Probability and Statistics (ECSE231L) Mini Project

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For this mini project, I have selected my own Browser history recorded over the past year as my dataset! I have made sure to do all kinds of analysis on this data and gain important insights on my browsing pattern and habits.

This notebook contains all of the code and analytics that I have performed. 😉

In [ ]:

```
import pandas as pd
import json
import tldextract
import datetime

'''
    I imported all of my browser history from a service called "google takeout".
    This was in a json format which I loaded into a panda dataframe using the ap
'''
with open("BrowserHistory.json") as g:
    data = json.loads(g.read())
    df = pd.DataFrame(data['Browser History'])
    df = df[(df['page_transition'] == "LINK") | (df['page_transition'] == "TYPED

# removing useless columns
df.drop('client_id', axis=1, inplace=True)
df.drop('favicon_url', axis=1, inplace=True)
```

This is how the data looks right now

(its very ugly 🥺)

In [ ]:

```
df
```

Out[ ]:

	page_transition	title	url	time_usec
1	TYPED	PULSE 2021-22	https://discord.com/invite/smCXRnVg	1635687222723527

	page_transition	title	url	time_usec
3	LINK	How to deactivate your Instagram account or de...	https://backlightblog-com.cdn.ampproject.org/v...	1635684284079522
4	LINK	How do I temporarily disable my Instagram acco...	https://help.instagram.com/728869160569983	1635684223975428
5	LINK	No, Japanese government hasn't decided to disp...	https://www.altnews.in/no-japanese-government-...	1635669575693796
7	LINK	Question	https://www.quora.com/Is-a-deaf-person-allowed...	1635613429701439
...	...	...	...	...
22389	LINK	WhiteHat Junior	https://code.whitehatjr.com/trial/register?utm...	1604382663714086
22390	LINK	PUBG Mobile Ban: You Can Still Play the Game D...	https://www-mysmartprice-com.cdn.ampproject.or...	1604382416117528
22391	LINK	PUBG Interactive Map - Map Comparison	https://pubgmap.io/compare.html	1604302335681147
22392	LINK	Gamehag - Conjure up rewards by playing games!	https://gamehag.com/	1604247505869787
22396	LINK	Just a moment...	https://gamehag.com/affmob?aff_id=894&s1=102c6...	1604247307969183

14562 rows × 4 columns

Now we will prepare this data for analysis and also perform cleaning 😎

In [ ]:

```
'''
    Here I have defined some functions to create new columns from the given colu
    to make my life easier.
'''

# This function has been defined to convert the time given in seconds into stand
def convert_time(x):
    return datetime.datetime.fromtimestamp(x/1000000)
df['date_time'] = df['time_usec'].apply(convert_time)

# This function extracts the domain name from the url
def get_domain(x):
    domain = tldextract.extract(x)[1]
    sub_domain = tldextract.extract(x)[0]
    if sub_domain == "mail":
        return sub_domain + "." + domain


    if domain == "google" and sub_domain=="www":
        return "google_search"
    return domain
df['domain'] = df['url'].apply(get_domain)

def get_category(x):
    if x in ["coursera", "kadenze", "fast", "kaggle", "freecodecamp", "edx"]:
        return "Learning"
    elif x in ["ycombinator", "medium", "hackernoon", "dev","manjaro","stackexch
        return "Tech Reads"
    elif x in ["youtube"]:
        return "YouTube"
    elif x in ["bennett"]:
        return "LMS"
    elif x in ["chess", "lichess"]:
        return "chess.com"
    elif x in ["flipkart", "amazon", "thesouledstore", "redwolf", "geekdawn", "c
        return "Shopping"
    elif x in ["google", "google_search"]:
        return "Google Search"
    elif x in ["kickassanime", "gogoanimes", "netflix", "primevideo", "gogoanime
        return "Video Streaming"
    elif x in ["newtab"]:
        return "New Tab"
    elif x in ["github", "codezinger", "geeksforgeeks", "codechef", "tryhackme",
        return "Programming"
    elif x in ["instagram", "facebook", "whatsapp", "reddit", "discord", "twitte
        return "Social Media"
    elif x in ["wikipedia"]:
        return "Wikipedia"
    elif x in ["spotify"]:
        return "Spotify"
    else:
        return "Other"
df['category'] = df['domain'].apply(get_category)

def is_secure(x):
    check = x[0:5]
    if check=="https":
        return True
    return False
df ['is_secure'] = df['url'].apply(is_secure)

def get_month(x):
    return x.month
df['month'] = df['date_time'].apply(get_month)

def get_date(x):
    return x.date()
df['date'] = df['date_time'].apply(get_date)

def get_hour(x):
    return x.hour
df['hour'] = df['date_time'].apply(get_hour)
```

```
def day_of_week(x):
    return x.strftime('%A')
df['day'] = df['date'].apply(day_of_week)


def is_weekend(x):
    weekend = ["Saturday", "Sunday"]
    if x in weekend:
        return True
    return False
df['is_weekend'] = df['day'].apply(is_weekend)


# since we have converted our time, we dont need the 'time_usec' column as well
df.drop('time_usec', axis=1, inplace=True)
# 'date_time' column is not needed as well as it has been broken down into hour,
df.drop('date_time', axis=1, inplace=True)
# we also want to remove rows in the dataframe where domain = newtab as they are
df = df[df['domain'] != "newtab"]
```

