**Intro and Web Scrape**

We used Beautiful Soup and webdriver to scrape the financial statements and financial ratios from the last 3 years on a quarterly basis from macrotrends.net. For our web scrape the major problem we ran into was the fact that there was a scrollbar on the website. When we were initially scraping the website, we were only able to pull the data that was visible. We wanted to pull the data all the way back to December 31, 2016. In order to do that, we had to use a feature in webdriver called ActionChains. This feature allows you to automate low level mouse events while web scraping, such as clicking and sliding the scrollbar. The loop that you see basically tells the scrape how far to scroll the scroll bar which took us a little trial and error to figure out. After that it was just a matter of grabbing the column headers separately from the row data and then putting the scraped data into a dataframe.

**Apple as of 6/30/19 +101%**

* Has $210.6 billion in cash on hand (more than half of this cash is in long-term marketable securities)
* Spent roughly $153 billion on share repurchase over the last 11 quarters
  + This amount is more than double what the other 4 tech giants spent on share repurchases combined over the same time period
* Net profit margins are within a couple percentage points above or below 20% each quarter which is pretty stable

**Microsoft as of 6/30/19 +140%**

* Has roughly $135 billion in cash on hand including marketable securities
* Spent roughly $35 billion on share repurchases over the last 11 quarters (the buybacks have been higher than average over the last 4 quarters)
* Net profit margins range from the high 20s to the high 30s on a quarterly basis
  + Experienced a negative profit margin in the last quarter of 2017 caused by a large tax bill from repatriation of foreign earnings

**Facebook as of 6/30/19 +40%**

* Has about $49 billion in cash on hand
* Spent roughly $16.5 billion on share repurchases over the last 10 quarters (initiated their first stock buyback in the 1Q 2017)
* The only one of these five companies that has zero debt
* Also, the only company that has no form of inventory reported on the balance sheet since they do not sell any physical products
* Net profit margins have generally been in the mid 30s to mid 40s but have dropped to the mid-to-high teens over the last 2 quarters
  + This is due to the increased spending and hiring by Facebook to combat the disinformation and false content problems it has been facing lately

**Google as of 6/30/19 +50%**

* Has about $120 billion cash which makes it the company with the most “cash on hand” technically speaking but Apple still has the most when factoring in marketable securities and cash equivalents
* Spent roughly $18.5 billion on share repurchases over the last 11 quarters
* Net profit margins tend to be quite volatile and anywhere from the high single digits to the high 20s on a quarterly basis due to seasonality but are more stable in the low 20s on an annual basis
  + Experienced the same issue as MSFT and had a negative profit margin in the last quarter of 2017 caused by a large tax bill from repatriation of foreign earnings

**Amazon as of 6/30/19 +104%**

* Has about $42 billion in cash on hand
* Has not repurchased any stock over the last 11 quarters (last buyback actually was 2012)
* Has had low single digit net profit margins that appear to be slowly increasing to the mid-single digits
  + This is most likely due to the company’s increasing profitability from Amazon Web Services and the fact that they no longer lose large amounts of money from their online store sales
  + 2016 was basically the first year that Amazon reported a notable profit

**Revenue**

* Facebook and Google generate the large majority of their revenues from advertising, 98% and 85% respectively for the fiscal year 2018
* Apple and Amazon generate slightly more than half of their revenue stream from iPhones and direct online store sales respectively
  + Both of these companies have been pushing hard to expand their footholds in the services business (Apple Pay, Apple TV, Apple Music; AWS for Amazon)
  + The services business has the highest profit margins which explains why these two companies are targeting this business segment
  + Apple’s revenue stream has remained relatively constant since 2016 with the contribution from each product only differing by a couple percentage points
* Microsoft has the most well diversified revenue stream by far with 8 different segments accounting for ~%5 or more of revenue for fiscal year 2018

**Main Difference**

* Apple, Amazon, and Microsoft market and sell products and services to their customers, whereas Facebook and Google generate the majority of their revenue by marketing their customers and allowing advertisers to target them with all types of advertisements based on their online habits

**Stock Plots**

We used Alpha Vantage to pull historical daily stock prices over the last 20 years from their Daily Stock Time Series API, which gave us roughly 5,000 data points of stock data. We are going to show stock price charts for each of the 5 tech giants over the last 3-year period.

When pulling the json data from the Alpha Vantage API we chose to loop through each json object and pull the open, close, low, and high stock price for each day as well as the date to be able to plot our candlestick charts. We chose to use Plotly JS library to plot our charts.

While using Plotly, we discovered that the slide bar below the x-axis only adjusts the x-axis range and not the y-axis range. So, this resulted in the range of the y-axis staying the same regardless of the visible data for the time period shown. This problem causes all of the stock movements to become essentially flat if you zoom in far enough since the y-axis range does not adjust. We searched in the Plotly documentation and discovered that this has been an ongoing problem with a bunch of people complaining about the lack of this feature and yet Plotly has not come out with a fix yet. Anyways, for our presentation we came up with a temporary fix where we sliced the last 3 years of data rather than including all 20 years in order to make the y-axis price range tighter on the chart.

We are going to create a MongoDB database to store our stock data for the 5 tech giants, which can be updated daily as each new day of stock data is added from the Alpha Vantage API.

For our website, we used the Anime.js library to create some moving letter animations to help make our relatively plain html page look a little more fancy.