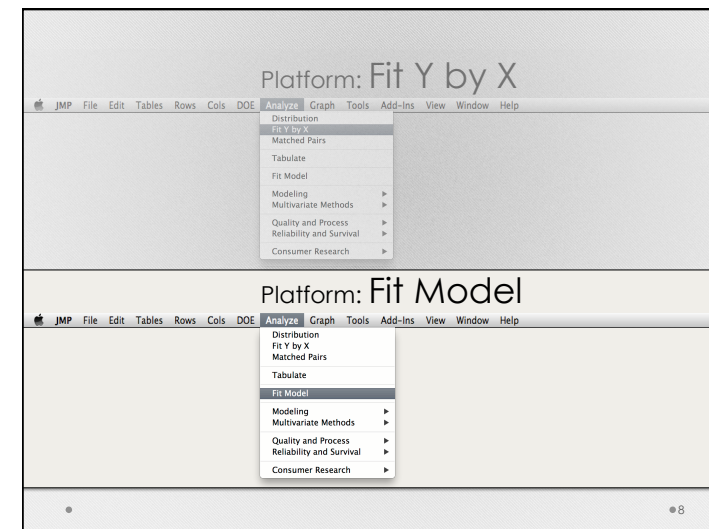
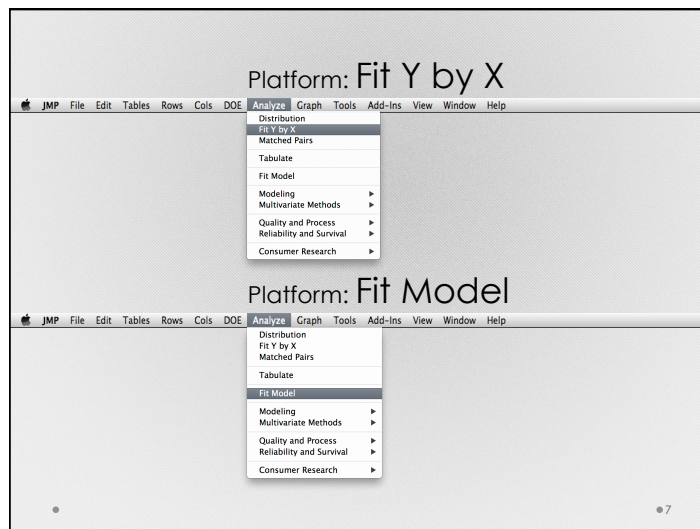
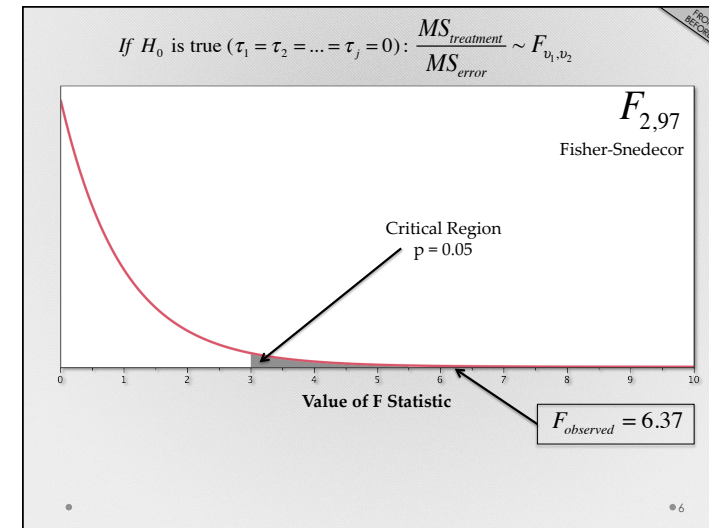
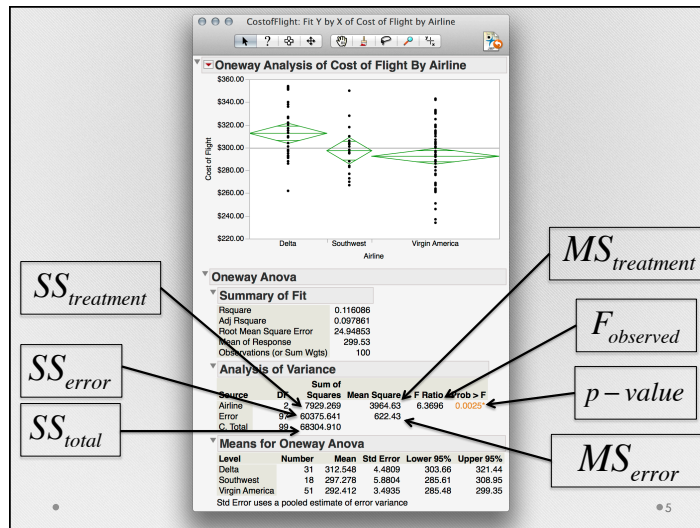
Platform: Fit Y by X

