Telangana Tourism Analysis

Data Importing & Cleaning

1. Importing libraries

```
[1]: import pandas as pd
     import numpy as np
     import matplotlib.pyplot as plt
     import seaborn as sb
     import geopandas as gpd
     from matplotlib.ticker import FuncFormatter
     from sklearn.linear_model import LinearRegression
```

2. Importing data

```
[2]: #importing data for domestic visitors
     df_dv16 = pd.read_csv('domestic_visitors/domestic_visitors_2016.csv')
     df_dv17 = pd.read_csv('domestic_visitors/domestic_visitors_2017.csv')
     df_dv18 = pd.read_csv('domestic_visitors/domestic_visitors_2018.csv')
     df_dv19 = pd.read_csv('domestic_visitors/domestic_visitors_2019.csv')

     #importing data for foreign visitors
     df_fv16 = pd.read_csv('foreign_visitors/foreign_visitors_2016.csv')
     df_fv17 = pd.read_csv('foreign_visitors/foreign_visitors_2017.csv')
     df_fv18 = pd.read_csv('foreign_visitors/foreign_visitors_2018.csv')
     df_fv19 = pd.read_csv('foreign_visitors/foreign_visitors_2019.csv')
```

3. Reading sample data

```
[3]: df_dv18.sample(2)
```

```
[3]:         district        date   month  year visitors
     148 Mahbubnagar  01-05-2018     May  2018   193478
     211    Nalgonda  01-08-2018  August  2018    10135
```

```
[4]: df_fv18.sample(2)
```

```
[4]:                     district        date    month  year visitors
     0                   Adilabad  01-01-2018  January  2018        0
     66  Jayashankar Bhoopalpally  01-07-2018     July  2018       40
```

4. Checking DataTypes & Null Values

```
[5]: #checking rows and columns
     print(df_dv16.shape, df_dv17.shape, df_dv18.shape, df_dv19.shape)
     print(df_fv16.shape, df_fv17.shape, df_fv18.shape, df_fv19.shape)
```

```
(372, 5) (372, 5) (372, 5) (396, 5)
(372, 5) (372, 5) (372, 5) (396, 5)
```

```
[6]: #checking data types and null values
     df_dv19.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 396 entries, 0 to 395
Data columns (total 5 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   district  396 non-null    object
 1   date      396 non-null    object
 2   month     396 non-null    object
 3   year      396 non-null    int64
 4   visitors  378 non-null    object
dtypes: int64(1), object(4)
memory usage: 15.6+ KB
```

Values despite being empty are not null and just space & columns not in proper format

5. Handling Null/Blank Values & Changing Type

```
[7]: #changing type and values of domestic data
     df_dv16['visitors'] = df_dv16['visitors'].replace(' ',0)
     df_dv16['visitors'] = df_dv16['visitors'].astype(int)
     df_dv16['date'] = pd.to_datetime(df_dv16['date'])

     df_dv17['visitors'] = df_dv17['visitors'].replace(' ',0)
     df_dv17['visitors'] = df_dv17['visitors'].astype(int)
     df_dv17['date'] = pd.to_datetime(df_dv17['date'])

     df_dv18['visitors'] = df_dv18['visitors'].fillna(0)
     df_dv18['visitors'] = df_dv18['visitors'].replace(' ',0)
     df_dv18['visitors'] = df_dv18['visitors'].astype(int)
     df_dv18['date'] = pd.to_datetime(df_dv18['date'])

     df_dv19['visitors'] = df_dv19['visitors'].fillna(0)
     df_dv19['visitors'] = df_dv19['visitors'].replace(' ',0)
```

```
df_dv19['visitors'] = df_dv19['visitors'].astype(int)
df_dv19['date'] = pd.to_datetime(df_dv19['date'])
df_dv19['district'] = df_dv19['district'].replace('Narayanapet','Narayanpet')
```

[8]:
```
#changing type and values of foreign data
df_fv16['visitors'] = df_fv16['visitors'].replace(' ',0)
df_fv16['visitors'] = df_fv16['visitors'].astype(int)
df_fv16['date'] = pd.to_datetime(df_fv16['date'])

df_fv17['visitors'] = df_fv17['visitors'].replace(' ',0)
df_fv17['visitors'] = df_fv17['visitors'].astype(int)
df_fv17['date'] = pd.to_datetime(df_fv17['date'])

df_fv18['visitors'] = df_fv18['visitors'].replace(' ',0)
df_fv18['visitors'] = df_fv18['visitors'].astype(int)
df_fv18['date'] = pd.to_datetime(df_fv18['date'])

df_fv19['visitors'] = df_fv19['visitors'].replace(' ',0)
df_fv19['visitors'] = df_fv19['visitors'].astype(int)
df_fv19['date'] = pd.to_datetime(df_fv19['date'])
```

6. Merging DataFrames

[9]:
```
#merging domestic & foreign data for each year
df_2016 = pd.merge(df_dv16, df_fv16, on=['district','date','month','year'],␣
 ↪suffixes=('_domestic','_foreign'),how='outer')
df_2017 = pd.merge(df_dv17, df_fv17, on=['district','date','month','year'],␣
 ↪suffixes=('_domestic','_foreign'),how='outer')
df_2018 = pd.merge(df_dv18, df_fv18, on=['district','date','month','year'],␣
 ↪suffixes=('_domestic','_foreign'),how='outer')
df_2019 = pd.merge(df_dv19, df_fv19, on=['district','date','month','year'],␣
 ↪suffixes=('_domestic','_foreign'),how='outer')
```

[10]:
```
#merging data of all years
df_merged = (df_2016.merge(df_2017,␣
 ↪on=['district','month'],how='outer',suffixes=('_16','_17'))
            .merge(df_2018,␣
 ↪on=['district','month'],how='outer',suffixes=('_17','_18'))
            .merge(df_2019,␣
 ↪on=['district','month'],how='outer',suffixes=('_18','_19')))

#rearranging columns
df_all =␣
 ↪df_merged[['district','month','visitors_domestic_16','visitors_foreign_16',
                    'visitors_domestic_17','visitors_foreign_17',
                    'visitors_domestic_18','visitors_foreign_18',
                    'visitors_domestic_19','visitors_foreign_19']]
```

```
df_all.head(2)
```

```
[10]:    district     month  visitors_domestic_16  visitors_foreign_16  \
      0  Adilabad   January              792136.0                  2.0
      1  Adilabad  February              937820.0                  0.0

         visitors_domestic_17  visitors_foreign_17  visitors_domestic_18  \
      0              318799.0                  5.0              320356.0
      1               83316.0                  0.0               36550.0

         visitors_foreign_18  visitors_domestic_19  visitors_foreign_19
      0                  0.0                 25071                    0
      1                  0.0                406177                    2
```

Data Analysis

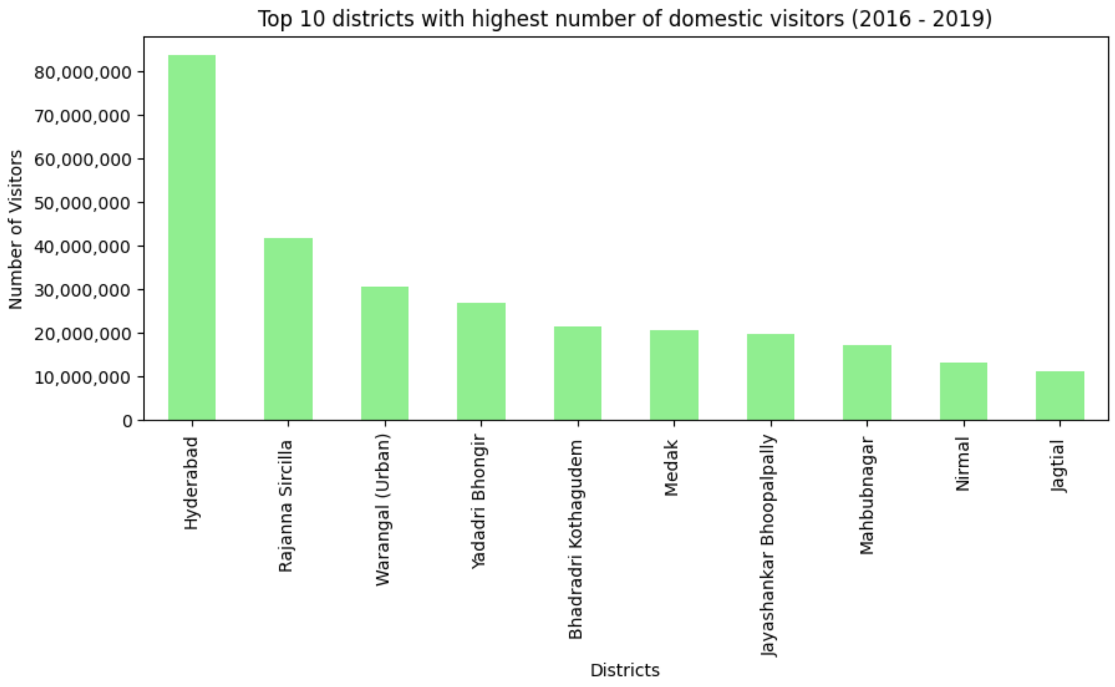
1. List down the top 10 districts that have the highest number of domestic visitors overall (2016 - 2019)?

```
[11]: #turning NaN to 0 for calculations
      df_all = df_all.fillna(0)

      #calculating total domestic & foreign visitors
      df_all['total_domestic'] =␣
        ↪df_all['visitors_domestic_16']+df_all['visitors_domestic_17']+df_all['visitors_domestic_18'
      df_all['total_foreign'] =␣
        ↪df_all['visitors_foreign_16']+df_all['visitors_foreign_17']+df_all['visitors_foreign_18']+d
```

```
[12]: #top 10
      df_dv10 = df_all.groupby('district')['total_domestic'].sum().
        ↪sort_values(ascending=False).head(10)
      df_dv10
```

```
[12]: district
      Hyderabad                  83900960.0
      Rajanna Sircilla           41763276.0
      Warangal (Urban)           30726603.0
      Yadadri Bhongir            26893080.0
      Bhadradri Kothagudem       21600962.0
      Medak                      20542639.0
      Jayashankar Bhoopalpally   19632865.0
      Mahbubnagar                17180118.0
      Nirmal                     13315796.0
      Jagtial                    11303514.0
      Name: total_domestic, dtype: float64
```