In [ ]:

```
# from collections import Counter
# count_dict = Counter(df['domain'])
# marklist = sorted(count_dict.items(), key=lambda x:x[1], reverse=True)
# count_dict = dict(marklist)
# uncomment the above code to get list of most visited domains
```

Now, the data looks like this:

In [ ]:

```
print(df.shape)
df
```

```
(12988, 11)
```

Out[ ]:

	page_transition	title	url	domain	category	is
1	TYPED	PULSE 2021-22	https://discord.com/invite/smCXRnVg	discord	Social Media	
3	LINK	How to deactivate your Instagram account or de...	https://backlightblog-com.cdn.ampproject.org/v...	ampproject	Other	
4	LINK	How do I temporarily disable my Instagram acco...	https://help.instagram.com/728869160569983	instagram	Social Media	
5	LINK	No, Japanese government hasn't decided to disp...	https://www.altnews.in/no-japanese-government-...	altnews	Other	
7	LINK	Question	https://www.quora.com/Is-a-deaf-person-allowed...	quora	Other	

	page_transition	title	url	domain	category	is
...	...	...	...	...	...	
22389	LINK	WhiteHat Junior	https://code.whitehatjr.com/trial/register?utm...	whitehatjr	Other	
22390	LINK	PUBG Mobile Ban: You Can Still Play the Game D...	https://www-mysmartprice-com.cdn.ampproject.or...	ampproject	Other	
22391	LINK	PUBG Interactive Map - Map Comparison	https://pubgmap.io/compare.html	pubgmap	Other	
22392	LINK	Gamehag - Conjure up rewards by playing games!	https://gamehag.com/	gamehag	Other	
22396	LINK	Just a moment...	https://gamehag.com/affmob?aff_id=894&s1=102c6...	gamehag	Other	

12988 rows × 11 columns

Finally, we are free to perform exploratory analysis on this data 🥳

In [ ]:

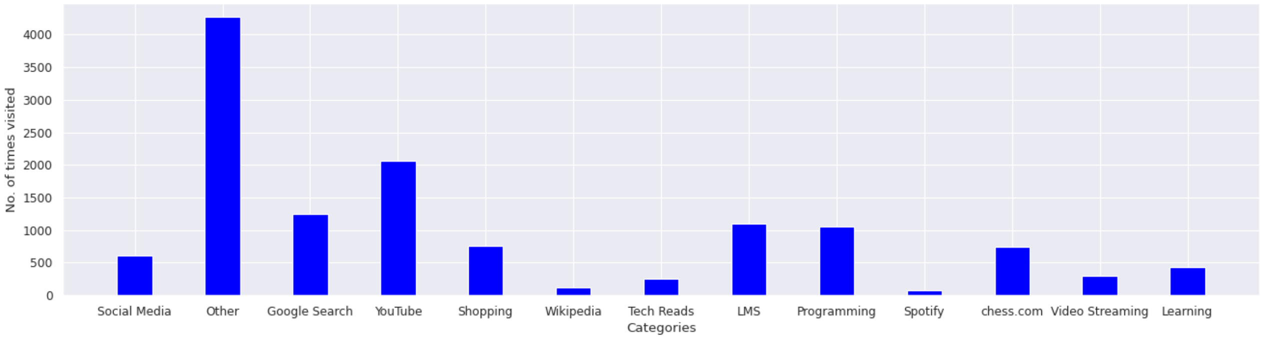
```
'''
    First, I would like to find out the oldest date and newest date present in t
'''
# finding oldest date
oldest = min(df['date'])
print("The oldest date in this data is", oldest)

import pytz
now = datetime.date.today()
youngest = max(dt for dt in df['date'] if dt < now)
print("The newest date in this data is", youngest)
```

```
The oldest date in this data is 2020-11-01
The newest date in this data is 2021-10-31
```

So, as we can see above, the data covers a period of about 1 year from 1st November 2020 to 31st October 2020

In [ ]:

```
'''
    Now, I want to analyse which category of websites I visit the most.
'''
import matplotlib.pyplot as plt
from collections import Counter
count_dict = Counter(df['category'])
count_dict = dict(count_dict)


categories = list(count_dict.keys())
values = list(count_dict.values())

# code to make the plot bigger
from matplotlib.pyplot import figure
figure(figsize=(20, 5), dpi=80)

plt.bar(categories, values, color ='blue', width=0.4)
plt.xlabel("Categories")
plt.ylabel("No. of times visited")
plt.show()
print(count_dict)
```



```
{'Social Media': 601, 'Other': 4268, 'Google Search': 1241, 'YouTube': 2065, 'Sh
opping': 755, 'Wikipedia': 120, 'Tech Reads': 251, 'LMS': 1096, 'Programming': 1
055, 'Spotify': 67, 'chess.com': 744, 'Video Streaming': 291, 'Learning': 434}
```

As we can see in the above plot, I have visited Youtube about 2000 times in the past year, which is about 5.5 times each day!

