Comparing Price and Perceived Level of Comfort of Office Chairs

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Introduction:
"You get what you pay for" is a widely used saying when comparing price with comfort. The question our project seeks to answer is, "Is there a relationship between the price of an office chair and the perceived level of comfort?" We collected our data at our local Staples

Sampling Design and Methodology:
We each brought 5 people, one at a time, to test the comfort level of 5 randomly chosen office chairs. When the project started, there was another member, so we tested a total of 75 chairs. The office chairs were chosen by using the random number generator on our TI-83 calculators. We generated a number for the row and a number for the chair in that row. The people we brought were our friends, so they were not randomly chosen. This is one potential limitation of this study. They did not know that our study was to compare the price with the perceived comfort level. We told them that we were trying to find the mean comfort level of the chairs. The individuals gave us a comfort rating on a scale from 1-5 stars (1 being the least comfortable and 5 being the most comfortable.) We didn't allow half stars, and once individuals gave their rating, they were not allowed to change it. This took place over 3 weeks. Each test subject had their own data sheet.

Definition and Assumptions:
Our population is defined as the chairs from the Staples in Coos Bay, Oregon. Technically, our sample only applies to the chairs within the Coos Bay Staples from February 1st to February 16th. However, our population of interest is office chairs in general. Our assumption is that our sample generalizes office chairs in all stores. Again, the choice of having friends rate the comfort level of each chair is a limitation in this study. The friends we chose are a sample of the college population. We have to assume this is a good representative sample.

Problems:
We ran into a few problems while collecting our data. We randomly selected the same chair a few times, and there were multiple chairs that were not tested. We also knew the people, so the test subjects were not taken from a true simple random sample. We had to assume that the subjects were honest with their evaluations and that they didn't rate the chairs based on the price.

Pooled Data:

Rating	Price
1 Star	179.99, 229.99, 199.99, 84.99, 179.99, 119.99, 277.99, 98.99, 77.69, 308.99, 196.99
2 Stars	229.99, 84.99, 299.99, 149.99, 99.99, 299.99, 169.49, 89.99, 148.99, 138.99
3 Stars	179.99, 229.99, 229.99, 169.49, 59.99, 299.99, 369.99, 119.99, 149.99, 119.99, 84.99, 179.99, 299.99, 179.99, 79.99, 129.99, 161.99, 110.49, 229.99, 119.99, 149.99

4 Stars	199.99, 119.99, 299.99, 279.99, 169.46, 169.99, 169.99, 149.99, 299.99, 119.99, 199.99, 229.99, 199.99, 179.99, 169.46, 134.99, 67.59, 115.99
5 Stars	229.99, 119.99, 229.99, 299.99, 169.99, 149.99, 299.99, 229.99, 144.99, 89.99, 144.49, 130.59, 57.59, 70.29, 349.99

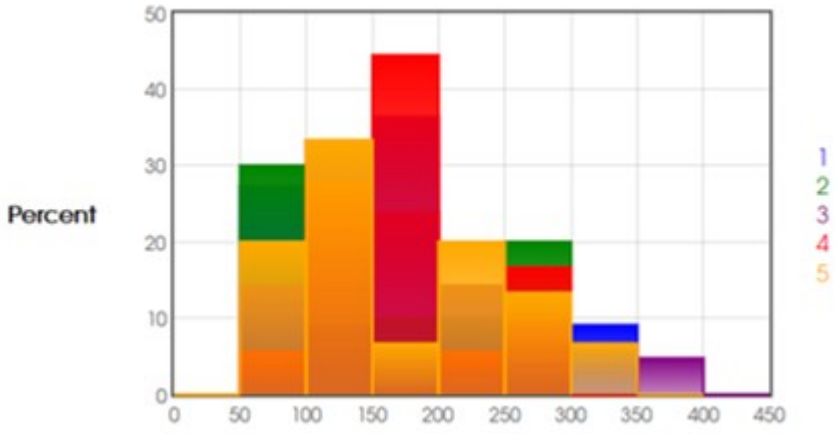
Analysis:
We began by running a Multi-Sample Descriptive Stats Calculator on holt.blue. We also ran a Normal Probability Plot and discovered that the data was not normal due to right-skew of the prices. The data is not continuous, so we did not feel justified in including Simple Linear Regression. There are forms of regression that can be used with discrete data, but we did not feel that we have enough knowledge on regression with discrete data to use it.

