**Project Goal:**

* Explore and visualize the relationship between FT (Free Trials), PS (Pay Subs), S (Spend), and CR (Conversion Rate) on various marketing channels.
* Identify patterns and trends through visualization.

**Exploratory Steps:**

* Plot FT and PS for various channels in box plots to determine if there are outlier subscription periods.
* Identify channels that have the highest volume of data: AdWords, Facebook, Instagram, Snapchat, and YouTube.
* Create data frame by excluding outliers in various channels.
* Plot FT, PS, S, and CR with time series graphs.
* Plot scatter plots for FT and PS against S on various channels.
* Build linear regression model to look at R-squared and P on various channels.
* Plot heat maps of correlations between all variables.

**Outcomes**

* S was paused between late 2016 and April 2017 on various channels.
* AdWords

Performance dropped around Nov 2016 where FT and PS declined in comparison to the amount spent.

* + Performance then later reached a great optimization level after May 2017, where S remained small, but FT and PS continued to go up.
  + CR had a high peak in July 2016, and another one in May 2017.
  + Regression model reported 0.24 R-squared and 0.004 P value on the relationship between AdWords S and FT. And 0.23 R-squared and 0.005 P value on the relationship between AdWords S and PS. R-squared is low, therefore AdWords data may not be the best for creating predictions.

* Facebook
  + Time series graphs showed FT and PS had similar patterns and trends.
  + FT and PS performance peaked for the first time around May 2016, and for the 2nd time around May 2017.
  + CR had a high peak in May 2017.
  + Regression model reported 0.66 R-squared and 0.000 P value on the relationship between Facebook S and FT. And 0.61 R-squared and 0.000 P value on the relationship between Facebook S and PS. This indicates a strong correlation between S, FT, and PS.
* Instagram
  + Time series graphs showed FT, PS, and S had similar patterns and trends.
  + FT and PS performance peaked for the first time around August 2016, and for the 2nd time around May 2017.
  + CR had high peaks in Oct 2016 and May 2017.
  + Regression model reported 0.75 R-squared and 0.000 P value on the relationship between Instagram S and FT. And 0.74 R-squared and 0.000 P value on the relationship between Instagram S and PS. This indicates a strong correlation between S, FT, and PS.
* Snapchat
  + Time series graphs showed FT and PS had similar patterns and trends. However, FT and PS reported a negative correlation to S where S went up but FT and PS went down. This can be explained by the Snapchat ad network being less developed compared with Facebook and Google, therefore more volatile.
  + FT and PS performance peaked for the first time around August 2016, and for the 2nd time around June 2017.
  + CR had a high peak in April 2017.
  + Regression model reported 0.24 R-squared and 0.001 P value on the relationship between Snapchat S and FT. And 0.74 R-squared and 0.001 P value on the relationship between Snapchat S and PS, therefore Snapchat data may not be the best for creating predictions.
* YouTube
  + Time series graphs showed FT, PS and S had similar patterns and trends.
  + FT and PS performance peaked for the first time around Oct 2016.
  + CR had a high peak in Oct 2016.
  + Regression model reported 0.5 R-squared and 0.000 P value on the relationship between YouTube S and FT. And 0.47 R-squared and 0.001 P value on the relationship between YouTube S and PS, therefore YouTube data may not be the best for creating predictions.