**WEEK 9 HOMEWORK­­**

**Question 19.1**

Describe analytics models and data that could be used to make good recommendations to the retailer. How much shelf space should the company have, to maximize their sales or their profit?

Of course, there are some restrictions – for each product type, the retailer imposed a minimum amount of shelf space required, and a maximum amount that can be devoted; and of course, the physical size of each store means there’s a total amount of shelf space that has to be used. But the key is the division of that shelf space among the product types.

For the purposes of this case, I want you to ignore other factors – for example, don’t worry about promotions for certain products, and don’t consider the fact that some companies pay stores to get more shelf space. Just think about the basic question asked by the retailer, and how you could use analytics to address it.

As part of your answer, I’d like you to think about how to *measure* the effects. How will you estimate the extra sales the company might get with different amounts of shelf space – and, for that matter, how will you determine whether the effect really exists at all? Maybe the retailer’s hypotheses are not all true – can you use analytics to check?

Think about the problem and your approach. Then talk about it with other learners, and share and combine your ideas. And then, put your approaches up on the discussion forum, and give feedback and suggestions to each other.

# You can use the {given, use, to} format to guide the discussions: Given {data}, use {model} to {result}.

One of the key issues in this case will be data – in this case, thinking about the data might be harder than thinking about the models.

**Hypotheses**

1. More shelf space -> More sales
2. More sales -> More complementary product sales
3. Larger effect if complementary products are adjacent.

**Given**

1. Company’s total usable space

* Row, Column, Width

1. Items sales data

* How much has this item been sold for the past days, weeks, months?

1. Items inventory data

* Stock amount for the items
* Items with more stock would be more likely to be placed at an “eye-level” shelf row

1. Items list
2. Items price
3. Items categories or types

* Snacks, Sweets, Fruits, Vegetables, Equipment, Cooking utensils, etc.

1. Items sizing

* Rectangular, Square, Round, Cubical, Cone, etc.

1. Item weights

* Heavier items would be more likely to be placed at the last row of the shelf

1. Items minimum amount of shelf space
2. Items maximum amount of shelf space

**Use**

1. Hard Classification

* To classify items according to its types.

1. PCA

* To filter out the least dominating factors or variables to further enhance our classification or grouping.

1. Full Factorial Design

* Basically, brute force to unveil the initial insight of our optimal model
* Test all possible shelf space combinations where Σ (Items size) ≤ Available shelf space
* Based on the factors derived from PCA
* Could also add another layer of combination by adding x Factors/Variable
  + Σ (Items size with x Factor) ≤ Available shelf space

1. Linear Programming Optimization

* To reconfirm if the result from Full Factorial Design is reliable
* Need to place in constraints

1. Louvain Algorithm

* To calculate the relation effect of having complementary products placed closed to one another

1. ARIMA

* Used to forecast sales profit for the models we choose
* Could be used in a loop within Optimization model

**To**

1. Decide how much shelf space should the company have to maximize their sales and profit
2. Find out the sales and profit increase from having an optimized shelf space
3. Prove the relation between the hypotheses and analytics

**Personal Assumptions**

1. Place items of the same categories = Save more time for customers to purchase

* Also implies that there is a larger effect if complementary products are placed adjacent