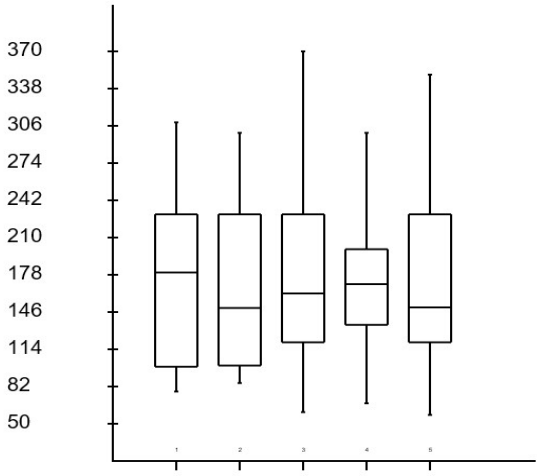
With 75 data points, no outliers, and no violations of homoscedasticity, ANOVA is sufficiently robust despite the right-skew observed in the price distributions of each rating. Our data did not violate the Standard Deviation rule for ANOVA which states that no standard deviation exceeds twice any other, so we ran the One-Way ANOVA test.

The null hypothesis of the One-Way ANOVA test is that the mean price of each rating group is the same. The alternative hypothesis is that the mean price of each rating group is not the same. Using a 0.01 significance level we ran an ANOVA test on holt.blue and discovered that the p-value was 0.9952 and the F-stat was 0.0503. Based on these statistics, we do not have significant evidence to reject the null hypothesis and say that the pricing for the rating groups is different.

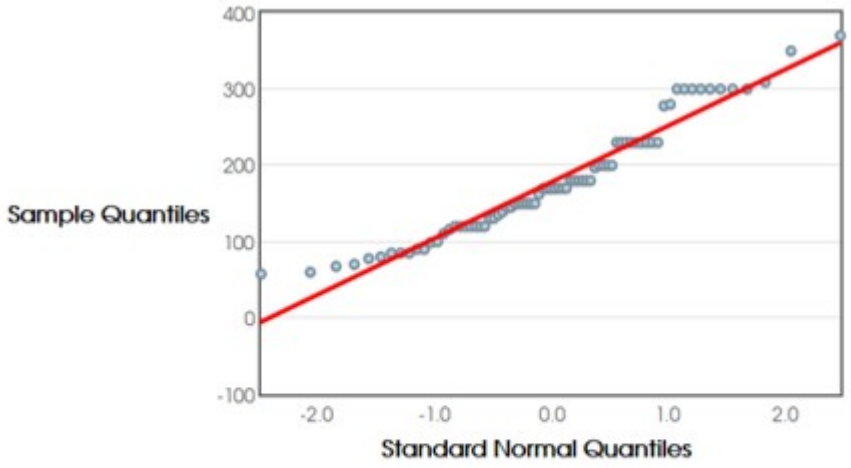
MULTI-SAMPLE DESCRIPTIVE STATS

Sample	Size	Mean	Standard Deviation	Five Number Summary
1	11	177.7809	76.832	77.69, 98.99, 179.99, 229.99, 308.99
2	10	171.24	80.0775	84.99, 99.99, 149.49, 229.99, 299.99
3	21	174.1329	79.2051	59.99, 119.99, 161.99, 229.99, 369.99
4	18	182.0756	64.0304	67.59, 134.99, 169.99, 199.99, 299.99
5	15	181.19	88.5679	57.59, 119.99, 149.99, 229.99, 349.99