I also visited the LMS about 2.25 times every day and played an average of 2 chess matches

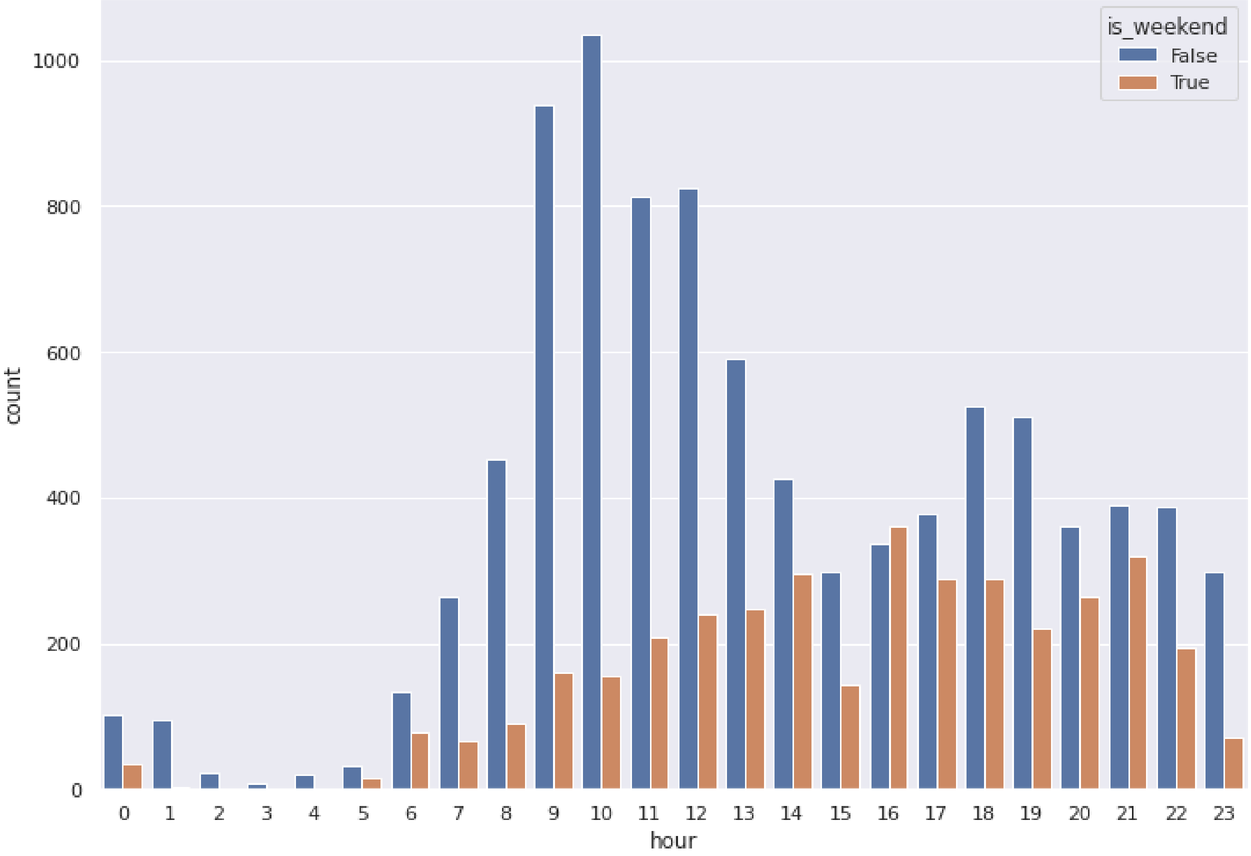
Whereas, I visited programming or learning wesbites only about 4.76 times 🥲

In [ ]:

```
'''
    Let's see my browsing trends on weekdays vs weekends
'''
import seaborn as sns
# below line is the adjust figure size
sns.set(rc={'figure.figsize':(11.7,8.27)})

sns.countplot(x="hour", hue="is_weekend", data=df)
```

