ASSIGNMENT 2

November 22, 2020

1 Using descriptive statistics to find out website performance.

1.0.1 Q1. Overview of Metrics

[1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import math
import statistics
import squarify
import warnings
warnings.simplefilter(action='ignore', category=FutureWarning)
pd.options.mode.chained_assignment = None  # default='warn'
```

[2]:
```
#read file
data = pd.read_csv('tripvn.csv')
```

[3]:
```
#clean data
for i in range(0,len(data)):
    data.Time[i] = data.Time[i].replace(":00 PM", "")
    data.Time[i] = data.Time[i].replace(":00 AM", "")
data['Time'] = pd.to_datetime(data['Time'])
data.tail()
```

[3]:
```
     Unnamed: 0                 Test                Time  Mdn DNS (ms)  \
355         355  [204709] - trip.com 2017-11-30 02:00:00         173.0
356         356  [204709] - trip.com 2017-11-30 04:00:00         352.0
357         357  [204709] - trip.com 2017-11-30 06:00:00         351.0
358         358  [204709] - trip.com 2017-11-30 08:00:00         291.5
359         359  [204709] - trip.com 2017-11-30 10:00:00         298.5

     Mdn SSL (ms)  Avg Time To First Byte (ms)  Mdn Webpage Response (ms)  \
355           NaN                       952.33                     9924.0
356           NaN                       533.33                    10449.0
357           NaN                       493.83                     9370.5
358           NaN                       612.00                     9881.5
359           NaN                       676.83                     9175.0
```

```
     Mdn Render Start (ms)  Avg Image Bytes  Avg Script Bytes  Avg Css Bytes  \
355                 1084.0        729606.45         538064.82       10762.73   
356                 1195.0        908992.58         582276.42       10765.92   
357                 1298.5        771258.33         581006.33       10765.08   
358                 1247.0        685265.08         581263.17       10763.33   
359                 1097.5        785543.17         578519.08       10760.42   

     % Availability  # Runns
355          83.333       12  
356         100.000       12  
357         100.000       12  
358         100.000       12  
359         100.000       12  
```

Table overview of 12 metrics

```
[4]: d1 = {'Metrics':['Values/Descriptive statistics'],
            'Test':[data['Test'].unique()],
            'Time':[data['Time'].agg(['min','max'])],
           'Mdn DNS (ms)':[data['Mdn DNS (ms)'].agg(['min','max','std','mean'])],
           'Mdn SSL (ms)':['Nah'],
           'Avg Time To First Byte (ms)':[data['Avg Time To First Byte (ms)'].
       ↪agg(['min','max','std','mean'])],
           'Mdn Webpage Response (ms)':[data['Mdn Webpage Response (ms)'].
       ↪agg(['min','max','std','mean'])],
           'Mdn Render Start (ms)':[data['Mdn Render Start (ms)'].
       ↪agg(['min','max','std','mean'])],
           'Avg Image Bytes':[data['Avg Image Bytes'].
       ↪agg(['min','max','std','mean'])],
           'Avg Script Bytes':[data['Avg Script Bytes'].
       ↪agg(['min','max','std','mean'])],
           'Avg Css Bytes':[data['Avg Css Bytes'].agg(['min','max','std','mean'])],
           '% Availability':[data['% Availability'].agg(['min','max','std','mean'])],
           '# Runs':[data['# Runs'].agg(['min', 'max'])]}
     df1 = pd.DataFrame(data=d1).transpose()
     pd.set_option('display.max_rows', None)
     pd.set_option('display.max_columns', None)
     pd.set_option('display.width', None)
     pd.set_option('display.max_colwidth', -1)
     df1
```

```
[4]:                                                                         0
     Metrics                       Values/Descriptive statistics
     Test                          [[204709] - trip.com]
     Time                          min   2017-11-01 00:00:00
     max   2017-11-30 12:00:00
     Name: Time, dtype: datetime64[ns]
```