[13]:
```python
#plotting
def format_y_ticks(value, tick_number):
    return f'{value:,.0f}'

fig, ax = plt.subplots(figsize=(10,4))
df_dv10.plot(kind='bar', color='lightgreen',ax=ax)

ax.set_title('Top 10 districts with highest number of domestic visitors (2016 -␣
 ↪2019)')
ax.set_ylabel('Number of Visitors')
ax.set_xlabel('Districts')
ax.yaxis.set_major_formatter(FuncFormatter(format_y_ticks))

plt.show()
```

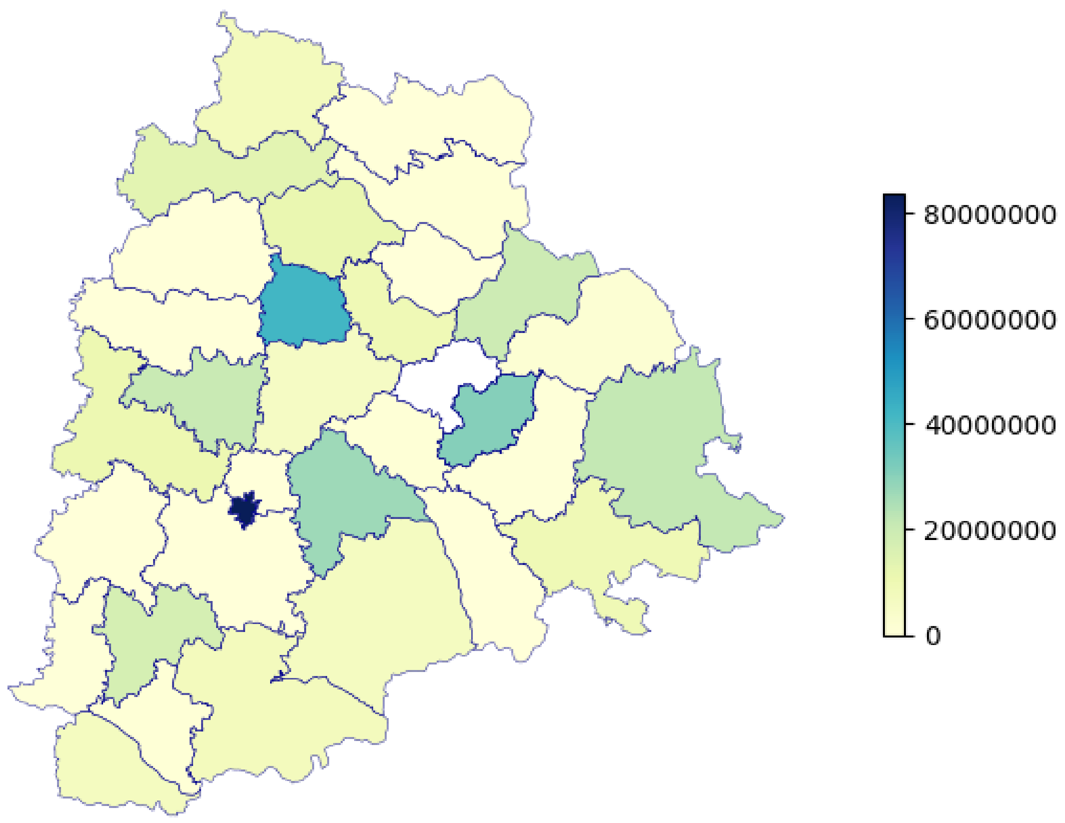


Creating a choropleth map to show domestic visitors of every district

[14]:
```python
#importing shape file
shp_telangana = gpd.read_file('shape/TS_District_Boundary_33_FINAL.shp')

#grouping and matching data for merging
dv_dist = df_all.groupby('district')['total_domestic'].sum().reset_index()
dv_dist['district'] = dv_dist['district'].str.strip()
dv_dist['district'].replace({'Jayashankar Bhoopalpally':'Jayashankar␣
 ↪Bhupalpally',
                             'Komaram Bheem Asifabad':'Kumurambheem Asifabad',
                             'Jangaon':'Jangoan',
                             'Medchal':'Medchal_Malkajgiri',
                             'Ranga Reddy':'Rangareddy',
                             'Mahbubnagar':'Mahabubnagar',
                             'Warangal (Rural)':'Warangal',
                             'Warangal (Urban)':'Warangal',
                             'Yadadri Bhongir':'Yadadri Bhuvanagiri'},␣
↪inplace=True)

#merging shape df & data df
df_shape = shp_telangana.merge(dv_dist, left_on='DISTRICT_N',␣
↪right_on='district', how='outer')
```

[15]:
```
#chaniging df type to gdf
df_shape = gpd.GeoDataFrame(df_shape)

#Plotting choropleth map
ax = df_shape.boundary.plot(edgecolor='darkblue', linewidth = 0.3,␣
 ↪figsize=(8,6))

df_shape.plot(ax=ax, column='total_domestic', cmap='YlGnBu',
            legend=True, legend_kwds={'shrink':0.5, 'format': '%.0f'} )

#removing axis and setting title
ax.axis('off')
ax.set_title('Domestic visitors of every Telangana District', size=12,␣
 ↪color='blue')

plt.show()
```

Domestic visitors of every Telangana District



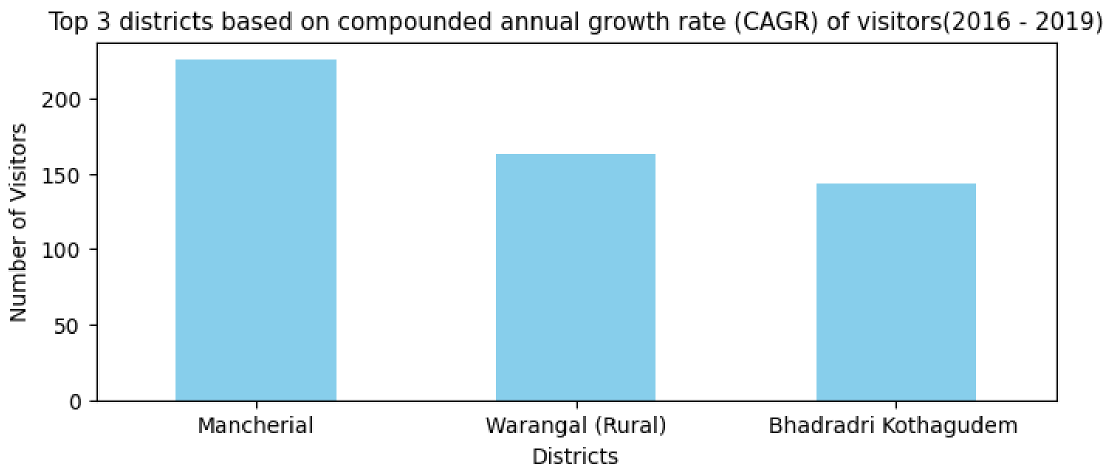
2. List down the top 3 districts based on compounded annual growth rate (CAGR) of visitors between (2016 - 2019)?