Out[ ]:

```
<AxesSubplot:xlabel='hour', ylabel='count'>
```

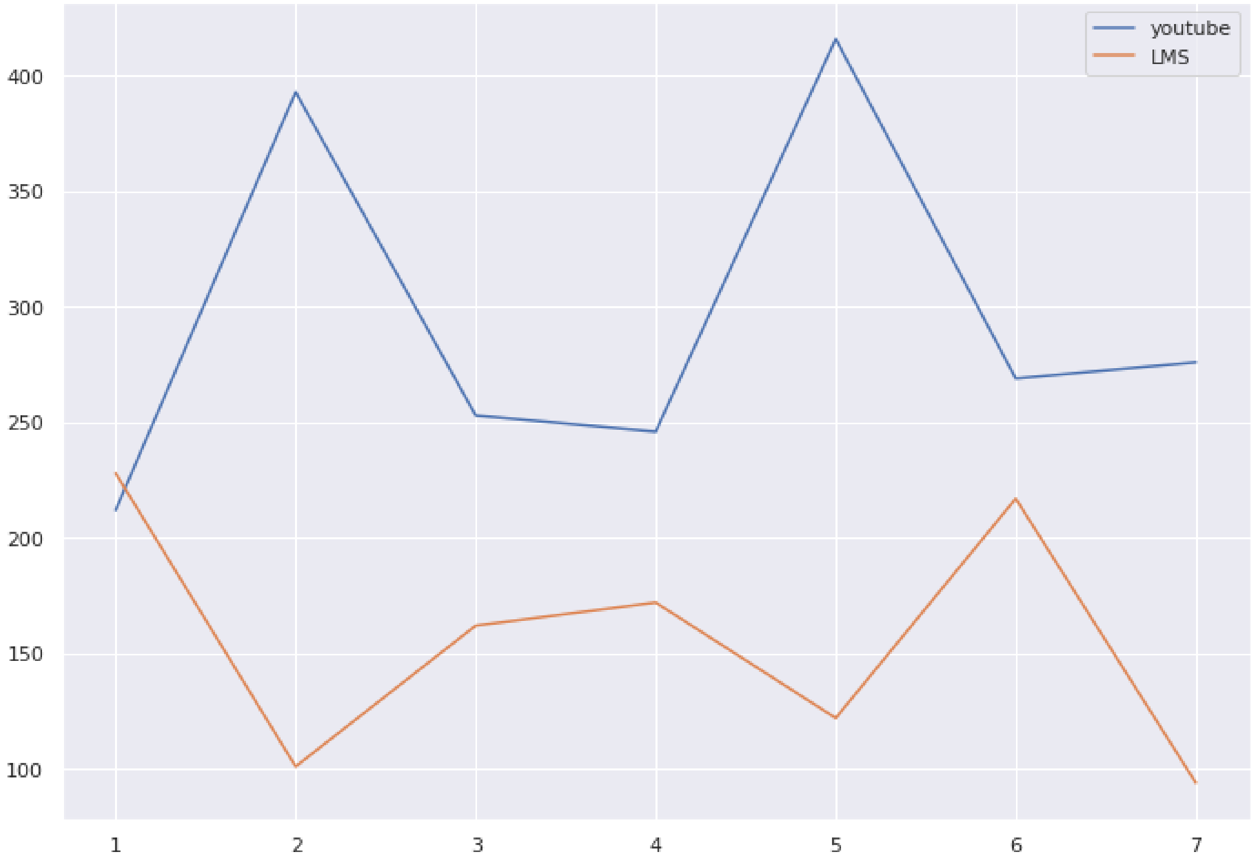


from the above plot, we can see a lot of interesting things. For example, we can see that at around 4 pm, my weekend activity exceeds my non-weekend activity even though there are 2.5x more non-weekend days(5) than weekend days(2). Another interesting thing is that we can clearly that there is almost no activity from 12 am to 5 am each day (which is when I sleep). Maximum activity is around 10 am on non-weekends which is understandable 😬.

In [ ]:

```
'''
    I also want to compare my youtube.com and LMS visits on each day of the week
'''
# disable IDIOT warning
import pandas as pd
pd.options.mode.chained_assignment = None  # default='warn'

# this function we find the day number of the days. For example, monday = 1, Tue
days_arr = ["Monday", "Tuesday", "Wednesday", "Thursday", "Friday", "Saturday",
def day_num(x):
    return days_arr.index(x) + 1
df['day_num'] = df['day'].apply(day_num)




x1 = [1,2,3,4,5,6,7]
```

```
y1 = [0,0,0,0,0,0,0,0]
df_new = df[df['domain']=='youtube']
for i in df_new['day_num']:
    y1[i-1] += 1
y2 = [0,0,0,0,0,0,0,0]
df_new = df[df['domain']=='bennett']
for i in df_new['day_num']:
    y2[i-1] += 1

plt.plot(x1,y1, label="youtube")
plt.plot(x1,y2, label="LMS")
plt.legend()
plt.show()
```

