

## SPSS: k Between Groups ANOVA & Analytic Comparisons

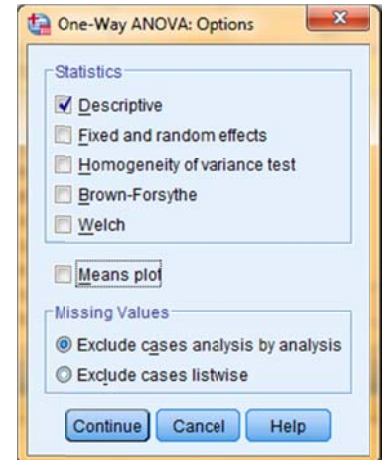
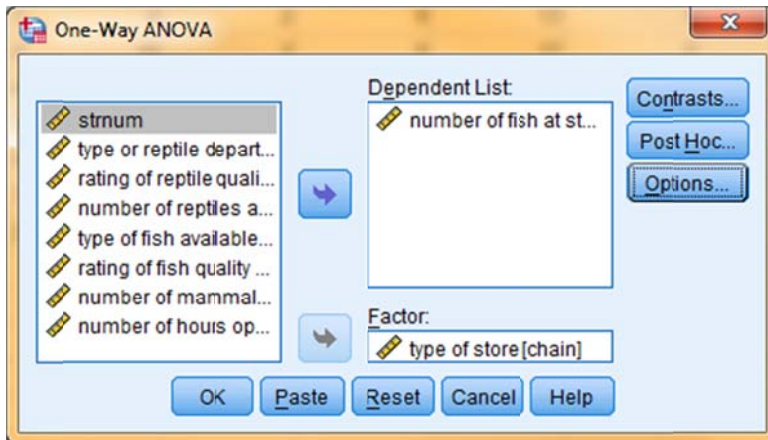
**Application:** To make specific comparisons among the means obtained from 3 or more independent groups.

**RH:** #1 - Chain stores will have fewer fish than Private stores. #2 - Coop stores will have more fish than Private stores.

**H0: for this analysis:** The three different types of pet shops have the mean number of fish displayed.

**Analyze → Compare Means → Oneway**

- highlight the “Dependent” variable (be sure it is **quantitative**) and click the arrow
- highlight the “Factor” (IV, grouping) variable (be sure it is **qualitative**) and click the arrow
- “Options” — check that you want “Descriptive Statistics”
- “Contrasts” – follow the steps below

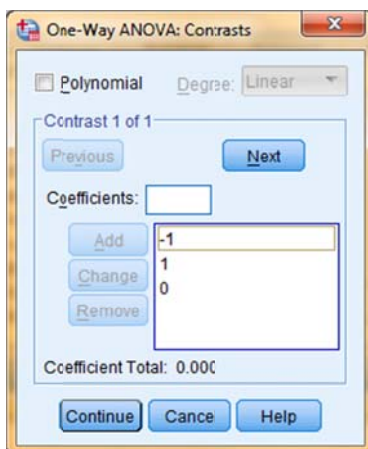


RH1: Chain stores will have fewer fish than Private stores.

RH2: Coop stores will have more fish than Private stores.

“Add” each coefficient one at a time. Be sure to enter them in the same order as the condition values.

Be sure each set of coefficients Total 0.00!



Then click “Next” to move to the next coefficient,

You can enter as many contrasts as you like...

## SPSS Syntax

```
ONEWAY fishnum BY chain
  /CONTRAST= -1 1 0
  /CONTRAST= 0 -1 1
  /STATISTICS DESCRIPTIVES.
```

```
← DV “by” IV
← contrasts Chain & Private RH: Chain < Private
← Contrasts Coop & Private RH: Private < Coop
← get descriptive stats
```

### Descriptives

number of fish at store

	N	Mean	Std. Deviation
chain store	5	17.40	5.030
privately owned	3	19.33	4.041
coop	4	35.50	4.796
Total	12	23.92	9.605

Remember, even if the printout shows it, never report  $p = .000$ , because that would suggest there is no possibility of a Type 1 error. Instead, report " $p < .001$ "

### ANOVA

number of fish at store

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	812.050	2	406.025	18.013	.001
Within Groups	202.867	9	22.541		
Total	1014.917	11			

The p-value of .001 means that there is about a .1% chance that this result is a Type I error



### Contrast Coefficients

Contrast	type of store		
	chain store	privately owned	coop
1	-1	1	0
2	0	-1	1

SPSS repeats the comparison weights and reports significance tests based on both homogeneity and heterogeneity of variance assumptions.

