Chopsticks!

A few researchers set out to determine the optimal length of chopsticks for children and adults. They came up with a measure of how effective a pair of chopsticks performed, called the "Food Pinching Performance." The "Food Pinching Performance" was determined by counting the number of peanuts picked and placed in a cup (PPPC).

An investigation for determining the optimum length of chopsticks.

Link to Abstract and Paper
the abstract below was adapted from the link

Chopsticks are one of the most simple and popular hand tools ever invented by humans, but have not previously been investigated by ergonomists. Two laboratory studies were conducted in this research, using a randomised complete block design, to evaluate the effects of the length of the chopsticks on the food-serving performance of adults and children. Thirty-one male junior college students and 21 primary school pupils served as subjects for the experiment to test chopsticks lengths of 180, 210, 240, 270, 300, and 330 mm. The results showed that the food-pinching performance was significantly affected by the length of the chopsticks, and that chopsticks of about 240 and 180 mm long were optimal for adults and pupils, respectively. Based on these findings, the researchers suggested that families with children should provide both 240 and 180 mm long chopsticks. In addition, restaurants could provide 210 mm long chopsticks, considering the trade-offs between ergonomics and cost.

For the rest of this project, answer all questions based only on the part of the experiment analyzing the thirty-one adult male college students.

Download the data set for the adults, then answer the following questions based on the abstract and the data set.

If you double click on this cell, you will see the text change so that all of the formatting is removed. This allows you to edit this block of text. This block of text is written using Markdown, which is a way to format text using headers, links, italics, and many other options. You will learn more about Markdown later in the Nanodegree Program. Hit shift + enter or shift + return to show the formatted text.

1. What is the independent variable in the experiment?

You can either double click on this cell to add your answer in this cell, or use the plus sign in the toolbar (Insert cell below) to add your answer in a new cell.

In [ ]:
```
Chopstick.Length
```

2. What is the dependent variable in the experiment?

In [ ]:
```
Food.Pinching.Efficiency
```

3. How is the dependent variable operationally defined?

In [ ]:
```
the number of peanuts picked and placed in a cup (PPPC)
```

4. Based on the description of the experiment and the data set, list at least two variables that you know were controlled.

Think about the participants who generated the data and what they have in common. You don't need to guess any variables or read the full paper to determine these variables. (For example, it seems plausible that the material of the chopsticks was held constant, but this is not stated in the abstract or data description.)

In [ ]:
```
age, gender
```

One great advantage of ipython notebooks is that you can document your data analysis using code, add comments to the code, or even add blocks of text using Markdown. These notebooks allow you to collaborate with others and share your work. For now, let's see some code for doing statistics.

In [1]:
```
import pandas as pd

# pandas is a software library for data manipulation and analysis
# We commonly use shorter nicknames for certain packages. Pandas is often abbreviated to pd.
# hit shift + enter to run this cell or block of code
```

In [2]:
```
path = r'C:\Users\baba.mahmudov.SOCAR\Desktop\pressa/chopstick-effectiveness.csv'
# Change the path to the location where the chopstick-effectiveness.csv file is located on your computer.
# If you get an error when running this block of code, be sure the chopstick-effectiveness.csv is located at the path on your co
mputer.

dataFrame = pd.read_csv(path)
dataFrame
```

Out[2]:

	Food.Pinching.Efficiency	Individual	Chopstick.Length
0	19.55	1	180
1	27.24	2	180
2	28.76	3	180
3	31.19	4	180
4	21.91	5	180
5	27.62	6	180
6	29.46	7	180
7	26.35	8	180
8	26.69	9	180
9	30.22	10	180
10	27.81	11	180
11	23.46	12	180
12	23.64	13	180
13	27.85	14	180
14	20.62	15	180
15	25.35	16	180
16	28.00	17	180
17	23.49	18	180
18	27.77	19	180
19	18.48	20	180
20	23.01	21	180
21	22.66	22	180
22	23.24	23	180
23	22.82	24	180
24	17.94	25	180
25	26.67	26	180
26	28.98	27	180
27	21.48	28	180
28	14.47	29	180
29	28.29	30	180
...	...	...	...
156	26.18	2	330
157	25.93	3	330
158	28.61	4	330

Let's do a basic statistical calculation on the data using code! Run the block of code below to calculate the average "Food Pinching Efficiency" for all 31 participants and all chopstick lengths.

In [3]:
```
dataFrame['Food.Pinching.Efficiency'].mean()
```

Out[3]:
```
25.005591397849461
```

This number is helpful, but the number doesn't let us know which of the chopstick lengths performed best for the thirty-one male junior college students. Let's break down the data by chopstick length. The next block of code will generate the average "Food Pinching Effeciency" for each chopstick length. Run the block of code below.

In [4]:
```
meansByChopstickLength = dataFrame.groupby('Chopstick.Length')['Food.Pinching.Efficiency'].mean().reset_index()
meansByChopstickLength

# reset_index() changes Chopstick.Length from an index to column. Instead of the index being the length of the chopsticks, the i
ndex is the row numbers 0, 1, 2, 3, 4, 5.
```

Out[4]:

	Chopstick.Length	Food.Pinching.Efficiency
0	180	24.935161
1	210	25.483871
2	240	26.322903
3	270	24.323871
4	300	24.968065
5	330	23.999677

5. Which chopstick length performed the best for the group of thirty-one male junior college students?

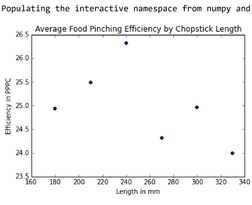
240 mm

In [5]:
```
# Causes plots to display within the notebook rather than in a new window
%pylab inline

import matplotlib.pyplot as plt

plt.scatter(x=meansByChopstickLength['Chopstick.Length'], y=meansByChopstickLength['Food.Pinching.Efficiency'])
                # title="")
plt.xlabel("Length in mm")
plt.ylabel("Efficiency in PPPC")
plt.title("Average Food Pinching Efficiency by Chopstick Length")
plt.show()
```

```
Populating the interactive namespace from numpy and matplotlib
```



6. Based on the scatterplot created from the code above, interpret the relationship you see. What do you notice?

In [ ]:
```
Chopsticks with the length of interval 180-240 have big Food Pinching Efficiency. In this length interval the longer the chopsti
ck, the more the Food Pinching Efficiency is. After this interval no relationship is noticed.
```

In the abstract the researchers stated that their results showed food-pinching performance was significantly affected by the length of the chopsticks, and that chopsticks of about 240 mm long were optimal for adults.

7a. Based on the data you have analyzed, do you agree with the claim?

No

7b. Why?

Because after the length of 240, there is no pattern in the trend of variables.

No. Because after the length of 240, there is no pattern observed in the trend of variables and further investigation is needed to jump a conclusion with a statistical value.

In [ ]:
```

```