[16]:
```
#creating df to calculate CAGR
df_cagr = df_all.
 ↪groupby('district')[['visitors_domestic_16','visitors_foreign_16',
                                                      ␣
 ↪'visitors_domestic_19','visitors_foreign_19']].sum()
df_cagr['total_visitors16'] =␣
 ↪df_cagr['visitors_domestic_16']+df_cagr['visitors_foreign_16']
df_cagr['total_visitors19'] =␣
 ↪df_cagr['visitors_domestic_19']+df_cagr['visitors_foreign_19']

#replacing 0 with NaN so division by 0 doesnt happen
df_cagr['total_visitors16'] = df_cagr['total_visitors16'].replace(0, np.nan)
```

```
[17]: #top 3 by CAGR
cagr = ((df_cagr['total_visitors19']/df_cagr['total_visitors16'])**(1/3)-1)*100
df_cagr3 = round(cagr.sort_values(ascending=False),2).head(3)
df_cagr3
```

```
[17]: district
Mancherial                225.80
Warangal (Rural)          163.15
Bhadradri Kothagudem      143.39
dtype: float64
```

```
[18]: #plotting
fig, ax = plt.subplots(figsize=(8,3))
df_cagr3.plot(kind='bar', color='skyblue',ax=ax)

ax.set_title('Top 3 districts based on compounded annual growth rate (CAGR) of␣
 ↪visitors(2016 - 2019)', size=11)
ax.set_ylabel('Number of Visitors')
ax.set_xlabel('Districts')
plt.xticks(rotation=0)

plt.show()
```

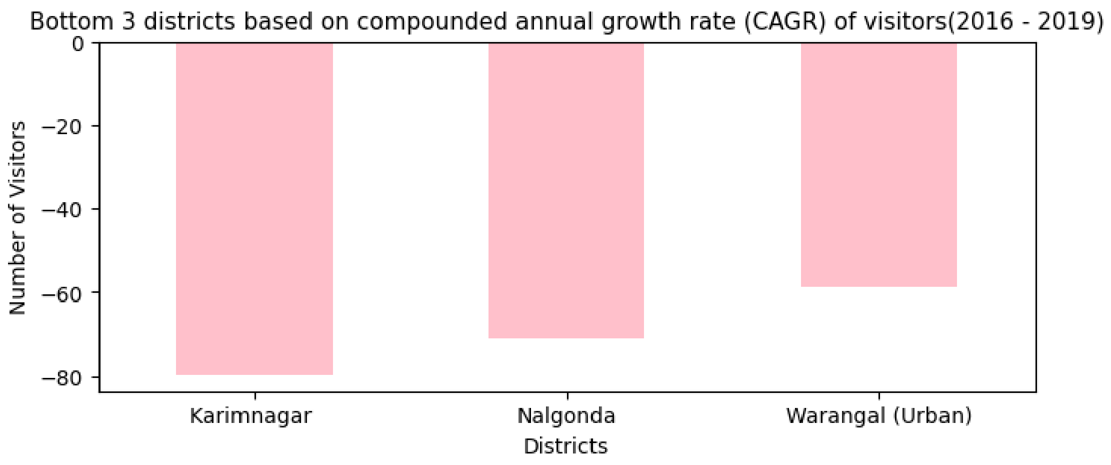


3. List down the bottom 3 districts based on compounded annual growth rate (CAGR) of visitors between (2016 - 2019)?

```
[19]: #bottom 3 by CAGR
df_cagrb3 = round(cagr.sort_values(ascending=True),2).dropna().head(3)
df_cagrb3
```

[19]:
```
district
Karimnagar         -79.63
Nalgonda           -71.13
Warangal (Urban)   -58.85
dtype: float64
```

[20]:
```
#plotting
fig, ax = plt.subplots(figsize=(8,3))
df_cagrb3.plot(kind='bar', color='pink',ax=ax)

ax.set_title('Bottom 3 districts based on compounded annual growth rate (CAGR)␣
 ↪of visitors(2016 - 2019)', size=11)
ax.set_ylabel('Number of Visitors')
ax.set_xlabel('Districts')
plt.xticks(rotation=0)

plt.show()
```



4. What are the peak and low season months for Hyderabad based on the data from 2016 to 2019 for Hyderabad district?

[21]:
```
#calculating total visitors
df_all['total_visitors'] = df_all['total_domestic']+df_all['total_foreign']
```

[22]:
```
#filtering Hyderabad data
df_hyd = df_all[df_all['district']=='Hyderabad']

#total visitors count in each month across 4 years
hyd_tv = df_hyd[['month','total_visitors']].
 ↪sort_values(by='total_visitors',ascending=False)
#domestic visitors count in each month across 4 years
```

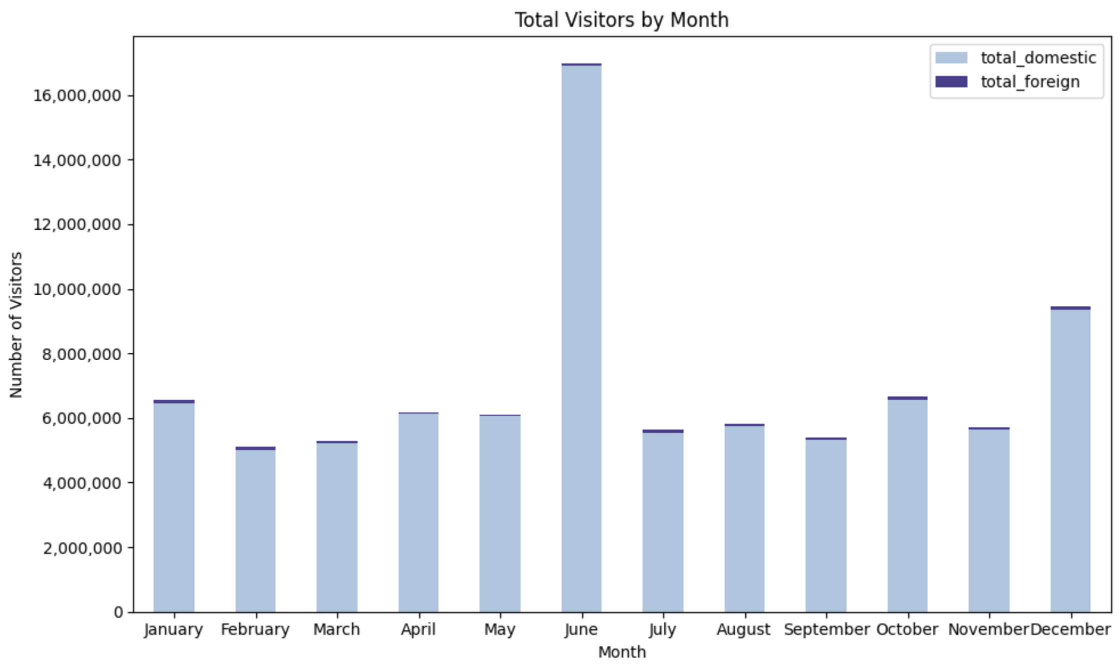
```
hyd_dv = df_hyd[['month','total_domestic']].
  ↪sort_values(by='total_domestic',ascending=False)
#foreign visitors count in each month across 4 years
hyd_fv = df_hyd[['month','total_foreign']].
  ↪sort_values(by='total_foreign',ascending=False)
#combining all 3
hyd_av = pd.merge(hyd_tv,hyd_dv, on='month').merge(hyd_fv, on='month')

#define the month order
month_order = ['January', 'February', 'March', 'April', 'May', 'June',
                'July', 'August', 'September', 'October', 'November',␣
  ↪'December']

#convert the 'month' column to a categorical type with the specified order
hyd_av['month'] = pd.Categorical(hyd_av['month'], categories=month_order,␣
  ↪ordered=True)
hyd_av = hyd_av.sort_values('month')
hyd_av
```

[22]:

```
        month  total_visitors  total_domestic  total_foreign
3     January       6558551.0       6452101.0       106450.0
11   February       5118208.0       5014430.0       103778.0
10      March       5303984.0       5227626.0        76358.0
4       April       6187334.0       6126839.0        60495.0
5         May       6109590.0       6049214.0        60376.0
0        June      16965307.0      16897783.0        67524.0
8        July       5633143.0       5552527.0        80616.0
6      August       5834736.0       5750967.0        83769.0
9   September       5406363.0       5312283.0        94080.0
2     October       6650351.0       6552397.0        97954.0
7    November       5719659.0       5626156.0        93503.0
1    December       9458632.0       9338637.0       119995.0
```

[23]:

```
#plotting
def format_y_ticks(value, tick_number):
    return f'{value:,.0f}'

fig, ax = plt.subplots(figsize=(10, 6))
hyd_av.plot(kind='bar',stacked=True, x='month', y=['total_domestic',␣
  ↪'total_foreign'], ax=ax, color=['lightsteelblue', 'darkslateblue'])

ax.set_title('Total Visitors by Month')
ax.set_ylabel('Number of Visitors')
ax.set_xlabel('Month')
ax.yaxis.set_major_formatter(FuncFormatter(format_y_ticks))

plt.xticks(rotation=0)
plt.tight_layout()
plt.show()
```



5. Show the top & bottom 3 districts with high domestic to foreign tourist ratio?

[24]:
```
#grouping domestic & foreign visitors by district
df_d2fr = df_all.groupby('district')[['total_domestic','total_foreign']].sum()

#calculating domestic to foreign tourist ratio
df_d2fr['domestic_to_foreign_ratio'] = df_d2fr['total_domestic']/
 ↪df_d2fr['total_foreign']

#handling inf values and replacing null with 0
df_d2fr['domestic_to_foreign_ratio'].replace([np.inf, -np.inf], np.nan,␣
 ↪inplace=True)
df_d2fr['domestic_to_foreign_ratio'].fillna(0, inplace=True)

#formating numbers in scientific notation to string then converting it to float␣
 ↪for sorting
df_d2fr['domestic_to_foreign_ratio'] = df_d2fr['domestic_to_foreign_ratio'].
 ↪apply(lambda x: f"{x:.2f}")
df_d2fr['domestic_to_foreign_ratio'] = df_d2fr['domestic_to_foreign_ratio'].
 ↪astype(float)
```