NORMAL PROBABILITY PLOT



Number of Data Points: $n = 75$

Regression Line: $y = 73.8738x + 177.5999$

Correlation: $r = 0.9754$

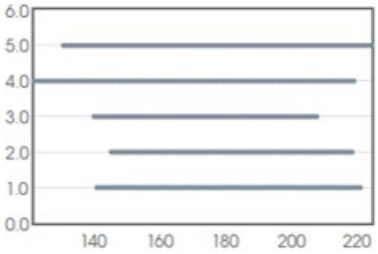
ONE-WAY ANOVA TEST

Source of variation	df	SS	MS	F-statistic	p-value
Variation Among Samples	4	1211	MSG=302.79	0.0503	0.9952
Variation Within Samples	70	421730	MSE=6024.72		
Total	74	422942			

Sample	n	Mean	Standard Deviation	95% Conf. Interval using Pooled Std Dev
1-Star	11	177.7809	76.832	(131.105, 224.4569)
2-Star	10	171.24	80.0775	(122.2858, 220.1942)
3-Star	21	174.1329	79.2051	(140.3513, 207.9144)
4-Star	18	182.0756	64.0304	(145.5873, 218.5638)
5-Star	15	181.19	88.5679	(141.2191, 221.1609)

Pooled Std Dev: 77.6191

95% Confidence Intervals Using Pooled Standard Deviation:



Interpretation: Assuming that all means are equal, the probability of seeing an F-statistic that is $\mathbf{0.0503}$ or larger is 0.9952.

Conclusion:

Keep the null hypothesis. ($\mathbf{0.9952 = p \geq \alpha = 0.05}$)

Future Work:

For future work on this project, we would expand the data collection sites to more stores that sell office chairs in the Coos Bay/North Bend area. We would also try to take a Simple Random Sample of people from the campus by sending out a campus-wide email asking people to participate. We would also collect more samples in future work to give a more accurate interpretation of the relationship between the comfort rating of chairs and the price level.

Conclusion:

Based on the ANOVA test, there is no difference between the mean pricing of each group rating. In other words, the price of a chair does not affect the rating that a person will give it. Overall, the more expensive chairs are not any more comfortable than the less expensive chairs. Thank you to Steven Kirk, the manager of Staples, for allowing us to conduct our test at his Coos Bay location.

References:

_____Holt, Benjamin. “Math 244”. *Mr. Holt's Homepage,* February 2020, holt.blue/math_244/homepage.html.

Final Draft of Project Proposal
Brianna, Kiersten, Nicole
Jan 24, 2020
Math 244

"You get what you pay for" is a widely used saying when comparing price with comfort. The question our project will be answering is "Is there a relationship between the price of an office chair and the perceived level of comfort?"

Our data will be collected at our local Staples. We have met with the manager, Steven Kirk, explained our project, and received permission to perform our test. We will acknowledge his generous consent in our final report, and we will include his business card. We will each bring at least 5 people, one at a time, to test the comfort level of 5 randomly chosen office chairs. We will randomly choose the 5 chairs by using the random number generator on our calculators. We will generate a number for the row that we will be picking, and we will generate a number for the chair in that row. The people we bring will not be randomly chosen since they are our friends. This is one potential limitation of this study. They will not know that we are comparing the price with the perceived comfort level. We will tell them that we are trying to find the mean comfort level of the chairs. The individuals will give us a comfort rating on a scale from 1-5 stars (0.5 being the least comfortable and 5 being the most comfortable.) We will allow half stars, but once individuals have given a rating, they cannot change it. This will take place over multiple days, but no more than 3 weeks. Each test subject would have their own data sheet.

Here is a potential data sheet:

(Test subject #, tester's initials)	Perceived Comfort Level (1-5)	Price	Additional Notes
Chair 1			
Chair 2			
Chair 3			
Chair 4			
Chair 5			

We would like to do a one-way ANOVA if our data sample allows it. We may use Simple Linear Regression if ANOVA doesn't work, or if we want an additional analysis.