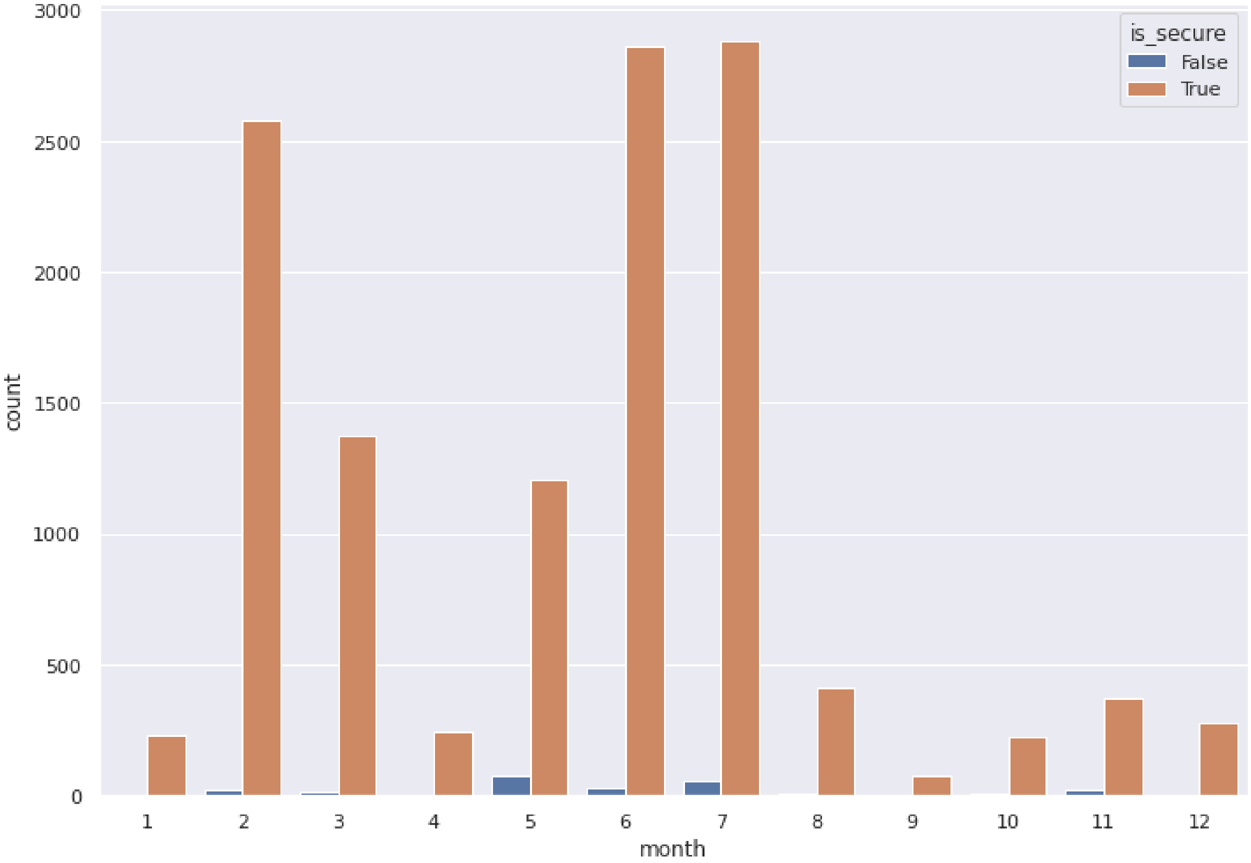


in the above plot, we can make the observation that on the days that youtube activity is at its peak (like tuesday and friday), LMS activity is at its lowest value and vice versa (like saturday, wednesday, thursday). Also, on mondays, LMS activity is more than youtube!

In [ ]:

```
'''
    now lets check how many websites I visited were secure. If a website uses ht
'''
# below line is the adjust figure size
sns.set(rc={'figure.figsize':(11.7,8.27)})

sns.countplot(x="month", hue="is_secure", data=df)
```

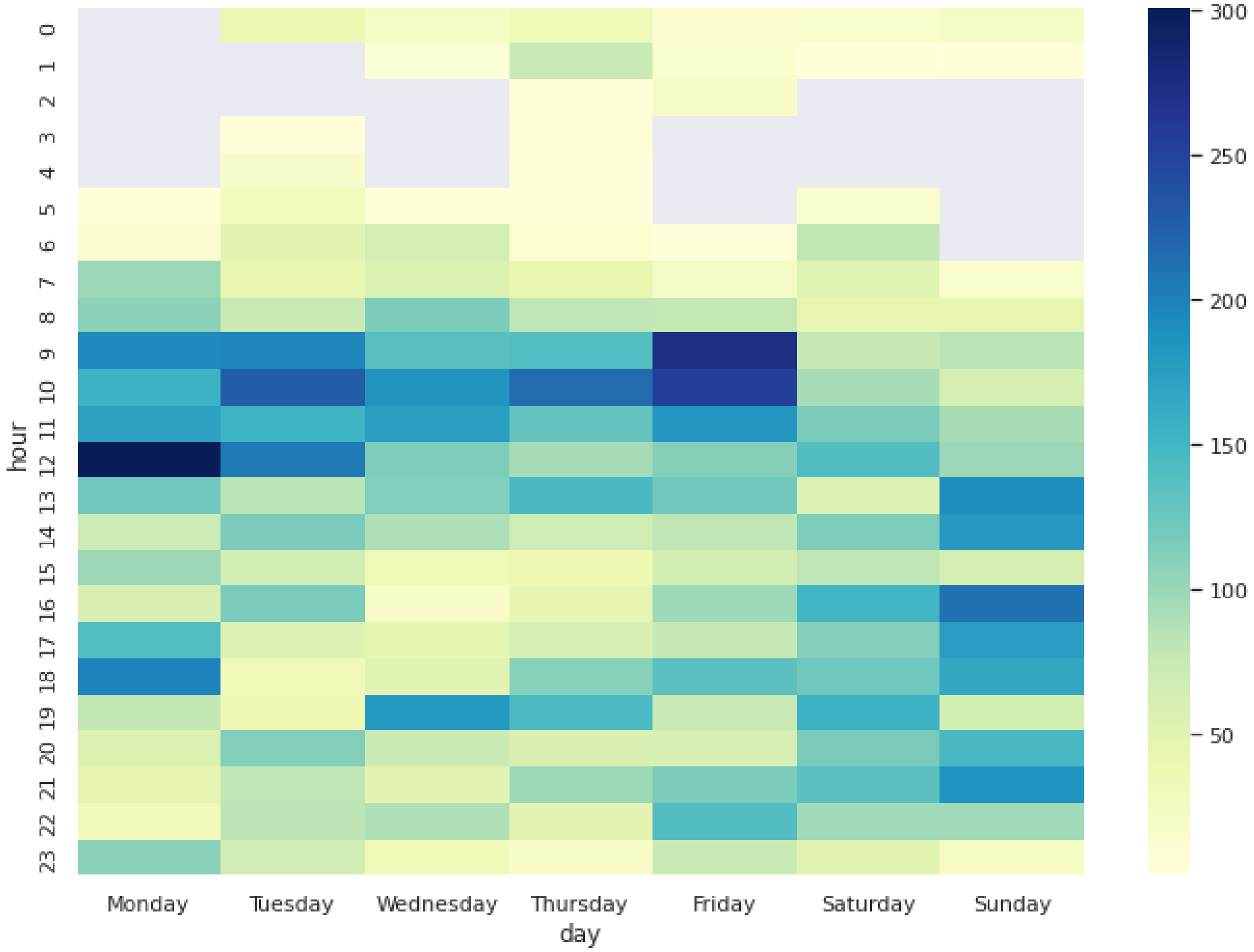
```
Out[ ]: <AxesSubplot:xlabel='month', ylabel='count'>
```



not suprisingly, we can see that most of the websites that I visited were secure....except some in may :)

```
In [ ]: '''
            lets explore my activity during hour of day using a heatmap
        '''

        df_heat = df.groupby(["hour", "day"])["domain"].size().reset_index()
        df_heat2 = df_heat.pivot("hour", "day", "domain")
        sns.heatmap(df_heat2[days_arr] , cmap="YlGnBu")
```

```
Out[ ]: <AxesSubplot:xlabel='day', ylabel='hour'>
```