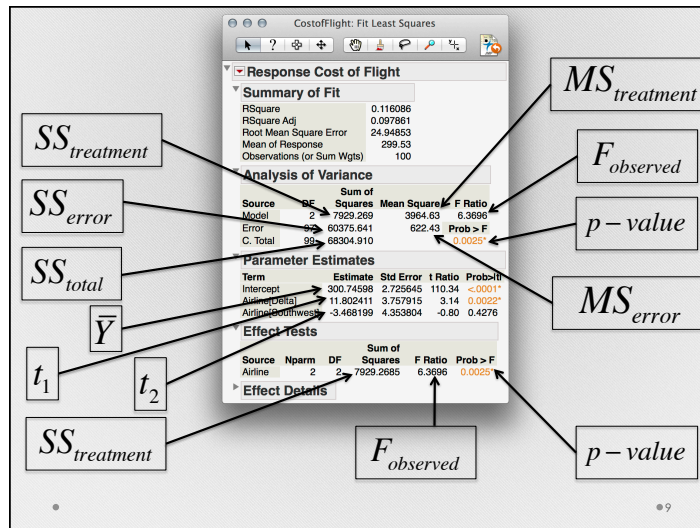


Platform: Fit Model



● 4





Inferences about Treatment Effects

$$H_0 : \tau_1 = \tau_2 = \dots = \tau_j = 0$$

$$H_1 : \text{Not All } \tau_j = 0$$

Inferences about Treatment Effects

"Main Effect" Test

$$H_0 : \tau_1 = \tau_2 = \dots = \tau_j = 0$$

$$H_1 : \text{Not All } \tau_j = 0$$

Main Effect

A "main effect" is the overall effect of a factor. A hypothesis test for a main effect is a test of whether there is evidence for an effect of different treatments (the levels of the factor)

Inferences about Treatment Effects

"Main Effect" Test

$$H_0 : \tau_1 = \tau_2 = \dots = \tau_j = 0$$

$$H_1 : \text{Not All } \tau_j = 0$$

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Pairwise Comparison


A pairwise comparison is a hypothesis test of a specific mean difference.

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Pairwise Comparisons in JMP



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CostOfFlight 

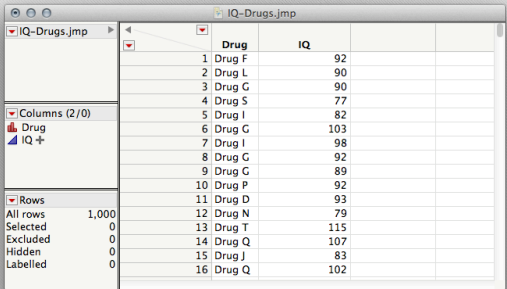
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IQ-Drugs

Hypothetical IQ Data 1000 People
taking 20 Different Drugs



	Drug	IQ
1	Drug F	92
2	Drug L	90
3	Drug G	90
4	Drug S	77
5	Drug I	82
6	Drug G	103
7	Drug I	98
8	Drug G	92
9	Drug G	89
10	Drug P	92
11	Drug D	93
12	Drug N	79
13	Drug T	115
14	Drug Q	107
15	Drug J	83
16	Drug Q	102

Columns (2/0): Drug, IQ

Rows: All rows 1,000, Selected 0, Excluded 0, Hidden 0, Labelled 0

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Familywise Error Rate

The familywise error rate (FWER), also called the experimentwise error rate, is the probability of making one or more false alarms when performing multiple pairwise comparisons

Multiple comparisons lead to “alpha escalation”

$$\alpha_{FWER} = 1 - (1 - \alpha_{each\ comparison})^g$$

g: the number of comparisons

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$$\alpha_{FWER} = 1 - (1 - 0.05)^{19}$$

$$\alpha_{FWER} = 0.623$$

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Planned Comparisons (A Priori) vs.
Unplanned Comparisons (Post-Hoc)

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Planned Comparison

A planned comparison is a specific comparison of means that a researcher was interested in testing before looking at the data

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Unplanned Comparison

An unplanned comparison is any comparison of means that a researcher is interested in testing after looking at the data. Unplanned comparisons are those tests that were suggested by the data

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Procedures for Planned Comparisons

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Bonferroni Correction

$$\alpha_B = \frac{\alpha_{FWER}}{g}$$

α_B : Alpha level for each planned comparison

α_{FWER} : Desired Maximum Familywise Error Rate

g : the number of specific planned comparisons

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Columns (2/0): Drug, IQ

Rows: All rows 1,000, Selected 0, Excluded 0, Hidden 0, Labelled 0

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Procedures for Unplanned Comparisons (Post-Hoc Tests)

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John W. Tukey

1915-2000

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Tukey-Kramer (HSD)

Honestly Significant Difference


$$HSD = q \sqrt{\frac{MS_{error}}{n_j}}$$

HSD is the mean difference considered
"Honestly Different" given the number of comparisons.

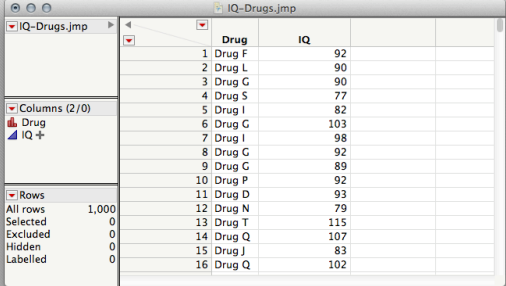
q is the *Studentized Range Statistic* based on:

- a) the number of treatments
- b) the degrees of freedom for MS_{error}
- c) the alpha level for the family of comparisons

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IQ-Drugs 

Hypothetical IQ Data 1000 People
taking 20 Different Drugs



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Columns (2/0)
Drug
IQ

Rows
All rows 1,000
Selected 0
Excluded 0
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Multiple Comparison Summary

- Planned Comparisons (A priori)
 - With 1 or 2 planned comparisons, no correction to alpha is usually needed (with a statistically significant main effect)
 - With 3-5 planned comparisons, the Bonferroni correction is usually most powerful
 - With more than 5 planned comparisons, the Tukey-Kramer HSD is usually most powerful
- Unplanned Comparisons (Post hoc)
 - Use Tukey-Kramer HSD
 - Bonferroni correction is NEVER* appropriate
 - * unless you correct for every possible pairwise comparison

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