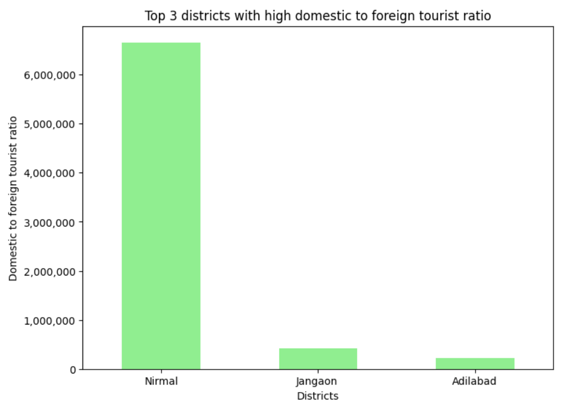
[25]:
```
#top 3
dtfr_t3 = df_d2fr.sort_values(by='domestic_to_foreign_ratio', ascending=False).
  ↪head(3).reset_index()
dtfr_t3
```

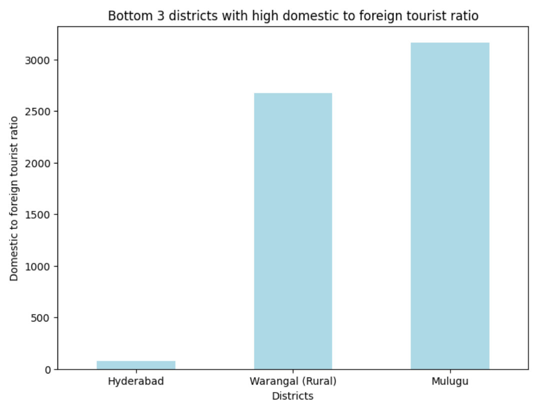
[25]:
```
   district  total_domestic  total_foreign  domestic_to_foreign_ratio
0    Nirmal      13315796.0            2.0                 6657898.00
1  Jangaon         826280.0            2.0                  413140.00
2  Adilabad       7321575.0           32.0                  228799.22
```

[26]:
```
#bottom 3
dtfr_b3 = df_d2fr[df_d2fr['domestic_to_foreign_ratio']!=0].
  ↪sort_values(by='domestic_to_foreign_ratio', ascending=True).head(3).
  ↪reset_index()
dtfr_b3
```

[26]:
```
           district  total_domestic  total_foreign  domestic_to_foreign_ratio
0         Hyderabad      83900960.0      1044898.0                      80.30
1  Warangal (Rural)        819162.0          306.0                    2677.00
2            Mulugu       1819800.0          575.0                    3164.87
```

[27]:
```
#plotting
def format_y_ticks(value, tick_number):
    return f'{value:,.0f}'

fig, axes = plt.subplots(nrows=1, ncols=2, figsize=(18, 6))

dtfr_t3.plot(kind='bar', x='district', y='domestic_to_foreign_ratio',␣
  ↪color='lightgreen', ax=axes[0], legend=False)
dtfr_b3.plot(kind='bar', x='district', y='domestic_to_foreign_ratio',␣
  ↪color='lightblue', ax=axes[1], legend=False)

axes[0].set_title('Top 3 districts with high domestic to foreign tourist ratio')
axes[0].set_ylabel('Domestic to foreign tourist ratio')
axes[0].set_xlabel('Districts')
axes[0].yaxis.set_major_formatter(FuncFormatter(format_y_ticks))
axes[0].set_xticklabels(axes[0].get_xticklabels(), rotation=0)

axes[1].set_title('Bottom 3 districts with high domestic to foreign tourist␣
  ↪ratio')
axes[1].set_ylabel('Domestic to foreign tourist ratio')
axes[1].set_xlabel('Districts')
axes[1].set_xticklabels(axes[1].get_xticklabels(), rotation=0)

plt.show()
```





6. List the top & bottom 5 districts based on 'population to tourist footfall ratio in 2019?

[28]:
```
#calculating total visitors in 2019 per district
df_tv = df_all.
  ↪groupby('district')[['visitors_domestic_19','visitors_foreign_19']].sum().
  ↪reset_index()
df_tv['total_visitors19'] =␣
  ↪df_tv['visitors_domestic_19']+df_tv['visitors_foreign_19']

#importing census data of 2011 for telangana districts
pop_2011 = pd.read_csv('telangana_2011.csv')
```

[29]:
```
#merging both dfs
df_ffr = pd.merge(df_tv, pop_2011, on='district', how='outer')

#calculating population to tourist footfall ratio
df_ffr['pop_to_tourist_footfall_ratio'] = df_ffr['total_visitors19']/
  ↪df_ffr['population']
```

[30]:
```
#top 5
ffr_t5 = df_ffr.sort_values(by='pop_to_tourist_footfall_ratio',␣
  ↪ascending=False).head(5)
ffr_t5
```

[30]:
```
                 district  visitors_domestic_19  visitors_foreign_19  \
23      Rajanna Sircilla              16832897                    0
1   Bhadradri Kothagudem              12817737                    0
14                 Medak               5452570                    0
16                Mulugu               1819800                  575
32        Yadadri Bhongir              4489374                    0
```

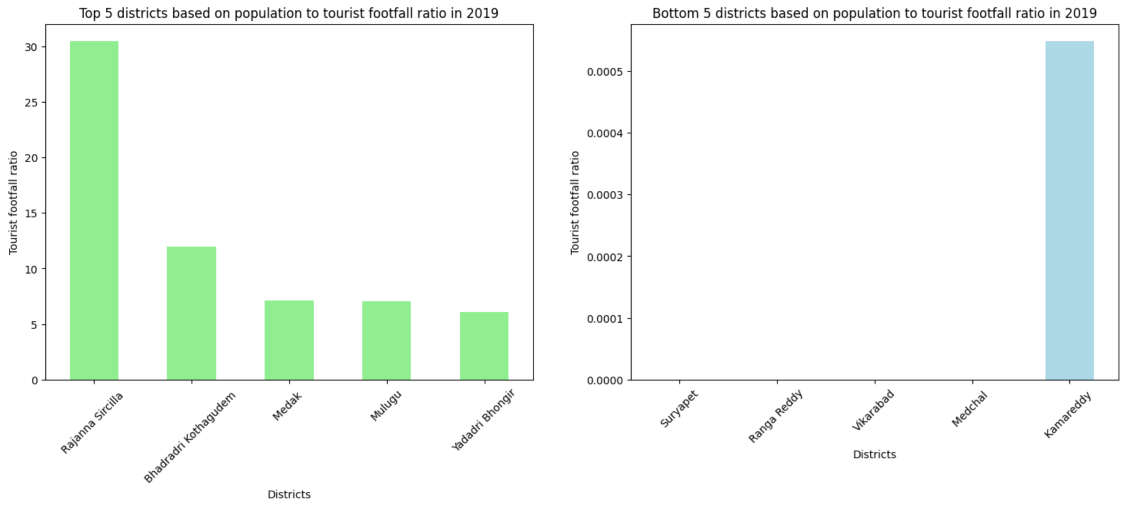
```
                total_visitors19 population        pop_to_tourist_footfall_ratio
23          16832897       552037                           30.492335
1           12817737      1069261                           11.987473
14           5452570       767428                            7.104992
16           1820375       257744                            7.062725
32           4489374       739448                            6.071250
```

[31]:
```
#Bottom 5
ffr_b5 = df_ffr.sort_values(by='pop_to_tourist_footfall_ratio', ascending=True).
 ↪head(5)
ffr_b5
```

[31]:
```
       district  visitors_domestic_19  visitors_foreign_19  total_visitors19  \
27     Suryapet                     0                    0                 0
24  Ranga Reddy                     0                    0                 0
28    Vikarabad                     0                    0                 0
15      Medchal                     0                    0                 0
7     Kamareddy                   534                    0               534

    population  pop_to_tourist_footfall_ratio
27     1099560                       0.000000
24     2446265                       0.000000
28      927140                       0.000000
15     2440073                       0.000000
7       972625                       0.000549
```

[32]:
```
#plotting
def format_y_ticks(value, tick_number):
    return f'{value:,.0f}'

fig, axes = plt.subplots(nrows=1, ncols=2, figsize=(18, 6))

ffr_t5.plot(kind='bar', x='district', y='pop_to_tourist_footfall_ratio',␣
 ↪color='lightgreen', ax=axes[0], legend=False)
ffr_b5.plot(kind='bar', x='district', y='pop_to_tourist_footfall_ratio',␣
 ↪color='lightblue', ax=axes[1], legend=False)

axes[0].set_title('Top 5 districts based on population to tourist footfall␣
 ↪ratio in 2019')
axes[0].set_ylabel('Tourist footfall ratio')
axes[0].set_xlabel('Districts')
axes[0].yaxis.set_major_formatter(FuncFormatter(format_y_ticks))
axes[0].set_xticklabels(axes[0].get_xticklabels(), rotation=45)

axes[1].set_title('Bottom 5 districts based on population to tourist footfall␣
 ↪ratio in 2019')
axes[1].set_ylabel('Tourist footfall ratio')
axes[1].set_xlabel('Districts')
```

```
axes[1].set_xticklabels(axes[1].get_xticklabels(), rotation=45)

plt.show()
```



7. What will be the projected number of domestic and foreign tourists in Hyderabad in 2025 based on the growth rate from previous years?