```
Mdn DNS (ms)                 min     108.500000
max     531.500000
std     70.513539
mean    280.076389
Name: Mdn DNS (ms), dtype: float64
Mdn SSL (ms)                 Nah
Avg Time To First Byte (ms)  min     209.750000
max     1957.580000
std     286.766903
mean    593.206944
Name: Avg Time To First Byte (ms), dtype: float64
Mdn Webpage Response (ms)    min     7535.500000
max     30094.000000
std     1461.569220
mean    9593.341667
Name: Mdn Webpage Response (ms), dtype: float64
Mdn Render Start (ms)        min     807.000000
max     2194.500000
std     192.891979
mean    1255.504167
Name: Mdn Render Start (ms), dtype: float64
Avg Image Bytes              min     566819.580000
max     908992.580000
std     61567.944565
mean    731153.379056
Name: Avg Image Bytes, dtype: float64
Avg Script Bytes             min     388817.400000
max     610802.170000
std     19237.706558
mean    573567.277056
Name: Avg Script Bytes, dtype: float64
Avg Css Bytes                min     10755.750000
max     11081.250000
std     25.517700
mean    10767.403389
Name: Avg Css Bytes, dtype: float64
% Availability               min     25.000000
max     100.000000
std     6.689858
mean    95.262775
Name: % Availability, dtype: float64
# Runs                       min    10
max    13
Name: # Runs, dtype: int64
```

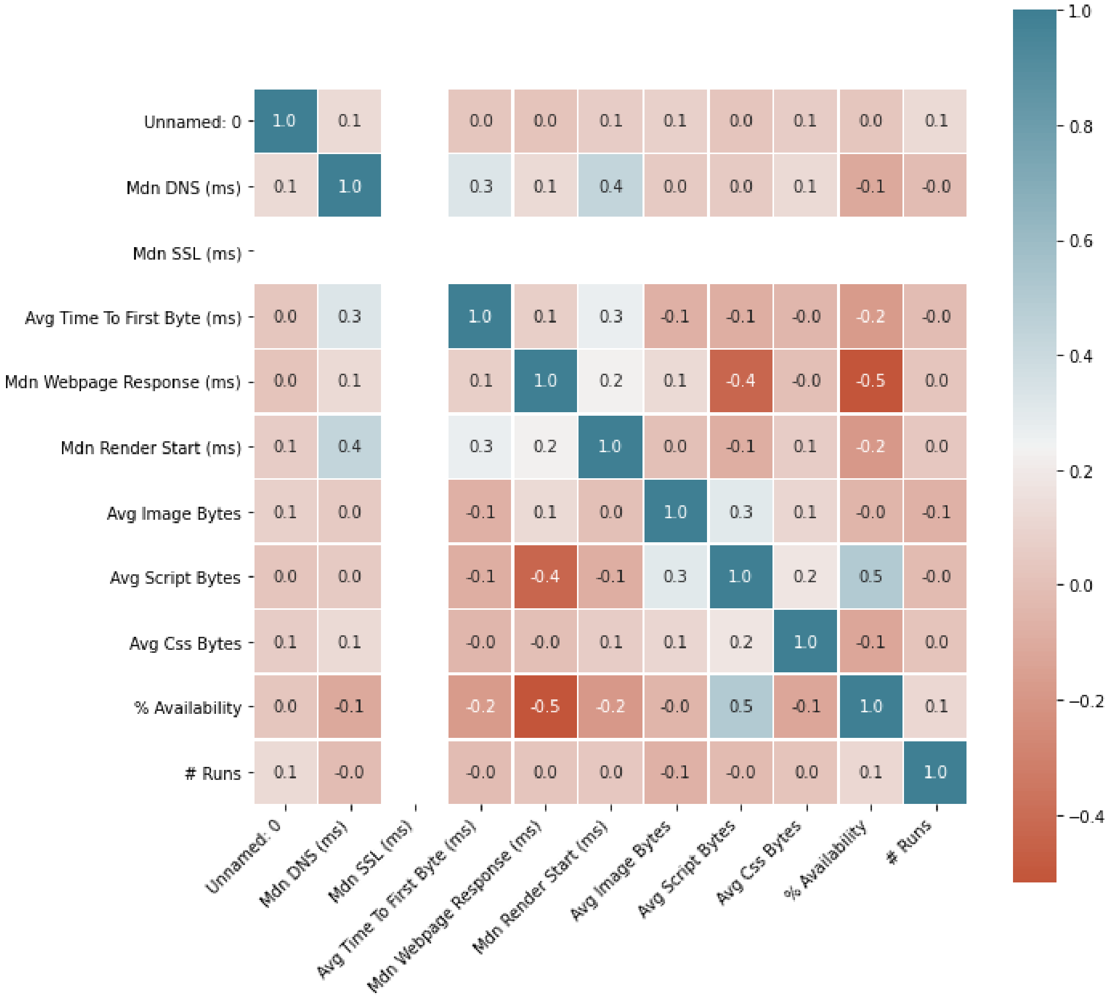
Heat map to show the correlations of the metrics

[5]:

```
f,ax = plt.subplots(figsize=(10,10))
sns.heatmap(data.corr()
            ,annot=True,
            linewidths=.5,
            fmt= '.1f',
            cmap=sns.diverging_palette(20, 220, n=200),
            square=True)
ax.set_xticklabels(
            ax.get_xticklabels(),
            rotation=45,
            horizontalalignment='right')
```

[5]:

```
[Text(0.5, 0, 'Unnamed: 0'),
 Text(1.5, 0, 'Mdn DNS (ms)'),
 Text(2.5, 0, 'Mdn SSL (ms)'),
 Text(3.5, 0, 'Avg Time To First Byte (ms)'),
 Text(4.5, 0, 'Mdn Webpage Response (ms)'),
 Text(5.5, 0, 'Mdn Render Start (ms)'),
 Text(6.5, 0, 'Avg Image Bytes'),
 Text(7.5, 0, 'Avg Script Bytes'),
 Text(8.5, 0, 'Avg Css Bytes'),
 Text(9.5, 0, '% Availability'),
 Text(10.5, 0, '# Runs')]
```



The map above shows the correlations of the metrics. Using the definition of heat map, I see that there're two pairs being slightly more correlative than others. The first pair is Mdn Webpage Response(ms) and % Availability, the another one is Mdn Webpage Response(ms) and Avg Script Bytes. As those are in negative correlation (-0.5 and -0.4), those are in contrary relationship, which means if a metric increases, the another decreases.

1.0.2 Q2. Website Speed Metrics Analysis

In this section, I focus to the metrics that describe the speed of website including : Mdn DNS (ms), Avg Time To First Byte (ms), Mdn Webpage Reponse (ms) and Mdn Render Start

From the definition table provided, I pick key informations for further analysis :

- Mdn DNS (ms) : According to YSlow, the average value take accounts around 20-120ms
- Avg Time To First Byte (ms) : According to KeyCDN, a proper TTFB would be suggested to less than 400 ms
- Mdn Webpage Response (ms) : The average is around 9593 ms
- Mdn Render Start (ms) : The start of render time is suggested to be within 2 seconds

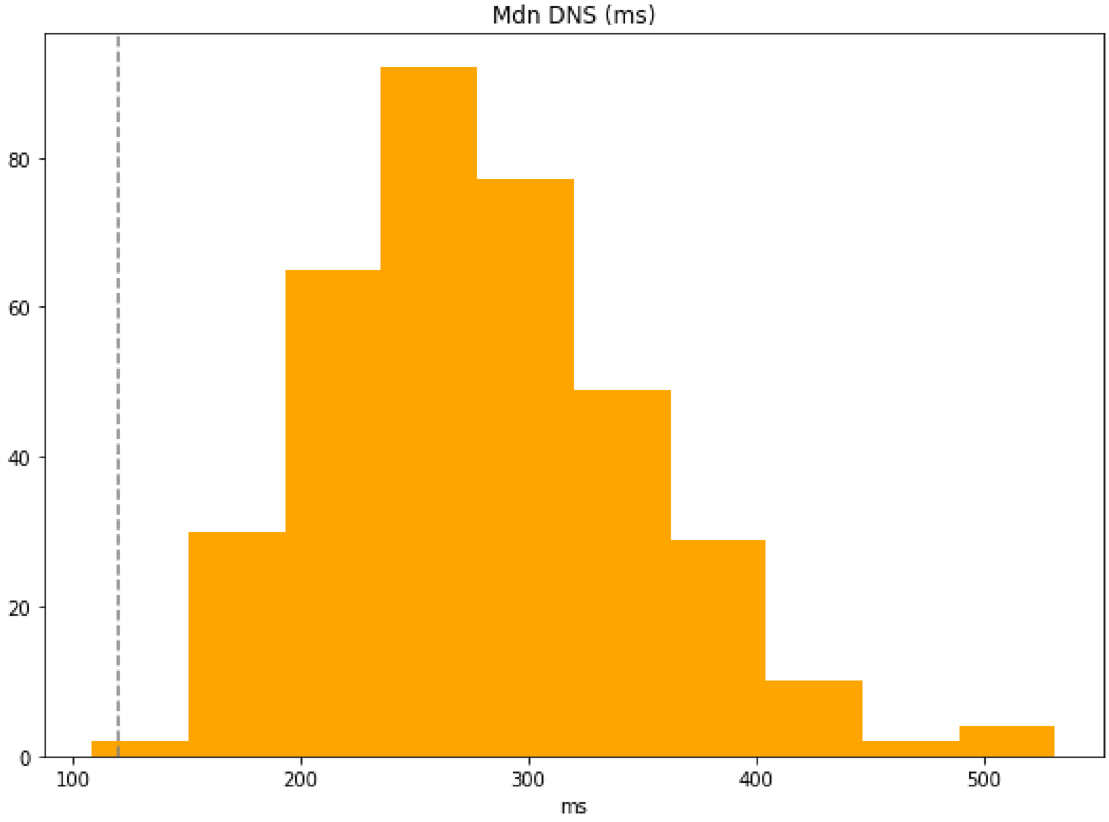
Mdn DNS analysis

[6]:

```
plt.figure(figsize = (10, 7))
x = data["Mdn DNS (ms)"]
plt.hist(x,color = "orange")
plt.title("Mdn DNS (ms)")
plt.xlabel("ms")
plt.axvline(x=120,color='gray',linestyle='--')
```

[6]:

```
<matplotlib.lines.Line2D at 0x1252636a0>
```



Looking to the graph, the gray line expresses the average value of Mdn DNS (120ms), however, the graph insists the average metrics of this website around 250-280ms, which is much higher than the average provided by YSlow. Also, there's time that time to find IP of is significant high (around 500ms or higher). Those are shown below.

[7]:

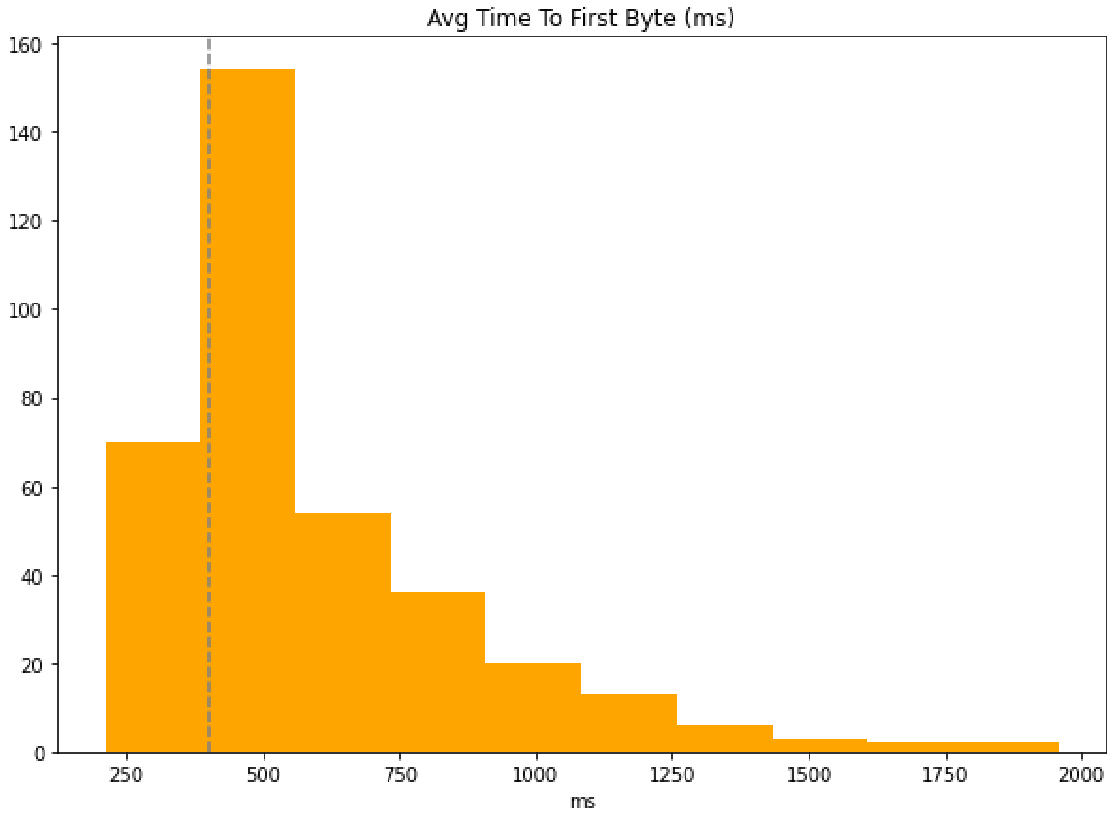
```
df = data.loc[data['Mdn DNS (ms)']>500]
print(df[['Mdn DNS (ms)','Time']])
```

```
     Mdn DNS (ms)                Time
103  508.5        2017-11-09 14:00:00
234  526.5        2017-11-20 12:00:00
340  531.5        2017-11-29 08:00:00
```

Avg Time To First Byte analysis

[8]:
```
plt.figure(figsize = (10, 7))
x = data["Avg Time To First Byte (ms)"]
plt.hist(x,color = "orange")
plt.title("Avg Time To First Byte (ms)")
plt.xlabel("ms")
plt.axvline(x=400,color='gray',linestyle='--')
```

[8]:
```
<matplotlib.lines.Line2D at 0x1253eca20>
```



From the graph, the average value of this website is around 500ms, which is a little bit higher than the average value from KeyCND (400ms). Let's check when it takes significant time (outlier) to send request to the server and wait until the first byte of the response to the client.

[9]:
```
df = data.loc[data['Avg Time To First Byte (ms)']>1600]
print(df[['Avg Time To First Byte (ms)','Time']])
```

