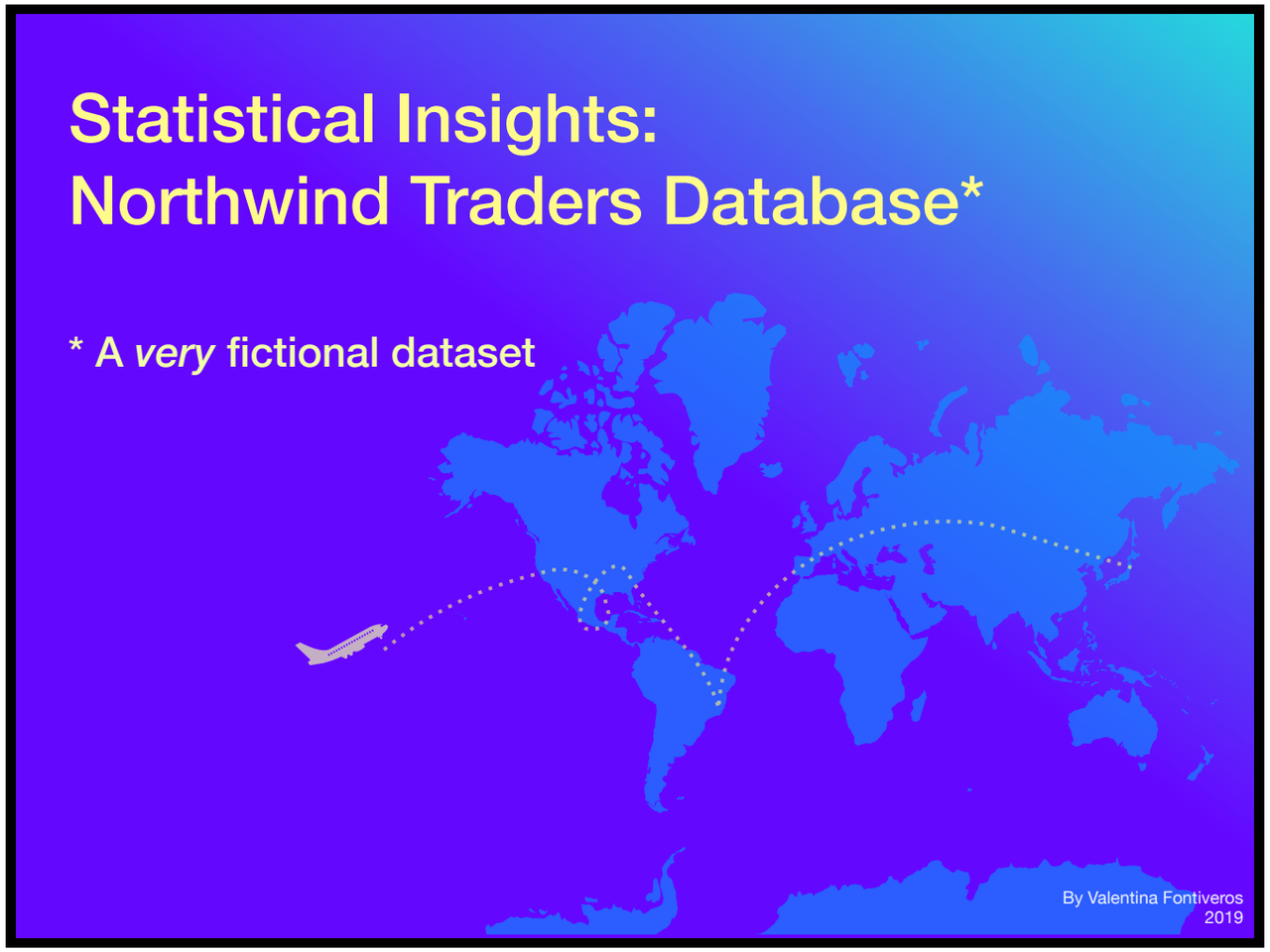
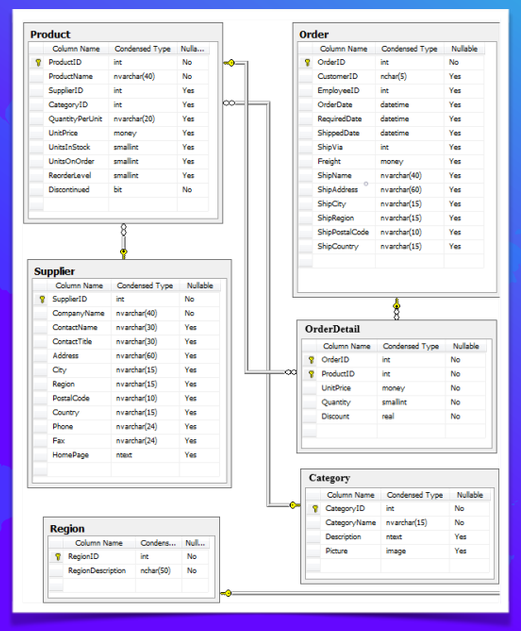


Hello, my name is Valentina and I will present to you today the results of several statistical tests done on the classical Northwind Traders Database.