[33]:
```
#appending all years dfs
df_append = pd.concat([df_2016,df_2017,df_2018,df_2019],axis=0)
df_append['total_visitors'] =␣
 ↪df_append['visitors_domestic']+df_append['visitors_foreign']

#filtering data for Hyderabad
df_append_hyd = df_append[df_append['district']=='Hyderabad']

#grouping tourists by year
df_append_hyd = df_append_hyd.
 ↪groupby('year')[['visitors_domestic','visitors_foreign']].sum().reset_index()
df_append_hyd
```

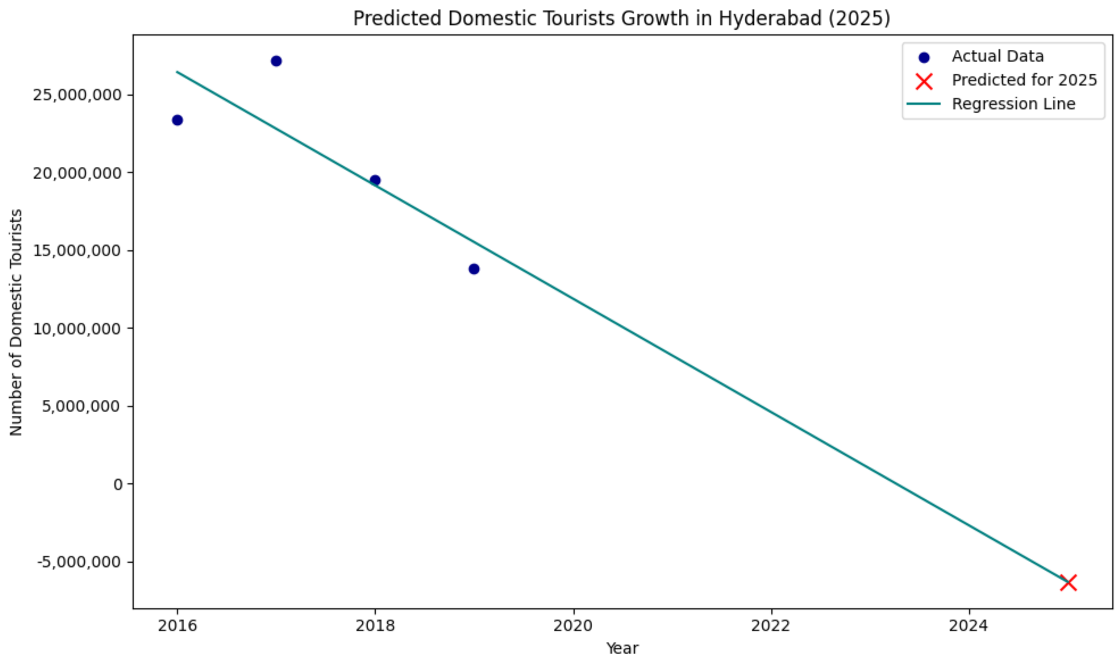
[33]:
```
   year  visitors_domestic  visitors_foreign
0  2016           23394705            163631
1  2017           27160242            247179
2  2018           19543651            314788
3  2019           13802362            319300
```

[34]:
```
#using regression to predict domestic tourists growth in Hyderabad in 2025
X = df_append_hyd['year'].values.reshape(-1, 1)
y = df_append_hyd['visitors_domestic'].values
```

```
model1 = LinearRegression()
model1.fit(X, y)

year_to_predict = np.array([[2025]])
predicted_domestic_visitors = model1.predict(year_to_predict)
print(f'Projected number of domestic tourists in Hyderabad 2025:␣
  ↪{predicted_domestic_visitors[0]}')
```

```
Projected number of domestic tourists in Hyderabad 2025: -6319975.0
```

[35]:
```
#plotting
def format_y_ticks(value, tick_number):
    return f'{value:,.0f}'

plt.figure(figsize=(10, 6))

plt.scatter(X, y, color='darkblue', label='Actual Data')
plt.scatter(year_to_predict, predicted_domestic_visitors, color='red',␣
  ↪marker='x', s=100, label='Predicted for 2025')
X_range = np.arange(min(X), year_to_predict[0,0]+1).reshape(-1, 1)
plt.plot(X_range, model1.predict(X_range), color='teal', label='Regression␣
  ↪Line')

plt.xlabel('Year')
plt.ylabel('Number of Domestic Tourists')
plt.title('Predicted Domestic Tourists Growth in Hyderabad (2025)')
plt.legend()
plt.gca().yaxis.set_major_formatter(FuncFormatter(format_y_ticks))

plt.tight_layout()
plt.show()
print(f'Projected number of domestic tourists in Hyderabad 2025:␣
  ↪{predicted_domestic_visitors[0]}')
```



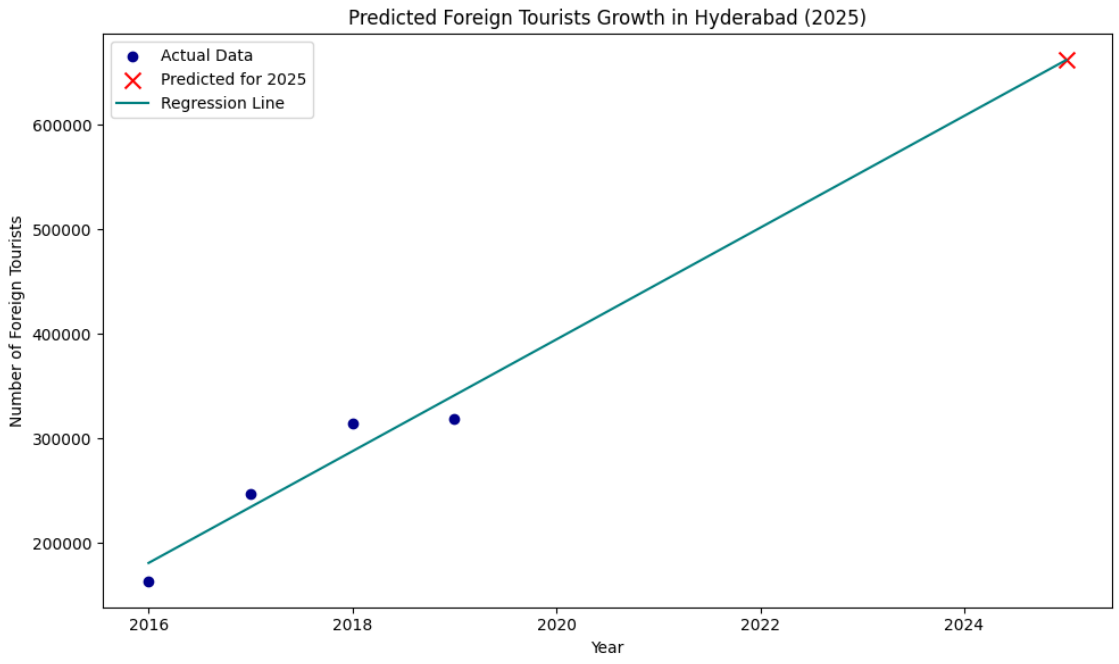
```
Projected number of domestic tourists in Hyderabad 2025: -6319975.0
```

[36]:
```
#using regression to predict foreign tourists growth in Hyderabad in 2025
A = df_append_hyd['year'].values.reshape(-1, 1)
b = df_append_hyd['visitors_foreign'].values

model2 = LinearRegression()
model2.fit(A, b)

year_to_predict = np.array([[2025]])
predicted_foreign_visitors = model2.predict(year_to_predict)
print(f'Projected number of foreign tourists in Hyderabad 2025:␣
  ↪{predicted_foreign_visitors[0]}')
```

```
Projected number of foreign tourists in Hyderabad 2025: 662186.5
```

[37]:
```
#plotting
plt.figure(figsize=(10, 6))

plt.scatter(A, b, color='darkblue', label='Actual Data')
plt.scatter(year_to_predict, predicted_foreign_visitors, color='red',␣
  ↪marker='x', s=100, label='Predicted for 2025')
X_range = np.arange(min(X), year_to_predict[0,0]+1).reshape(-1, 1)
plt.plot(X_range, model2.predict(X_range), color='teal', label='Regression␣
  ↪Line')
```

```
plt.xlabel('Year')
plt.ylabel('Number of Foreign Tourists')
plt.title('Predicted Foreign Tourists Growth in Hyderabad (2025)')
plt.legend()

plt.tight_layout()
plt.show()
print(f'Projected number of foreign tourists in Hyderabad 2025:␣
↪{predicted_foreign_visitors[0]}')
```



```
Projected number of foreign tourists in Hyderabad 2025: 662186.5
```

8. Estimate the projected revenue for Hyderabad in 2025 based on average spend per tourist?

[38]:
```
#creating df of average spending by visitors
tourist = ['domestic', 'foreign']
avg_rev = [1200, 5600]
visitors_2025 = [predicted_domestic_visitors.item(), predicted_foreign_visitors.
↪item()]

avg_spend = pd.DataFrame({'tourist':tourist, 'avg_rev':avg_rev, 'visitors_2025':
↪visitors_2025})

#calculating  projected revenue for Hyderabad in 2025
avg_spend['predicted_rev'] = avg_spend['avg_rev']*avg_spend['visitors_2025']
```