```
     Avg Time To First Byte (ms)                 Time
56   1716.36                      2017-11-05 16:00:00
234  1938.08                      2017-11-20 12:00:00
241  1957.58                      2017-11-21 02:00:00
293  1612.58                      2017-11-25 10:00:00
```

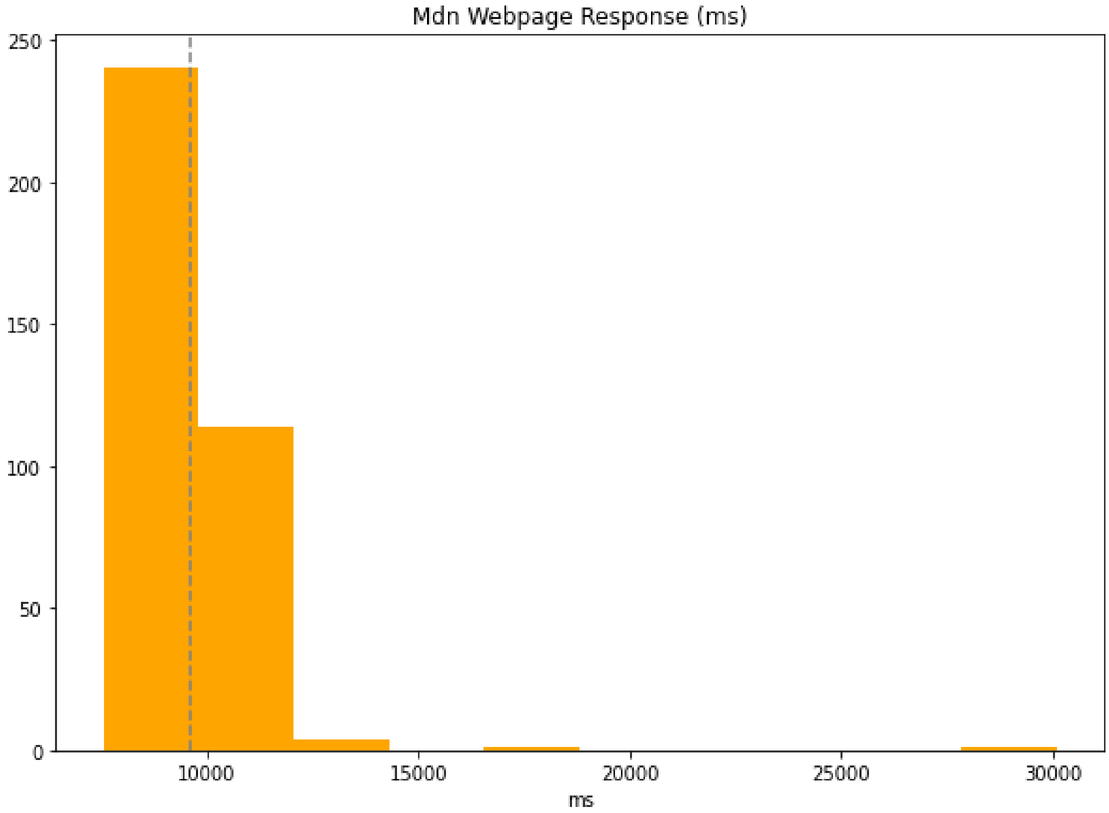
Mdn Webpage Response (ms)

[10]:

```
plt.figure(figsize = (10, 7))
x = data["Mdn Webpage Response (ms)"]
plt.hist(x,color = "orange")
plt.title("Mdn Webpage Response (ms)")
plt.xlabel("ms")
plt.axvline(x=9593,color='gray',linestyle='--')
```

[10]:

```
<matplotlib.lines.Line2D at 0x124b59da0>
```



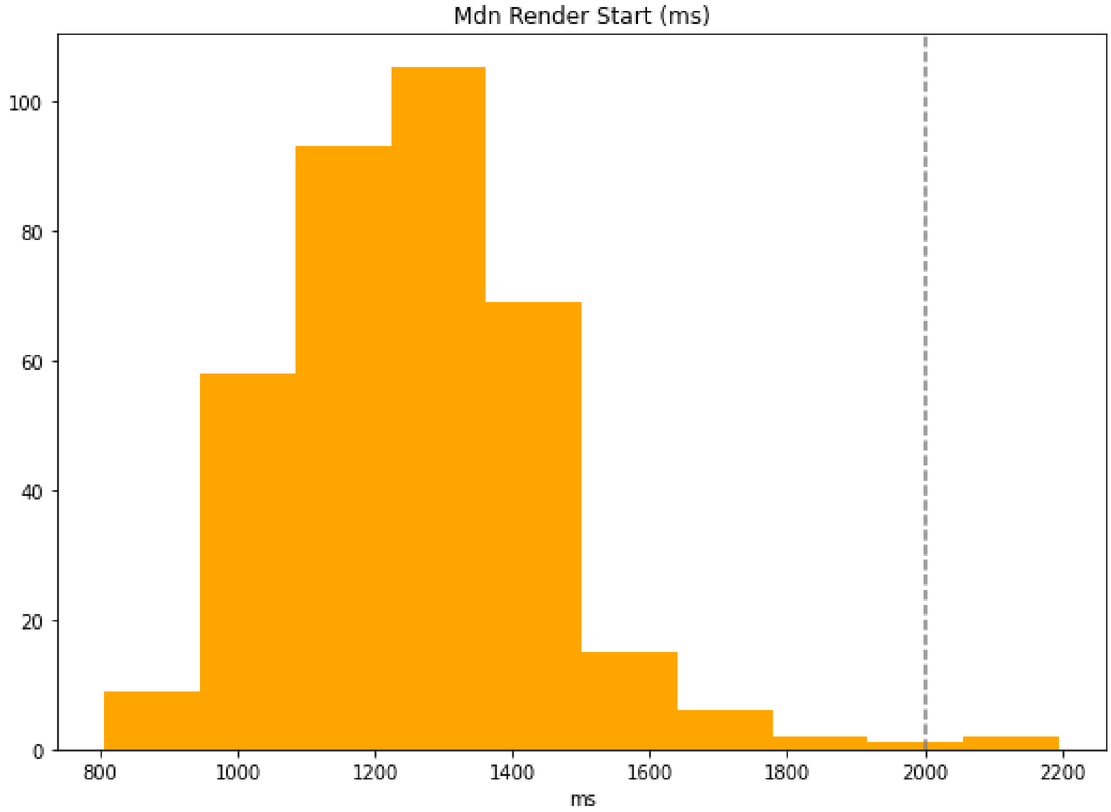
In this category, the average response time of this website is slightly higher than the average acceptable metric (less than 9593ms). However, it has some outliers which showcase that the reponse time is surprisingly low, those are 18s and 30s.

Mdn Render Start (ms)

[11]:

```
plt.figure(figsize = (10, 7))
x = data["Mdn Render Start (ms)"]
plt.hist(x,color = "orange")
plt.title("Mdn Render Start (ms)")
plt.xlabel("ms")
plt.axvline(x=2000,color='gray',linestyle='--')
```

```
[11]: <matplotlib.lines.Line2D at 0x1257ba7f0>
```



This graphs show great performance from the website, almost all metrics are lower than the acceptable metric(2s). There are two outliers, which can be shown below.

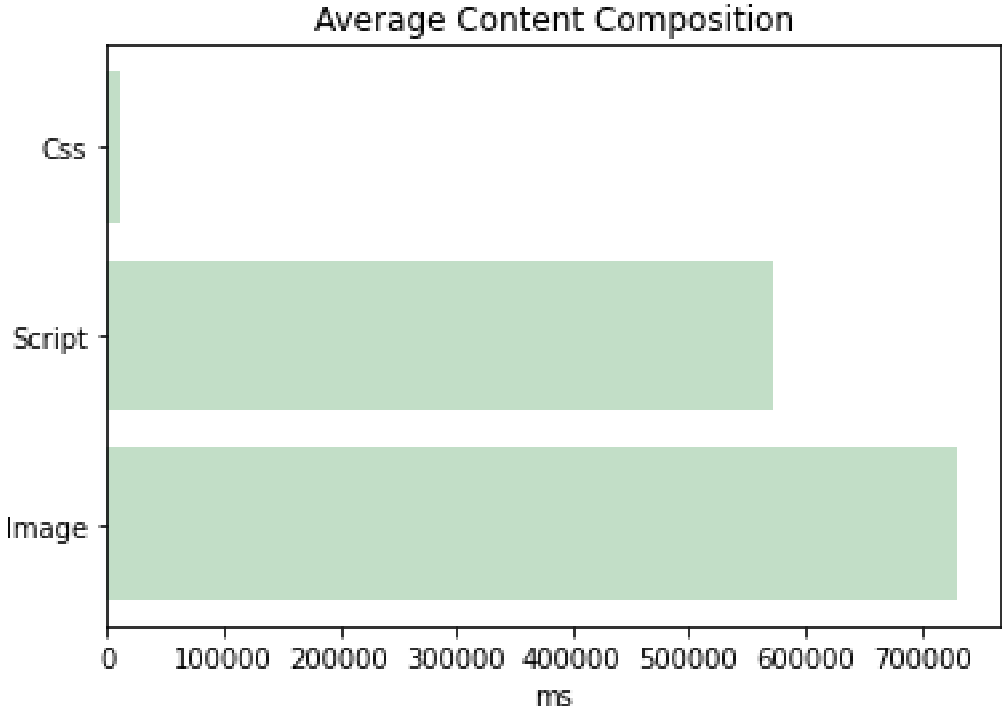
```
[12]: df = data.loc[data['Mdn Render Start (ms)']>2000]
      print(df[['Mdn Render Start (ms)','Time']])
```