In the above heatmap, we can again see that there is not much activity in the 12am - 5am period during which I sleep 😴

Now lets ask some questions and try to answer them by using this DATA (this is the fun part)

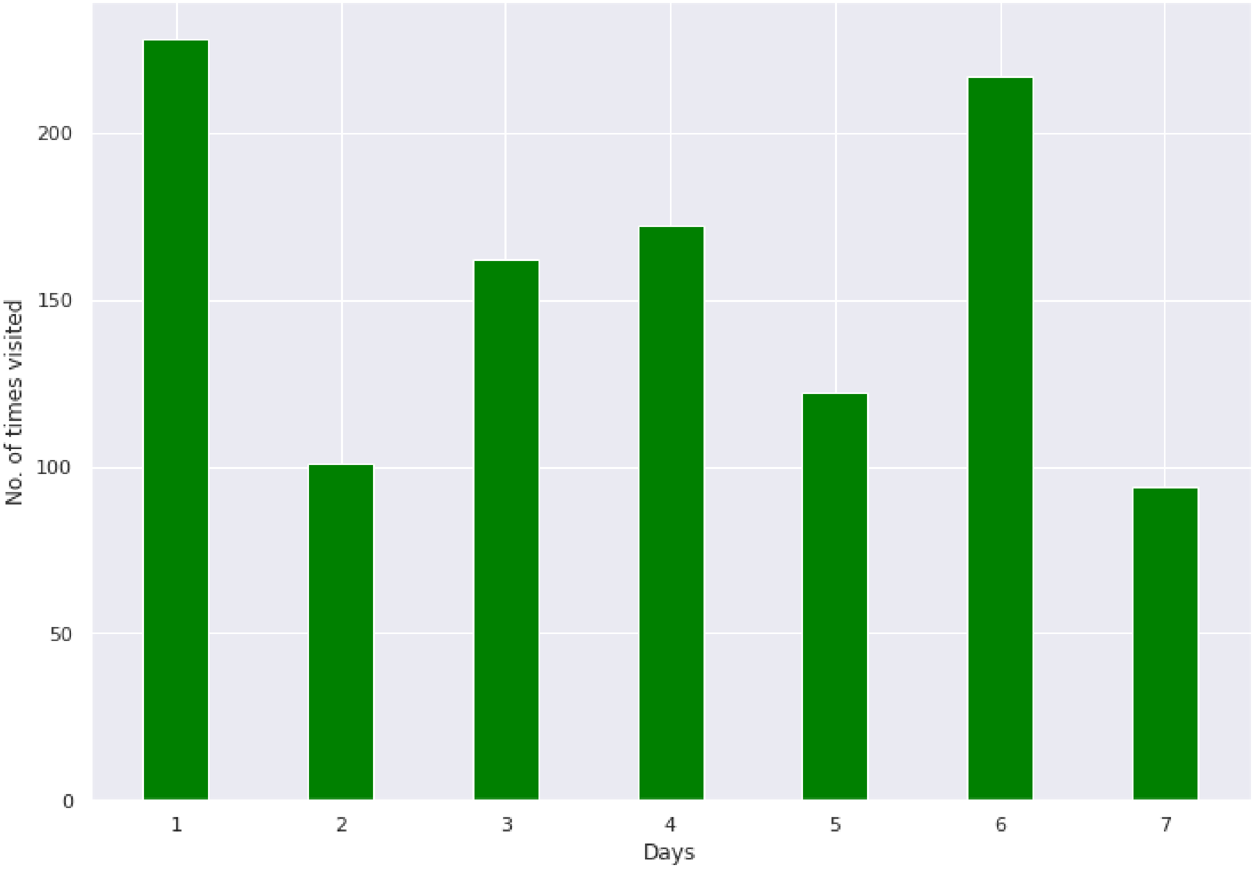
Q1) When do I study the most? (weekends or non-weekends)

In [ ]:

```
'''
    To try and answer this question, I would like to make the following assumpti
    During each study session, I open the LMS atleast once.
    So, we can track the usage of LMS on each day of the week to get our answer
'''

df_new = df[df['domain']=='bennett']
count_dict = Counter(df_new['day_num'])
count_dict = dict(count_dict)

# Creates a sorted dictionary (sorted by key)
from collections import OrderedDict
dict1 = OrderedDict(sorted(count_dict.items()))
```

```
print(dict1)

categories = list(count_dict.keys())
values = list(count_dict.values())

plt.bar(categories, values, color ='green', width=0.4)
plt.xlabel("Days")
plt.ylabel("No. of times visited")
plt.show()
```

```
OrderedDict([(1, 228), (2, 101), (3, 162), (4, 172), (5, 122), (6, 217), (7, 9
4)])
```



So, as we can see from above graph that I like to distribute my work throughout the week but I do the most work on Saturdays and Mondays (which I know is true) and chill on sundays like chads do 😎