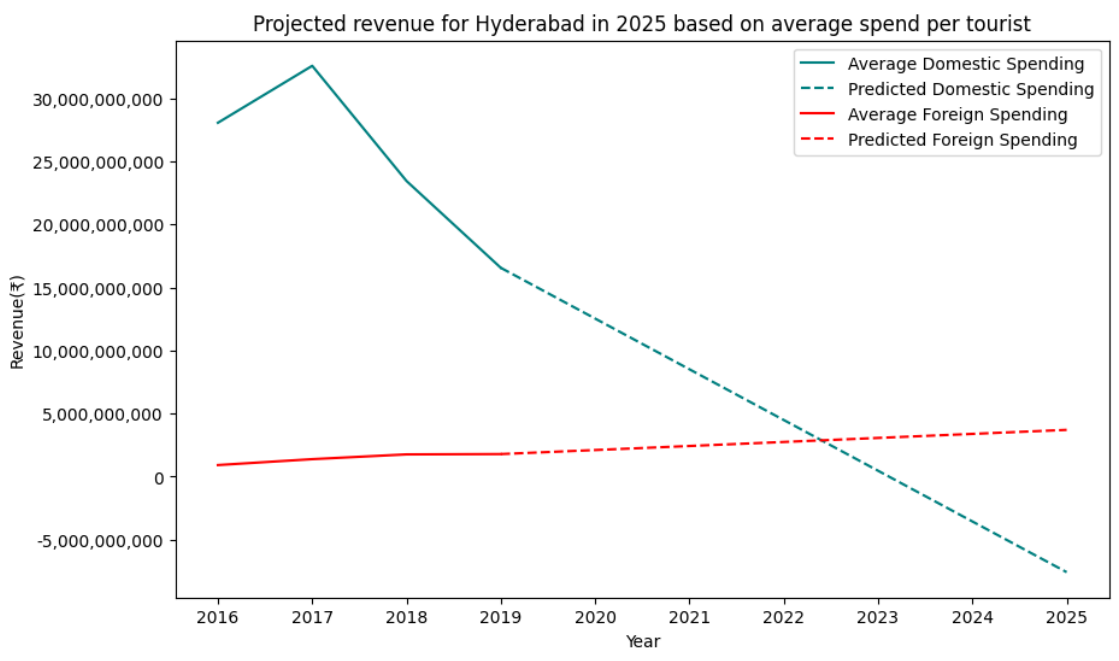
```
#turning to scientific numbers to normal digits
avg_spend['predicted_revenue'] = avg_spend['predicted_rev'].apply(lambda x:␣
 ↪f"{x}")

avg_spent = avg_spend[['tourist','predicted_revenue']]

print(avg_spent)
print('Domestic Revenue cannot be less than 0 unless it is predicting for a␣
 ↪loss')
```

```
   tourist predicted_revenue
0 domestic           -7583970000
1 foreign            3708244400
Domestic Revenue cannot be less than 0 unless it is predicting for a loss
```

[39]:
```
#pivoting avg_spend
avg_spent = avg_spent.T
avg_spent.columns = avg_spent.iloc[0]
avg_spent = avg_spent[1:]
avg_spent.insert(0, 'year', 2025)
avg_spent = avg_spent.reset_index(drop=True)

#concatinating data from 2016-2025 for revenue generated
df_concat = pd.concat([df_2016, df_2017, df_2018, df_2019])
df_concat = df_concat[df_concat['district']=='Hyderabad']
df_concat2 = df_concat.
 ↪groupby('year')[['visitors_domestic','visitors_foreign']].sum().reset_index()
df_concat2.insert(2,'d_spend', 1200)
df_concat2.insert(4,'f_spend', 5600)

df_concat2['domestic'] = df_concat2['visitors_domestic']*df_concat2['d_spend']
df_concat2['foreign'] = df_concat2['visitors_foreign']*df_concat2['f_spend']

avg_spent_all = df_concat2[['year', 'domestic', 'foreign']]

avg_spend_all = pd.concat([avg_spent_all, avg_spent])
avg_spend_all
```

[39]:
```
   year        domestic        foreign
0  2016     28073646000      916333600
1  2017     32592290400     1384202400
2  2018     23452381200     1762812800
3  2019     16562834400     1788080000
0  2025   -7583970000.0   3708244400.0
```

[40]:
```
#plotting
def format_y_ticks(value, tick_number):
    return f'{value:,.0f}'

plt.figure(figsize=(10, 6))

smooth_years = avg_spend_all[avg_spend_all['year'] <= 2019]
dotted_years = avg_spend_all[avg_spend_all['year'] > 2018]

# Plot smooth line for domestic spending
plt.plot(smooth_years['year'], smooth_years['domestic'], color='teal',␣
 ↪linestyle='-', label='Average Domestic Spending')
# Plot dotted line for domestic spending
plt.plot(dotted_years['year'], dotted_years['domestic'], color='teal',␣
 ↪linestyle='--', label='Predicted Domestic Spending')

# Plot smooth line for foreign spending
plt.plot(smooth_years['year'], smooth_years['foreign'], color='red',␣
 ↪linestyle='-', label='Average Foreign Spending')
# Plot dotted line for foreign spending
plt.plot(dotted_years['year'], dotted_years['foreign'], color='red',␣
 ↪linestyle='--', label='Predicted Foreign Spending')

plt.title('Projected revenue for Hyderabad in 2025 based on average spend per␣
 ↪tourist')
plt.xlabel('Year')
plt.ylabel('Revenue( )')
plt.legend()
plt.xticks(ticks=range(2016, 2026))
plt.gca().yaxis.set_major_formatter(FuncFormatter(format_y_ticks))

plt.show()
```



9. Districts with highest potential?

[41]:
```
#grouping by districts, year
df_append2 = df_append.groupby(['district','year'])['total_visitors'].sum().
  ↪reset_index()

#using CAGR to identify top4 districts with most growth potential
top4_cagr = cagr.sort_values(ascending=False).head(4).index
top4_cagr
```

[41]:
```
Index(['Mancherial', 'Warangal (Rural)', 'Bhadradri Kothagudem ', 'Siddipet'],
dtype='object', name='district')
```

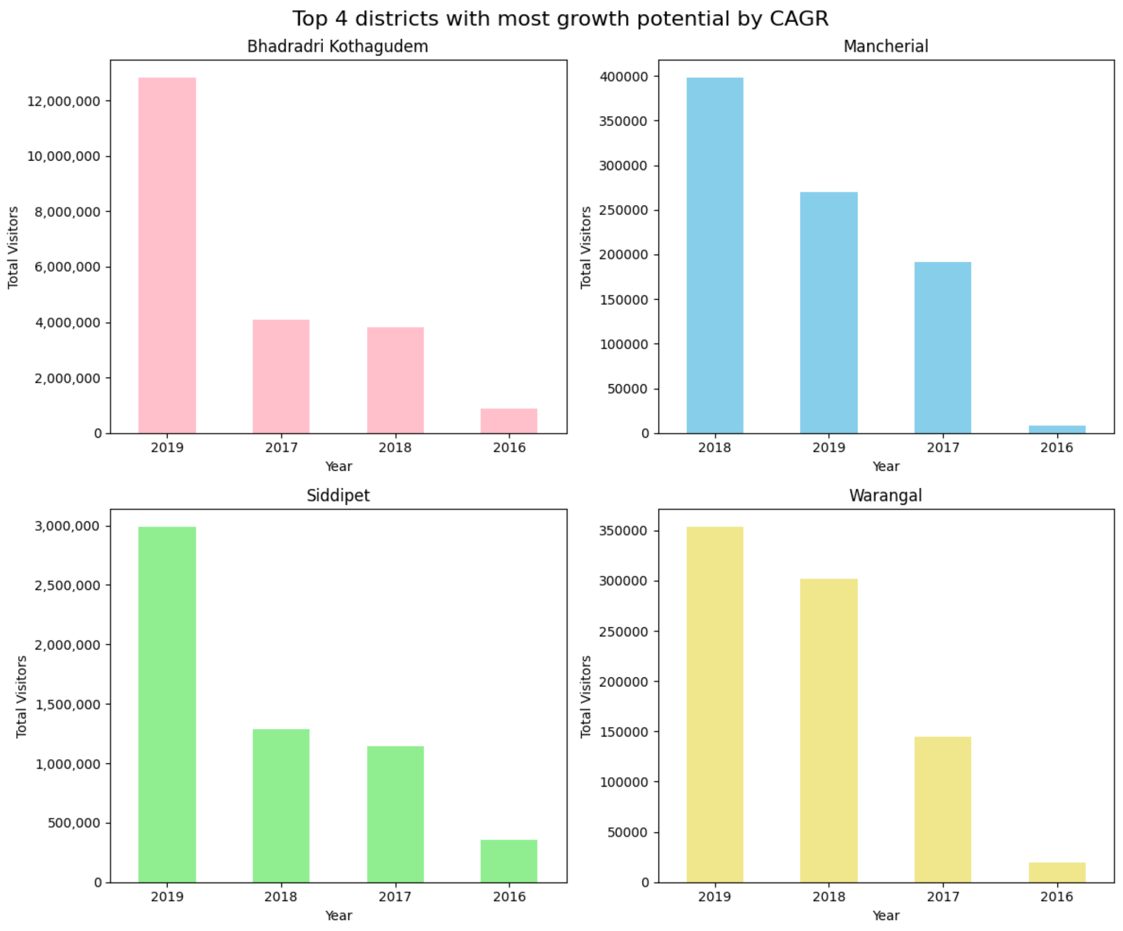
[42]:
```
#top4 districts with most growth potential by CAGR
growth_potential_cagr = df_append2[df_append2['district'].isin(top4_cagr)]
df_gp = growth_potential_cagr.
  ↪sort_values(by=['district','total_visitors','year'],␣
  ↪ascending=[True,False,False])
df_gp
```

