



## One-way ANOVA Test

1. Intro and Data Setup
  - a. If you've watched our video that explains the concept of an ANOVA test, you may recall that an ANOVA test helps you figure out when you really do have groups of people who behave or think differently along a particular phenomenon. That is, when people are acting like apples, oranges, pears, nectarines, etc., instead of like different shades of apples.
  - b. In this example, we are going to take a look at average Overall Rating of the festival by Time at Festival, using four groups for Time at Festival – 31-45 minutes, 46-60 minutes, 61-90 minutes, and More than 91 minutes. The Overall Rating question asked festival attendees, "How would you rate today's event overall?" Festival goers could choose an answer on a 5-point scale from Poor to Excellent.
  - c. Here, Time at Festival is the predictor variable – we want to know if the time spent at the festival predicts differences in overall festival rating. Overall Rating is our outcome variable – it is the variable that we want to learn more about.
  - d. The EvalFest Database for SPSS contains the data we will use to conduct the one-way ANOVA test.
2. Conducting the one-way ANOVA test
  - a. To conduct the one-way ANOVA test, click on the Analyze menu at the top of the screen.
  - b. Hover the mouse over Compare Means.
  - c. Choose One-way ANOVA from the menu that appears on the right.
  - d. Click on the outcome variable, in this example OverallCode, in the list at the left.
  - e. Click the top arrow to move OverallCode to the Dependent List box.
  - f. Click on the predictor variable, in our case TimeAtFestivalCode.
  - g. Click on the bottom arrow to move TimeAtFestivalCode to the Factor box.
    - i. Note that TimeAtFestival, the string variable, is not in the list of variables at the left. SPSS will only allow you to compute an ANOVA using numeric variables.
  - h. Click on Options at the right.
  - i. Check the Descriptive box and click Continue.
  - j. Click on Post Hoc on the right. This allows us to run post hoc tests at the same time that we run the ANOVA test. We will talk about post hoc tests in a few minutes.

- k. Choose Bonferroni and click Continue.
  - l. Click OK.
3. Interpretation of the one-way ANOVA test
- a. SPSS populates the output window – these are your results.
  - b. The Descriptives table shows the size of each group, each group's mean, standard deviation, and various other group level descriptive statistics. Recall that a 2 indicates that people have been at the festival for 31-45 minutes, 3 indicates 46-60 minutes, 4 is the group that has been at the festival 61-90 minutes, and 5 is the indicator for those who have been at the festival for 91 minutes or more.
  - c. The ANOVA table provides information about the 2 types of variance, the between groups variance and the within groups variance. We also see the degrees of freedom, the value of F, and the p-value (labeled Sig.). You're most interested in the p-value to determine if you have differences between one or more pairs of Time at Festival groups.
  - d. If you've watched the conceptual video, you may recall that the p-value is a measure of the risk you take in making a decision based on your data. If the p-value is less than .05, that means there is less than 5% chance that the results are based on something other than the data. Thinking about this another way, there is a 1 minus the p-value chance that you DO have differences in overall festival ratings among Time at Festival groups, and people are acting like apples, oranges, pears, etc., as opposed to acting more similarly, like different shades of apples. In more statistical terms, you use the p-value to determine if the mean of the outcome variable is statistically significantly different among the groups in the predictor variable.
  - e. For this scenario, we see that our p value is .000, which indicates that we have a very small p-value. Because this is less than .05, we know that we have one or more pairs of Time at Festival groups that differ statistically significantly in average overall rating of festival.
  - f. Note that the p-value simply tells you if there are pairs of groups for which the ratings are different – it doesn't tell you which groups differ significantly from one another. To figure that out, we ran what are called a post hoc tests.
4. Bonferroni post hoc test
- a. Remember that the p-value is the risk that your results are actually from chance and not based on a real difference in your data. The value  $p < .05$  is the acceptable risk for one test. If you do more than one test, you have to adjust your risk level to help make sure that your estimates account for the extra level of risk. The more tests you conduct, the greater the possibility of making the wrong decision based on the p-value.
  - b. SPSS is able to run the full set of 6 post hoc independent samples tests simultaneously, and adjusts the p-value for each post hoc test to determine whether or not the two groups being tested are significantly different from one another. Because SPSS makes what is called the Bonferroni adjustment for you, you don't have to make this adjustment when assessing the p-value. The Multiple Comparisons table contains the results of the Bonferroni post hoc test. A p-value of less than .05 in the Sig. column indicates that the average overall festival rating between the two groups being tested is different – that

you DO have people acting like apples and oranges.

- c. We see that those who had been at the festival 91 minutes or more, or group 5, rated the festival significantly more positively than all other groups.
5. Final interpretation
- a. So how do you think about interpreting these results? Remember that these ratings were made on a five-point scale, where 1 was Poor and 5 was Excellent. The average ratings were above 4.0 for all groups, so somewhere between Very Good and Excellent on the scale. When interpreting these kinds of results, you want to think about the kinds of ratings you have overall and the group differences. So, for these results, we might say something like:  
Ratings for the Festival were quite positive. As festival-goers spent more time at the festival, average overall rating increased. Specifically, those who had been at the festival more than 91 minutes rated the festival significantly more positively than all other groups.



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