Introduction



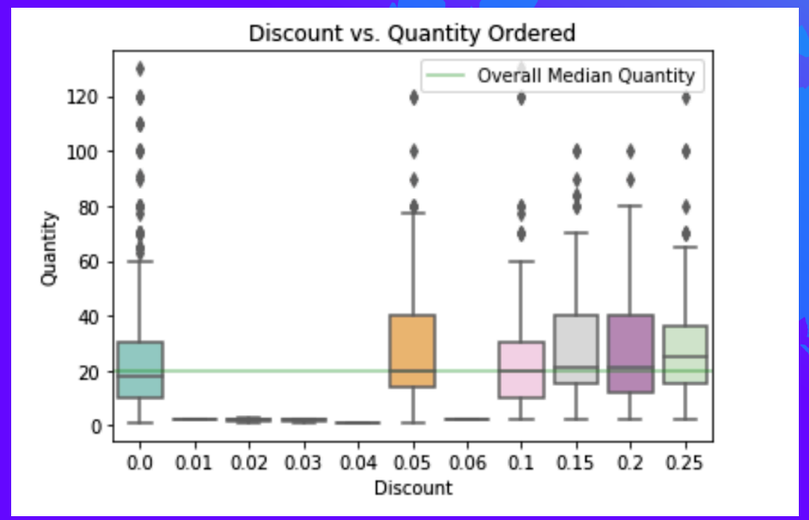
In 1992, Microsoft released the first version of MS Access. The original software package included a sample database documenting Northwind Traders' transactions involving the international trade of grocery goods. Because it is an open-sourced dataset, it has been widely used since then as an economical way to practice queries in various applications.

What is less well understood is whether the database contains realistic data or just mumbo-jumbo. Were the developers involved in generating the numerical data in a hurry or did they embed more thought into their task?

Methodology

In order to answer this question without asking Microsoft, we first had to come up with a set of tests. Since the database claims to deal with international trade, one would expect certain trends. For example, prices are often higher in Europe than in America. Does the dataset show this? We used SQL queries to extract the pricing and geographical information of all transactions.
Then we created a pandas dataframe for ease of exploration and wrangling of the data. We formulated Execute two-sample t-tests for each questions.
Calculate average p-value from 1000 iterations, assess significance.

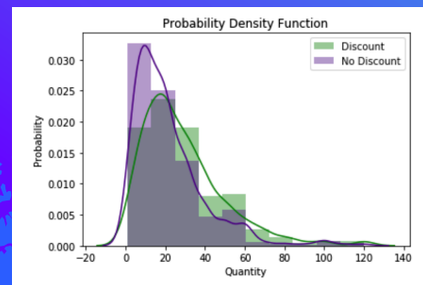
Do discounts affect the number of bulk orders?



From a cursory look at mean quantities ordered, it would seem that only a discount of 25% would result in a significant incentive to change the median quantity ordered by customers. However, visualizing these relationships do not provide the necessary resolution to answer the question authoritatively.

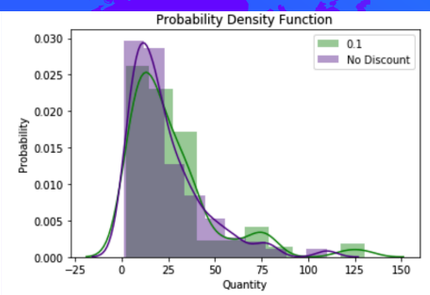
Do discounts affect the number of bulk orders?