[42]:
```
                  district  year  total_visitors
7     Bhadradri Kothagudem  2019        12817737
5     Bhadradri Kothagudem  2017         4094317
6     Bhadradri Kothagudem  2018         3799878
4     Bhadradri Kothagudem  2016          889030
54              Mancherial  2018          398004
```

```
55             Mancherial  2019         269820
53             Mancherial  2017         191626
52             Mancherial  2016           7802
101              Siddipet  2019        2987864
100              Siddipet  2018        1283300
99               Siddipet  2017        1145721
98               Siddipet  2016         358400
117      Warangal (Rural)  2019         353500
116      Warangal (Rural)  2018         302012
115      Warangal (Rural)  2017         144556
114      Warangal (Rural)  2016          19400
```

[43]:
```
#plotting
bhadradri_kothagudem = df_gp[df_gp['district'] == 'Bhadradri Kothagudem ']
mancherial = df_gp[df_gp['district'] == 'Mancherial']
siddipet = df_gp[df_gp['district'] == 'Siddipet']
warangal = df_gp[df_gp['district'] == 'Warangal (Rural)']

def format_y_ticks(value, tick_number):
    return f'{value:,.0f}'

fig, axes = plt.subplots(2,2,figsize=(12, 10))

#plotting each district's data on its corresponding subplot
bhadradri_kothagudem.plot(kind='bar', x='year', y='total_visitors', ax=axes[0,␣
 ↪0], color='pink', legend=False)
axes[0, 0].set_title('Bhadradri Kothagudem')
axes[0, 0].set_ylabel('Total Visitors')
axes[0, 0].set_xlabel('Year')
axes[0, 0].yaxis.set_major_formatter(FuncFormatter(format_y_ticks))
axes[0, 0].set_xticklabels(axes[0, 0].get_xticklabels(), rotation=0)

mancherial.plot(kind='bar', x='year', y='total_visitors', ax=axes[0, 1],␣
 ↪color='skyblue', title='Mancherial', legend=False)
axes[0, 1].set_title('Mancherial')
axes[0, 1].set_ylabel('Total Visitors')
axes[0, 1].set_xlabel('Year')
axes[0, 1].set_xticklabels(axes[0, 1].get_xticklabels(), rotation=0)

siddipet.plot(kind='bar', x='year', y='total_visitors', ax=axes[1, 0],␣
 ↪color='lightgreen', title='Siddipet', legend=False)
axes[1, 0].set_title('Siddipet')
axes[1, 0].set_ylabel('Total Visitors')
axes[1, 0].set_xlabel('Year')
axes[1, 0].yaxis.set_major_formatter(FuncFormatter(format_y_ticks))
axes[1, 0].set_xticklabels(axes[1, 0].get_xticklabels(), rotation=0)
```

```
warangal.plot(kind='bar', x='year', y='total_visitors', ax=axes[1, 1],␣
 ↪color='khaki', title='Warangal (Rural)', legend=False)
axes[1, 1].set_title('Warangal')
axes[1, 1].set_ylabel('Total Visitors')
axes[1, 1].set_xlabel('Year')
axes[1, 1].set_xticklabels(axes[1, 1].get_xticklabels(), rotation=0)

fig.suptitle('Top 4 districts with most growth potential by CAGR', fontsize=16)
plt.tight_layout()
plt.show()
```



10. Is there any correlation between visitors count and festival months?

```
[44]: #calculating all visitors in each month
month_visitors = df_all.groupby('month')['total_visitors'].sum().reset_index()

#importing data of major telangana festival months
festivals = pd.read_csv('festivals.csv')
```

```
festivals.head(2)
```

```
[44]:    sno            festivals      month
      0    1  Bathukamma Festival  September
      1    1  Bathukamma Festival    October
```

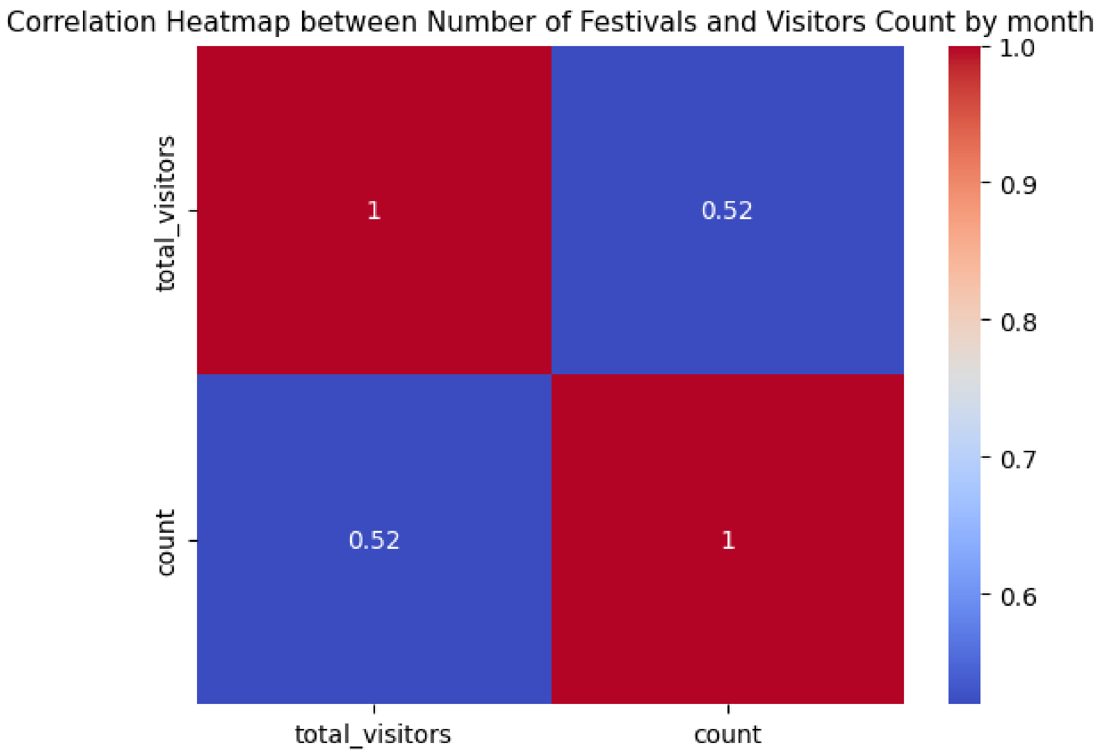
```
[45]: #counting number of festivals in each month
      festivals_cnt = festivals['month'].value_counts().reset_index()
      festivals_cnt.head(2)
```

```
[45]:       month  count
      0  February      6
      1   October      4
```

```
[46]: #merging two dfs to perform correlation
      corr_data = pd.merge(month_visitors, festivals_cnt, on='month', how='left').
       ↪replace(np.nan,0)
      corr_data
```

```
[46]:         month  total_visitors  count
      0       April      24016874.0    2.0
      1      August      22397805.0    2.0
      2    December      29951462.0    1.0
      3    February      58180996.0    6.0
      4     January      41490735.0    4.0
      5        July      19254597.0    1.0
      6        June      43206139.0    0.0
      7       March      28817880.0    2.0
      8         May      22942333.0    1.0
      9    November      23643367.0    3.0
      10    October      22593054.0    4.0
      11  September      20906303.0    1.0
```

```
[47]: #plotting
      sb.heatmap(corr_data[['total_visitors','count']].corr(), annot=True,␣
       ↪cmap='coolwarm')
      plt.title('Correlation Heatmap between Number of Festivals and Visitors Count␣
       ↪by month', size=11)
      plt.show()

      corr = round(corr_data['total_visitors'].corr(corr_data['count']),2)
      print(f'There is moderately positive correlation of {corr}')
```



There is moderately positive correlation of 0.52

11. Competition Analysis (2019-2021)

[48]:
```
#importing data of tourist visits in all states between 2019-2021
other_states = pd.read_csv('other_states.csv')

#creating more columns
other_states['2019_all'] = other_states['2019_dv']+other_states['2019_fv']
other_states['2020_all'] = other_states['2020_dv']+other_states['2020_fv']
other_states['2021_all'] = other_states['2021_dv']+other_states['2021_fv']
other_states['total_domestic'] =␣
 ↪other_states['2019_dv']+other_states['2020_dv']+other_states['2021_dv']
other_states['total_foreign'] =␣
 ↪other_states['2019_fv']+other_states['2020_fv']+other_states['2021_fv']
other_states['total'] =␣
 ↪other_states['2019_all']+other_states['2020_all']+other_states['2021_all']
other_states.head(3)
```

[48]:
```
   sno                        state    2019_dv  2019_fv   2020_dv  2020_fv  \
0    1  Andaman and Nicobar Islands     505398    16206    191207     5412
1    2               Andhra Pradesh  237051508   280356  70828590    67591
2    3            Arunachal Pradesh     555639     7825     42871      961
```