```
     Mdn Render Start (ms)                 Time
43   2094.5                2017-11-04 14:00:00
103  2194.5                2017-11-09 14:00:00
```

1.0.3 Q3. Website Content Analysis

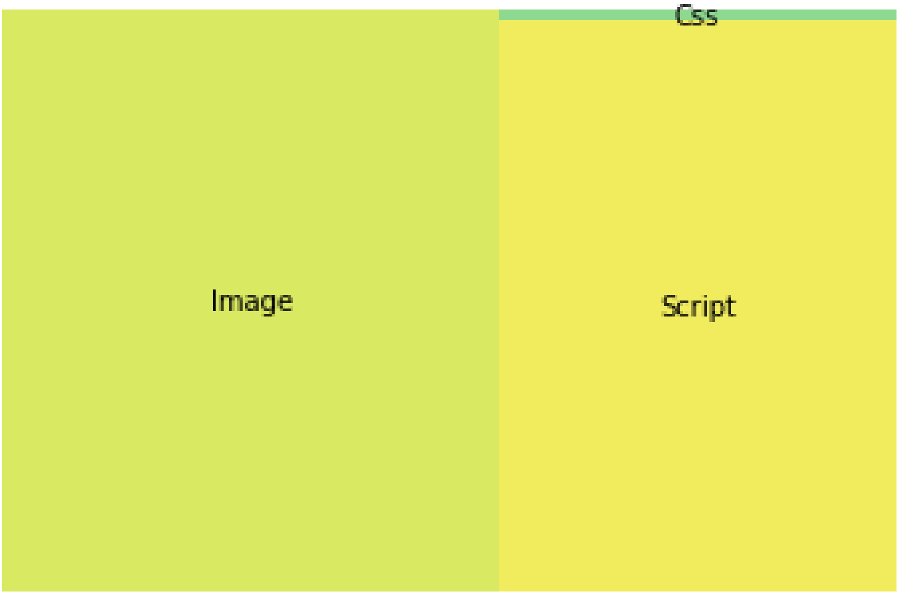
```
[13]: fig, ax = plt.subplots()
      Image = data['Avg Image Bytes'].mean()
      Script = data['Avg Script Bytes'].mean()
      Css = data['Avg Css Bytes'].mean()
      metrics = (Image,Script,Css)
      names = ('Image','Script','Css')
      y_pos = np.arange(len(metrics))
      plt.barh(y_pos, metrics, align='center', alpha=0.5, color='#86bf91', zorder=1)
      plt.yticks(y_pos, names)
      plt.title('Average Content Composition')
      plt.xlabel("ms")
```

```
[13]: Text(0.5, 0, 'ms')
```



```
[17]: squarify.plot(sizes=metrics, label=names, alpha=0.7 )
      plt.axis('off')
```

```
[17]: (0.0, 100.0, 0.0, 100.0)
```



It's shown that Image and Script take most content of the website. The average size of Image, Script and Css respectively are 731153.4, 573567.3, 10767.4 bytes. Hence, the average of all content metrics are 1315488.1 bytes = 1315.49KB. In comparison with the size of traveloka.com which has 878.1KB, this websize has larger size of content. This might be the cause to bad performance of website. To increase performance, I suggest reducing the size of Image and Script of this website.

```
[25]: metrics
```

```
[25]: (731153.3790555556, 573567.2770555556, 10767.403388888888)
```

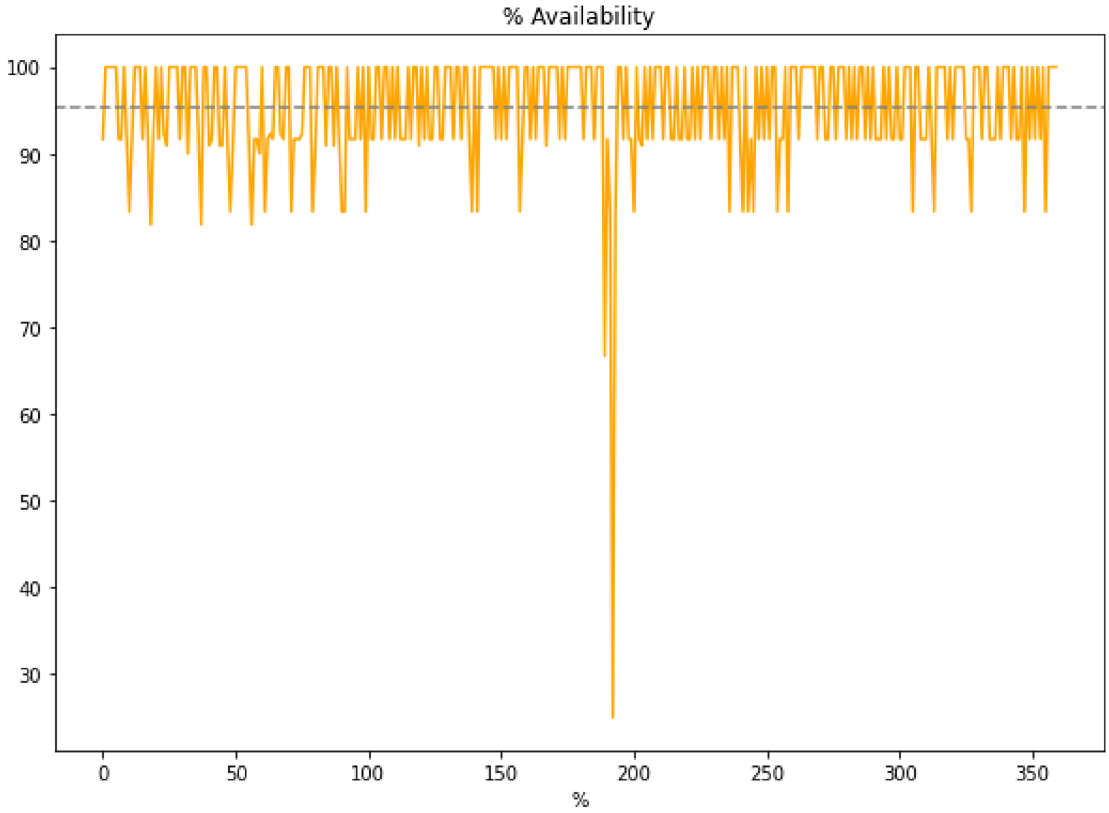
```
[26]: 731153.4 + 573567.3 + 10767.4
```