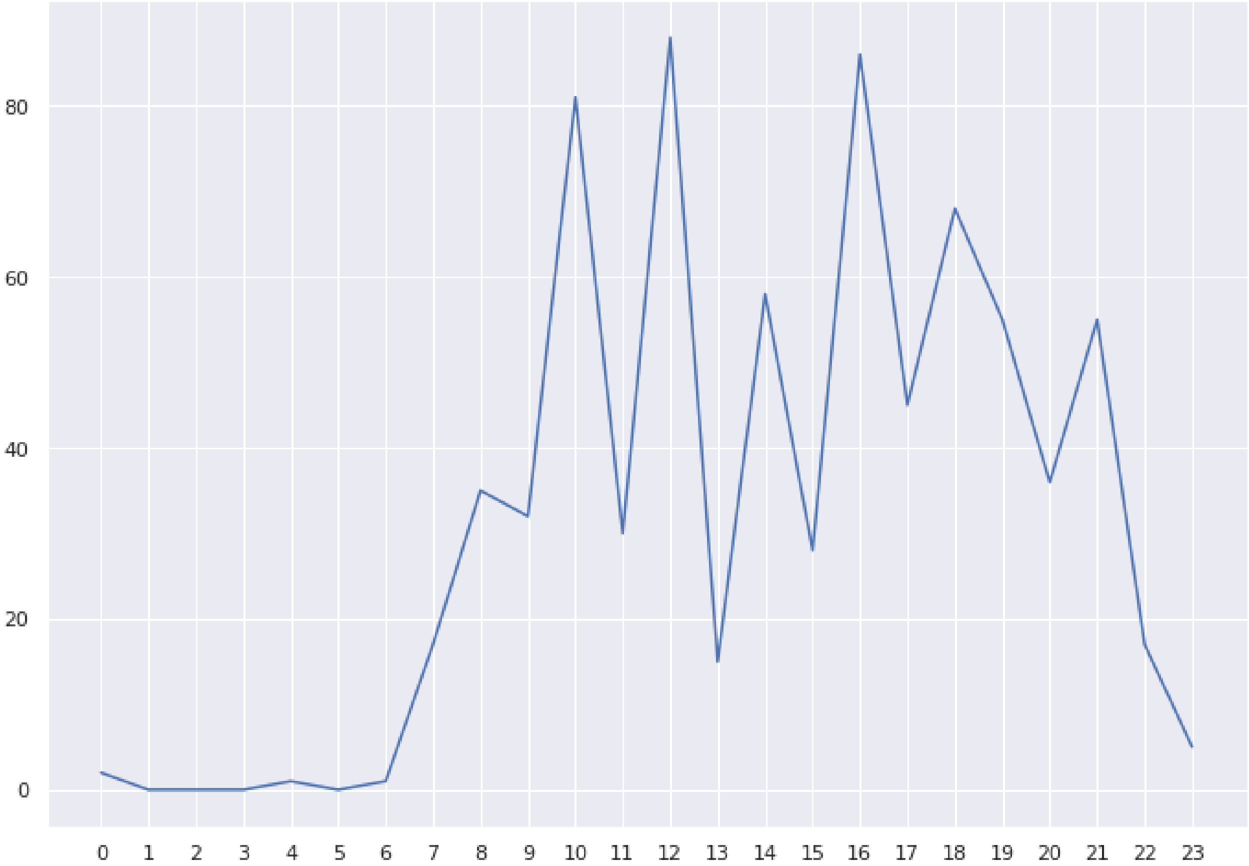
Q2) Which hour of the day do I shop most?

In [ ]:

```
'''
    To answer this question, we can plot out my visits on shopping websites duri
'''

x = set()
for i in df['hour']:
    x.add(i)
x = list(x)
y = []
```

```
for i in range(24):
    y.append(0)
df_new = df[df['category']=='Shopping']
for i in df_new['hour']:
    y[i] += 1

print(x)
print(y)
plt.plot(x,y)
plt.xticks(x)
plt.show()
```

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 2
2, 23]
[2, 0, 0, 0, 1, 0, 1, 17, 35, 32, 81, 30, 88, 15, 58, 28, 86, 45, 68, 55, 36, 5
5, 17, 5]
```



We observe that I shop mostly at 12 pm followed closely by 4 pm in the afternoon and 10 am and I tend to shop least at around 1 pm (non-sleeping hours)

Q3) What is the average number of pages I visit each day? What is minimum and what is maximum?

In [ ]:

```
'''
    To answer this question, I will make a list of website visits each day and t
'''

count_dict = Counter(df['date'])
```

```
values = count_dict.values()
values = list(values)

import numpy as np
from scipy import stats

mean = np.mean(values)
median = np.median(values)
mode = stats.mode(values)


print("The mean number of pages you visited each day is :", mean)
print("However, the median of this data is", median)
print("and the mode is", mode[0], "which occured", mode[1], "times")