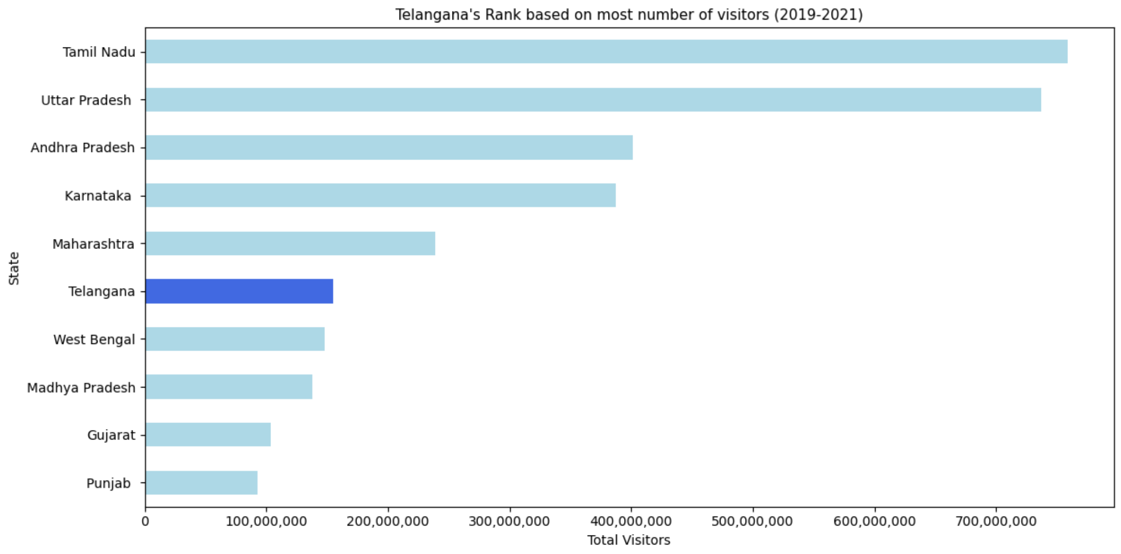
```
    2021_dv  2021_fv    2019_all  2020_all  2021_all  total_domestic  \
0    126238     1687      521604    196619    127925          822843
1  93277569    27551   237331864  70896181  93305120       401157667
2    102915      182      563464     43832    103097          701425

   total_foreign      total
0          23305     846148
1         375498  401533165
2           8968     710393
```

(i) What is Telangana's Rank based on most number of visitors?

[49]:
```
#ranking states based on most number of visitors
other_states['rank'] = other_states['total'].rank(ascending=False)
all_rank = other_states[['state','total','rank']].sort_values(by='rank').
 ↪head(10)
all_rank
```

[49]:
```
             state      total  rank
30      Tamil Nadu  759005489   1.0
33   Uttar Pradesh  737366740   2.0
1   Andhra Pradesh  401533165   3.0
16       Karnataka  387568278   4.0
20     Maharashtra  239075288   5.0
32       Telangana  155409452   6.0
35     West Bengal  147687999   7.0
19  Madhya Pradesh  138250216   8.0
11         Gujarat  103671361   9.0
27          Punjab   92486605  10.0
```

[50]:
```
#plotting
def format_y_ticks(value, tick_number):
    return f'{value:,.0f}'

highlight_index = 5
colors = ['lightblue'] * len(all_rank)
colors[highlight_index] = 'royalblue'

fig, ax = plt.subplots(figsize=(12,6))

all_rank.plot(kind='barh',x='state',y='total', color=colors, ax=ax,␣
 ↪legend=False)

ax.set_title("Telangana's Rank based on most number of visitors (2019-2021)",␣
 ↪size=11)
ax.set_ylabel('State')
ax.set_xlabel('Total Visitors')
plt.xticks(rotation=0)
plt.gca().invert_yaxis()
ax.xaxis.set_major_formatter(FuncFormatter(format_y_ticks))

plt.tight_layout()
plt.show()
```



(ii) What is Telangana's position in terms of domestic & foreign visitors in comparison to it's neighbouring states?

[51]:
```
#identifying neighbouring states with a list
neighbouring_states = ['Maharashtra','Andhra Pradesh','Chhattisgarh','Karnataka␣
↪','Telangana']

#filtering data of neighbouring states
df_neighbouring_states = other_states[other_states['state'].
↪isin(neighbouring_states)]
```

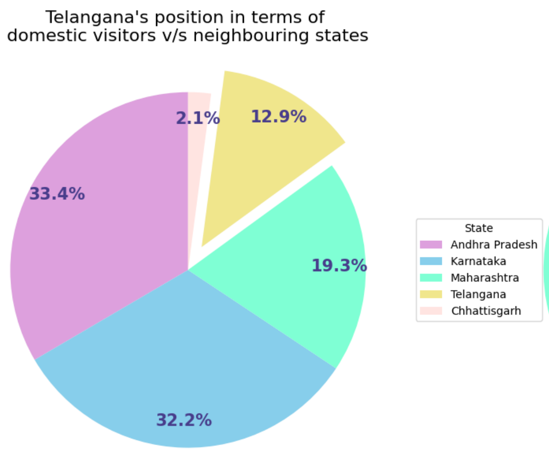
[52]:
```
#telangana's position in domestic vsitors list
dv_ns_rank = df_neighbouring_states[['state','total_domestic']].
↪sort_values(by='total_domestic', ascending=False)
dv_ns_rank
```

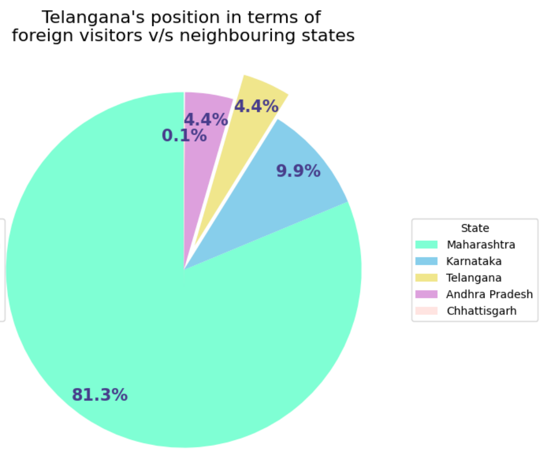
[52]:
```
             state  total_domestic
1   Andhra Pradesh       401157667
16       Karnataka       386721712
20     Maharashtra       232098532
32       Telangana       155033515
6     Chhattisgarh        24862150
```

```
[53]: #telangana's position in foreign usitors list
      fv_ns_rank = df_neighbouring_states[['state','total_foreign']].
       ↪sort_values(by='total_foreign', ascending=False)
      fv_ns_rank
```

```
[53]:             state  total_foreign
      20     Maharashtra        6976756
      16       Karnataka         846566
      32       Telangana         375937
      1   Andhra Pradesh         375498
      6     Chhattisgarh           9147
```

```
[54]: #plotting
      color1 = ['plum','skyblue','aquamarine','khaki','mistyrose']
      color2 = ['aquamarine','skyblue','khaki','plum','mistyrose']
      explodeTuple1 = (0.0, 0.0, 0.0, 0.15, 0.0)
      explodeTuple2 = (0.0, 0.0, 0.15, 0.0, -0.1)
      labels_dv = dv_ns_rank['state']
      labels_fv = fv_ns_rank['state']

      fig, axes = plt.subplots(nrows=1, ncols=2, figsize=(16,8))

      axes[0].pie(dv_ns_rank['total_domestic'], colors=color1, explode=explodeTuple1,
                  autopct='%1.1f%%', pctdistance=0.85, startangle=90,␣
       ↪textprops={'color': "darkslateblue", 'size': 15, 'weight': 'bold'})
      axes[0].set_title("Telangana's position in terms of \ndomestic visitors v/s␣
       ↪neighbouring states", size=16)
      axes[0].legend(labels_dv, title="State", loc="center left", bbox_to_anchor=(1,␣
       ↪0, 0.5, 1))

      # Plot for foreign visitors
      axes[1].pie(fv_ns_rank['total_foreign'], colors=color2, explode=explodeTuple2,
                  autopct='%1.1f%%', pctdistance=0.85, startangle=90,␣
       ↪textprops={'color': "darkslateblue", 'size': 15, 'weight': 'bold'})
      axes[1].set_title("Telangana's position in terms of \nforeign visitors v/s␣
       ↪neighbouring states", size=16)
      axes[1].legend(labels_fv, title="State", loc="center left", bbox_to_anchor=(1,␣
       ↪0, 0.5, 1))

      plt.show()
```





12. Provide recommendations that can boost the telangana tourism

Recommendations:

- **Promote Heritage Sites:**
  Market iconic landmarks such as the Golconda Fort, Charminar, and the Qutb Shahi Tombs through digital platforms, travel agencies, and cultural events.
- **Cultural Festivals:**
  Organize festivals showcasing Telangana's music, dance (like Perini Shivatandavam), and cuisine (Hyderabadi biryani and traditional sweets).
- **Wildlife and Nature Reserves:**
  Develop eco-tourism initiatives in places like the Kawal Wildlife Sanctuary and Pocharam Wildlife Sanctuary.
- **Tourist Police:**
  Establish dedicated tourist police units to ensure safety and provide assistance to visitors.