Discount	Mean P value 1000 trials	Significant?
5%	0.03	✓
10%	0.20	✗
15%	0.03	✓
20%	0.06	✗
25%	0.03	✓



✓

Ttest_indResult(statistic=7.592263710187593, pvalue=5.217529356034328e-14)

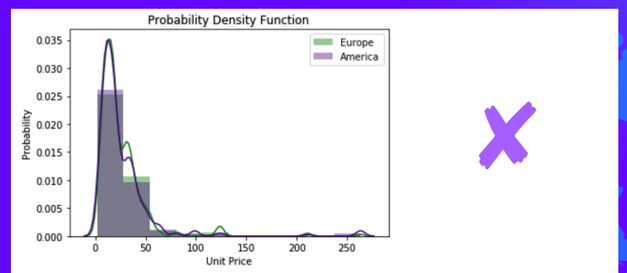


✗

Ttest_indResult(statistic=1.3264263804621745, pvalue=0.18557842581651013)

Instead, data scientists perform what we call t-tests: we compare two samples, in this case quantities ordered with a discount and no discount, and we determine how statistically different they are by using mathematical formulae. In this example, we found that discounts do change the quantities ordered. However, when we look closer at various discount brackets, we see that some are more effective than others. Discounts of 10% and 20% are not statistically different as the no-discount case, whereas discounts of 5%, 15%, and 25% are. This finding merits further research!

Does location affect product prices?



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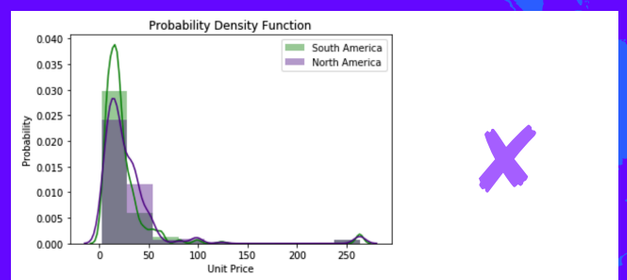
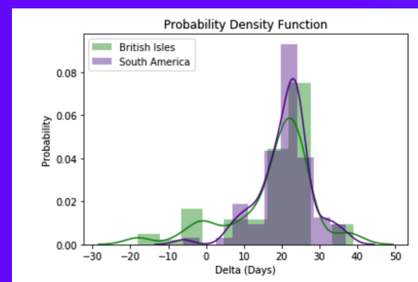


Ttest_indResult(statistic=-1.3659566190365702, pvalue=0.17245928464011284)

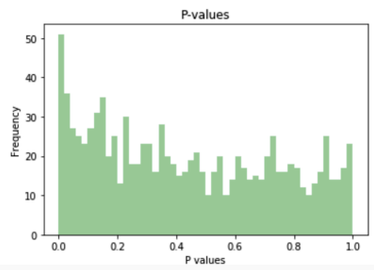
COMPARING	P VALUE	Significant?
EUROPE VS. AMERICAS	0.65	✗
NORTH VS. SOUTH AMERICA	0.17	✗

Another question we asked was: does shipment destination affect price? We looked at various regions in the world, and the surprising conclusions was that, in fact, they are not affected. This is frankly unrealistic from a business perspective and may be a consequence of using a synthetic dataset!

Does location affect delivery wait times?



Ttest_indResult(statistic=-2.202425756106206, pvalue=0.02918224062520203)



Mean p-value for all experiments: 0.43620651248311854

?

What's going on here?

Sample size matters!

The last question we asked was, does geography affect delivery times? Similarly to the previous finding, this answer was also a clear-cut negative. However, when comparing delivery times between South America and the British Isles, we got an interesting result. A requirement for two sample t-tests is to use samples with the same number of entries. On this dataset, deliveries to the British Isles were limited, less than 50. Therefore, the sample size was quite limited. There was high instability when computing p-values. In some instances, the p-value would come out lower than 0.05, which is the significance threshold used. In the majority of trials, however, the p-value was much higher than the significance threshold, resulting in an average p-value of 0.44 for 1000 trials. The importance of this is that 1) We need to review sample sizes in automated analyses and that 2) some questions require executing various t-test trials to reach a valid conclusion.

Conclusions

- Dataset does in fact appear to be synthetic.
- Some discount levels significantly affect order quantity.
- Shipment destination does not affect price.
- Shipment destination does not affect delivery wait times.

While this is most likely a synthetic dataset, we found some interesting insights:
Not all discount levels significantly affect order quantity.
All significant discounts ended in # 5
Shipment destination does not affect price.
Shipment destination does not affect delivery wait times.

Future Work

- Repeat a similar analysis using a real corporate dataset.
- Explore the relationship between discount numbers and quality bought (is there a psychological link?)

For future work, it would be interesting to repeat this analysis with a real corporate dataset.
If in fact, the discount information is valid, researching the potential psychological link to various discount numbers would be of value for the marketing department.

Thank you! (By the way this is the original logo of the fictional corporation created by Microsoft).