values.sort()
print("\nThe min visits are", values[0])
print("and the max visits are", values[len(values)-1])
```

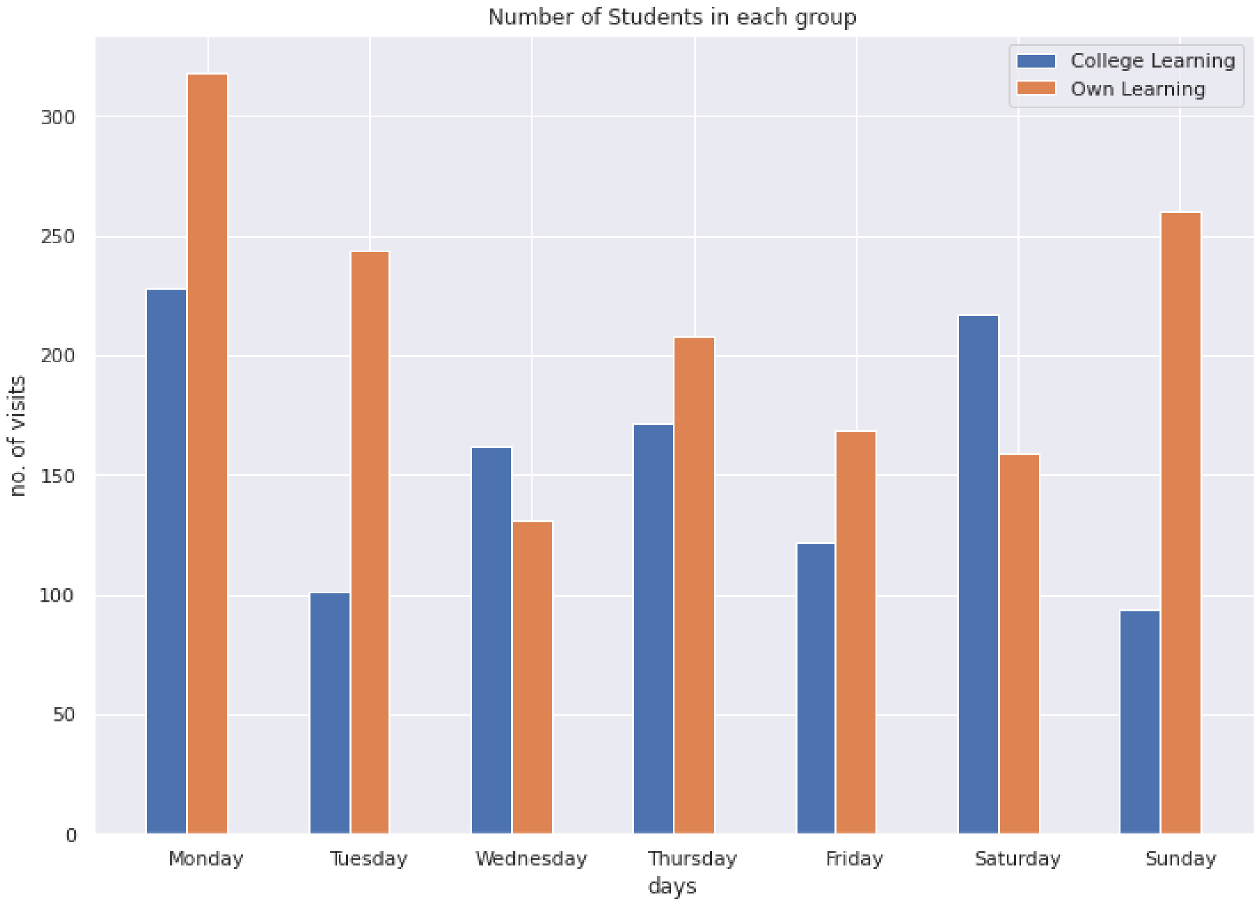
```
The mean number of pages you visited each day is : 39.12048192771084
However, the median of this data is 9.5
and the mode is [1] which occured [28] times

The min visits are 1
and the max visits are 420
```

We can see that I visit around 40 pages each day and there have been around 28 days where I visited only 1 website (hopefully holidays).

Q4) What do I prefer: learning through college professors or learning on my own?

In [ ]:

```
'''
    To answer this question, I will make the following assumptions:
    1) If I learn through college professors, I open the LMS atleast once.
    2) If I learn on my own, I open websites mentioned in the programming and le
'''


x = days_arr
width = 0.25
ind = np.arange(7)
# first we will make array of number of times LMS has been visited in each day
y1 = [0,0,0,0,0,0,0]
df_new = df[df['domain']=='bennett']
for i in df_new['day_num']:
    y1[i-1] += 1
# now we will make array of number of times programming and learning websites ha
y2 = [0,0,0,0,0,0,0]
df_new = df[(df['category'] == "Programming") | (df['category'] == "Learning")]
for i in df_new['day_num']:
    y2[i-1] += 1

plt.bar(ind, y1, 0.25, label = 'College Learning')
plt.bar(ind+width, y2, 0.25, label = 'Own Learning')

plt.xticks(ind+width,days_arr)
plt.xlabel("days")
plt.ylabel("no. of visits")
plt.title("Number of Students in each group")
plt.legend()
plt.show()
```



as we can clearly see, I prefer learning on my own. On saturdays and wednesdays, I tend to open the LMS more whereas, I learn on my own on the other days. This observation fits perfectly with my usual routine where I try to revise college work done during the week on saturdays and do my own learning on sundays and mondays.

CONCLUSION

After so much of analysis, we finally come to the conclusion of our project. To sum up, I took a data set representing my browser history over the past year and tried to extract meaningful insights from it. Since we were able to perform a thorough analysis and also answer so many question, I would call this project a success.

I learnt a lot while doing this project. I gained some interesting insights into my life.

> I realised that I generally shop and visit youtube during class hours 🤭.
>
> I also saw that my top 10 visited websites make up most of my internet activity.
>
> We also saw that my youtube activity goes up whenever my LMS activity comes down and vice versa indicating that these two are co-related.

Future Plans

Apart from offering brower history data, "google takeout" provides all kinds of data that has been collected from your google acoount like google photos data, drive data, and most importantly, google maps data. So, the future plan is to improve upon this project by taking into account data from other services like google maps. This would allow us to answer questions like "what websites I visit while I am travelling?" or "what is the average number of photos I take per outing?"

THE END 🥰