### Contrast Tests

		Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
number of fish at store	Assume equal variances	1	1.93	3.467	.558	9	.591
		2	16.17	3.626	4.458	9	.002
	Does not assume equal variances	1	1.93	3.241	.597	5.200	.576
		2	16.17	3.346	4.832	4.849	.005

The "Value of Contrast" for a simple comparison is the mean difference between the two compared conditions.

RH#1: Chain stores will have fewer fish than Private stores.

- Based on these results, we would conclude that Chain stores have about the same number of fish as Private stores.
- These results do not support the RH:

RH#2 Coop Stores will have more fish than Private stores

- Based on these results, we would conclude that Coop stores have more fish than Private stores
- These results support the RH:

Sometimes people prefer to present F-tests of analytic comparisons. If that case square t and report the df as (1, df). For the 2<sup>nd</sup> comparison or Private v Coop stores, this would be  $F(1, 9) = 19.87$ ,  $MSE = 22.541$ ,  $p = .002$ .

## Reporting the Results

The number of fish displayed at each type of store is summarized in Table/Figure 1. There were significant mean differences in the number of fish displayed among the three types of stores,  $F(2,9) = 18.01$ ,  $Mse = 22.54$ ,  $p = .001$ . Contrary to the hypothesis, Chain stores did not have significantly fewer fish than Private stores,  $t(9) = .558$ ,  $p = .591$ . However, as hypothesized, the Coop stores had significantly more fish than did Private stores,  $t(9) = 4.458$ ,  $p = .002$ .

## Distinguishing Between the Information Obtained from a “Single Complex Comparison” and a “Set of Simple Comparisons”

The off-handed statement, “Chain stores have fewer fish than Private and Coop Stores.” Can be interpreted two ways, that require different analytic comparison analyses and may not have the same answer!

**Descriptives**

number of fish at store

	N	Mean	Std. Deviation
chain store	5	17.40	5.030
privately owned	3	19.33	4.041
coop	4	35.50	4.796
Total	12	23.92	9.605

### Version #1:

#### RH:

The number of fish at Chain stores is less than the average number fish at Private and Coop stores.

This RH: requires the use of a single complex analytic comparison, because it requires that we “group” the Private and Coop stores and compare the resulting “group” to the Chain stores,

#### SPSS Code:

```
ONEWAY fishnum BY chain
/CONTRAST= -2 1 1
/STATISTICS DESCRIPTIVES.
```

#### Results:

**Contrast Coefficients**

Contrast	type of store		
	chain store	privately owned	coop
1	-2	1	1

The “Value of Contrast” is obtained by applying the weights to the group means.  $(-2 \times 17.40) + (1 \times 19.33) + (1 \times 35.50)$

Based on the results below we would conclude that, as hypothesized, there are fewer fish at Chain stores than the average number of fish as Private and Coop stores.

**Contrast Tests**

Contrast			Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
number of fish at store	Assume equal variances	1	20.03	5.584	3.588	9	.006
	Does not assume equal variances	1	20.03	5.607	3.573	7.704	.008

### Version #2:

#### RH:

The number of fish at Chain stores is less than the number of fish at Private stores or at Coop stores.

This RH: requires a set of simple complex comparisons, because it requires that we compare Chain stores separately to the Private stores and to the Coop stores.

#### SPSS Code:

```
ONEWAY fishnum BY chain
/CONTRAST= -1 1 0
/CONTRAST= -1 0 1
/STATISTICS DESCRIPTIVES.
```

#### Results:

**Contrast Coefficients**

Contrast	type of store		
	chain store	privately owned	coop
1	-1	1	0
2	-1	0	1

Based on the results below, we would conclude that, as hypothesized, there are fewer fish at Chain than Coop stores, but that, contrary to the hypothesis, there equivalent numbers of fish at Chain and Private stores.

**Contrast Tests**

Contrast			Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
number of fish at store	Assume equal variances	1	1.93	3.467	.558	9	.591
		2	18.10	3.185	5.683	9	.000
	Does not assume equal variances	1	1.93	3.241	.597	5.200	.576
		2	18.10	3.288	5.505	6.707	.001

**Notice we got different results from the single complex comparison and from the set of simple comparisons!!**  
**Every RH: corresponds to one (and only one) comparison or set of comparisons!!**