```
[26]: 1315488.1
```

1.0.4 Q4. Website Availability

```
[56]: plt.figure(figsize = (10, 7))
      x = data["% Availability"]
      plt.plot(x,color = "orange")
      plt.title("% Availability")
      plt.xlabel("%")
      plt.axhline(y=x.mean(),color='gray',linestyle='--')
```

```
[56]: <matplotlib.lines.Line2D at 0x125b475c0>
```



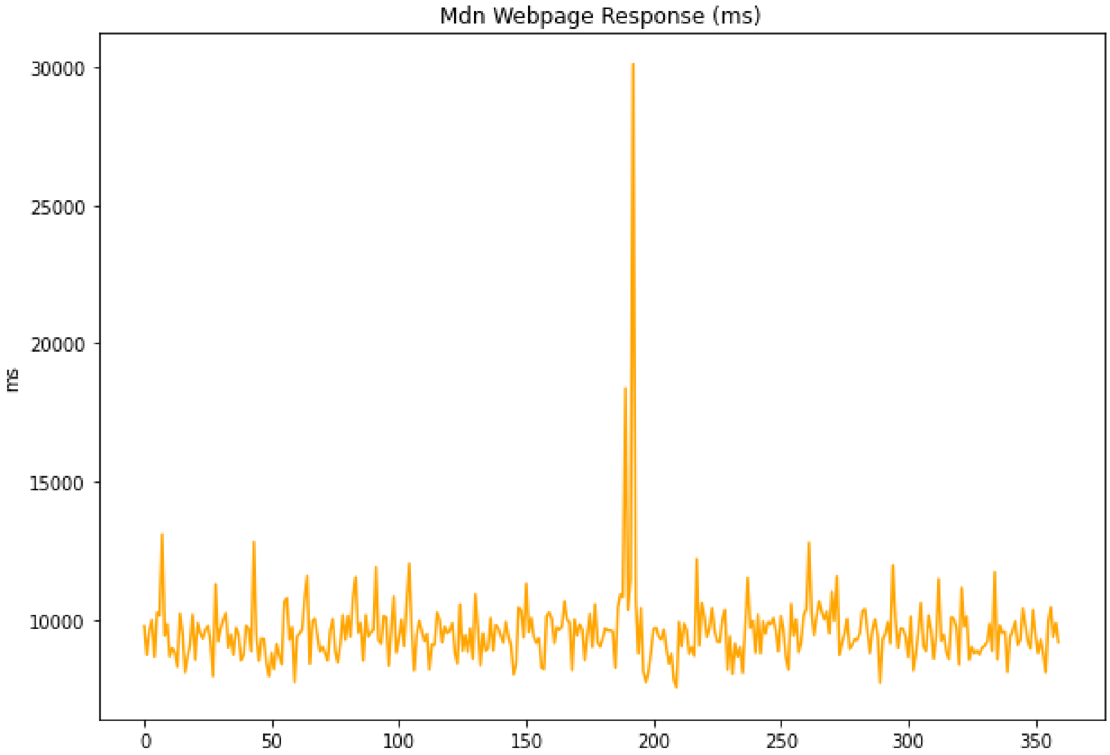
Average availability of this website is 95% which is considered as good performance. However, there are outliers when the metric drops significantly. Let's check when this category metric drops.

[57]:
```
df = data.loc[data['% Availability']<70]
print(df[['% Availability','Time']])
```

```
     % Availability                Time
189   66.667        2017-11-16 06:00:00
192   25.000        2017-11-17 12:00:00
```

[58]:
```
plt.figure(figsize = (10, 7))
x = data["Mdn Webpage Response (ms)"]
plt.plot(x,color = "orange")
plt.title("Mdn Webpage Response (ms)")
plt.ylabel("ms")
```

[58]:
```
Text(0, 0.5, 'ms')
```



In the 1st question, I see that Mdn Webpage Response(ms) and % Availability are in contrary correlative. Thus, when checking, I see that when the availability of the website drops, this is time when the webpage has the highest response.

```
[ ]:
```