In [ ]:

```
import pandas as pd
import numpy as np
```

In [ ]:

```
!pip install geopandas
```

```
Collecting geopandas
  Downloading https://files.pythonhosted.org/packages/d7/bf/e
9cefb69d39155d122b6ddca53893b61535fa6ffdad70bf5ef708977f53f/g
eopandas-0.9.0-py2.py3-none-any.whl (994kB)
     |████████████████████████████████| 1.0MB 5.3MB/s
Collecting pyproj>=2.2.0
  Downloading https://files.pythonhosted.org/packages/b1/72/d
52e9ca81caef056062d71991b0e9b1d16af042245627c5d0e4916a36c4f/p
yproj-3.0.1-cp37-cp37m-manylinux2010_x86_64.whl (6.5MB)
     |████████████████████████████████| 6.5MB 12.2MB/s
Collecting fiona>=1.8
  Downloading https://files.pythonhosted.org/packages/47/c2/6
7d1d0acbaaee3b03e5e22e3b96c33219cb5dd392531c9ff9cee7c2eb3e4/F
iona-1.8.18-cp37-cp37m-manylinux1_x86_64.whl (14.8MB)
     |████████████████████████████████| 14.8MB 228kB/s
Requirement already satisfied: shapely>=1.6 in /usr/local/li
b/python3.7/dist-packages (from geopandas) (1.7.1)
Requirement already satisfied: pandas>=0.24.0 in /usr/local/l
ib/python3.7/dist-packages (from geopandas) (1.1.5)
Requirement already satisfied: certifi in /usr/local/lib/pyth
on3.7/dist-packages (from pyproj>=2.2.0->geopandas) (2020.12.
5)
Requirement already satisfied: six>=1.7 in /usr/local/lib/pyt
hon3.7/dist-packages (from fiona>=1.8->geopandas) (1.15.0)
Requirement already satisfied: attrs>=17 in /usr/local/lib/py
thon3.7/dist-packages (from fiona>=1.8->geopandas) (20.3.0)
Collecting munch
  Downloading https://files.pythonhosted.org/packages/cc/ab/8
5d8da5c9a45e072301beb37ad7f833cd344e04c817d97e0cc75681d248f/m
unch-2.5.0-py2.py3-none-any.whl
Collecting click-plugins>=1.0
  Downloading https://files.pythonhosted.org/packages/e9/da/8
24b92d9942f4e472702488857914bdd50f73021efea15b4cad9aca8ecef/c
lick_plugins-1.1.1-py2.py3-none-any.whl
Collecting cligj>=0.5
  Downloading https://files.pythonhosted.org/packages/42/1e/9
47eadf10d6804bf276eb8a038bd5307996dceaaa41cfd21b7a15ec62f5d/c
ligj-0.7.1-py3-none-any.whl
Requirement already satisfied: click<8,>=4.0 in /usr/local/li
b/python3.7/dist-packages (from fiona>=1.8->geopandas) (7.1.
2)
Requirement already satisfied: numpy>=1.15.4 in /usr/local/li
b/python3.7/dist-packages (from pandas>=0.24.0->geopandas)
(1.19.5)
Requirement already satisfied: pytz>=2017.2 in /usr/local/li
b/python3.7/dist-packages (from pandas>=0.24.0->geopandas) (2
018.9)
Requirement already satisfied: python-dateutil>=2.7.3 in /us
```

```
/local/lib/python3.7/dist-packages (from pandas>=0.24.0->geo
pandas) (2.8.1)
Installing collected packages: pyproj, munch, click-plugins,
cligj, fiona, geopandas
Successfully installed click-plugins-1.1.1 cligj-0.7.1 fiona-
1.8.18 geopandas-0.9.0 munch-2.5.0 pyproj-3.0.1
```

In [ ]:

```
import matplotlib.pyplot as plt
import seaborn as sns
import geopandas as gpd
```

In [ ]:

```
%matplotlib inline
```

In [ ]:

```
from google.colab import drive
drive.mount('/content/gdrive')
```

In [ ]:

```
data1 = pd.read_csv("gdrive/My Drive/air_quality_state.csv")
```

In [ ]:

```
data1
```

Out[ ]:

	Country	State	city	place	lastupdate	Avg	Max	Min
0	India	Andhra_Pradesh	Amaravati	Secretariat, Amaravati - APPCB	21-12-2018 03:00	70.0	108.0	42.0
1	India	Andhra_Pradesh	Amaravati	Secretariat, Amaravati - APPCB	21-12-2018 03:00	76.0	102.0	43.0
2	India	Andhra_Pradesh	Amaravati	Secretariat, Amaravati - APPCB	21-12-2018 03:00	73.0	118.0	46.0
3	India	Andhra_Pradesh	Amaravati	Secretariat, Amaravati - APPCB	21-12-2018 03:00	5.0	6.0	4.0
4	India	Andhra_Pradesh	Amaravati	Secretariat, Amaravati - APPCB	21-12-2018 03:00	41.0	109.0	2.0
...	...	...	...	...	...	...	...	...
819	India	West_Bengal	Siliguri	Ward-32 Bapupara, Siliguri - WBPCB	21-12-2018 03:00	49.0	83.0	14.0
820	India	West_Bengal	Siliguri	Ward-32 Bapupara, Siliguri - WBPCB	21-12-2018 03:00	8.0	13.0	2.0

821	India	West_Bengal	Siliguri	Ward-32 Bapupara, Siliguri - WBPCB	21-12-2018 03:00	5.0	8.0	2.0
822	India	West_Bengal	Siliguri	Ward-32 Bapupara, Siliguri - WBPCB	21-12-2018 03:00	33.0	67.0	14.0
823	India	West_Bengal	Siliguri	Ward-32 Bapupara, Siliguri - WBPCB	21-12-2018 03:00	33.0	65.0	7.0

824 rows × 8 columns

In [ ]:

```
fp = "gdrive/My Drive/india/india_administrative_state_boundary.shp"
```

In [ ]:

```
map_data = gpd.read_file(fp)
```

In [ ]:

```
map_data.head()
```

Out[ ]:

	gid	st_nm	tid	territory_	geometry
0	1	Andaman & Nicobar Island	None	None	MULTIPOLYGON (((93.71976 7.20707, 93.71909 7.2...
1	2	Arunanchal Pradesh	None	None	POLYGON ((96.16261 29.38078, 96.16860 29.37432...
2	3	Assam	None	None	MULTIPOLYGON (((89.74323 26.30362, 89.74290 26...
3	4	Bihar	None	None	MULTIPOLYGON (((84.50720 24.26323, 84.50355 24...
4	5	Chandigarh	None	None	POLYGON ((76.84147 30.75996, 76.83599 30.73623...

In [ ]:

```
data1.rename(columns = {'State' : 'st_nm'},inplace=True)
```

In [ ]:

```
data1.head()
```

Out[ ]:

	Country	st_nm	city	place	lastupdate	Avg	Max	Min
0	India	Andhra_Pradesh	Amaravati	Secretariat, Amaravati - APPCB	21-12-2018 03:00	70.0	108.0	42.0

Secretariat

1	India	Andhra_Pradesh	Amaravati	Secretariat, Amaravati - APPCB	21-12-2018 03:00	76.0	102.0	43.0
2	India	Andhra_Pradesh	Amaravati	Secretariat, Amaravati - APPCB	21-12-2018 03:00	73.0	118.0	46.0
3	India	Andhra_Pradesh	Amaravati	Secretariat, Amaravati - APPCB	21-12-2018 03:00	5.0	6.0	4.0
4	India	Andhra_Pradesh	Amaravati	Secretariat, Amaravati - APPCB	21-12-2018 03:00	41.0	109.0	2.0

In [ ]:

```
merged= map_data.merge(data1, on='st_nm', how='left')
merged.head()
```

Out[ ]:

	gid	st_nm	tid	territory_	geometry	Country	city	place
0	1	Andaman & Nicobar Island	None	None	MULTIPOLYGON (((93.71976 7.20707, 93.71909 7.2...	NaN	NaN	NaN
1	2	Arunanchal Pradesh	None	None	POLYGON ((96.16261 29.38078, 96.16860 29.37432...	NaN	NaN	NaN
2	3	Assam	None	None	MULTIPOLYGON (((89.74323 26.30362, 89.74290 26...	NaN	NaN	NaN
3	4	Bihar	None	None	MULTIPOLYGON (((84.50720 24.26323, 84.50355 24...	India	Gaya	Collectorate, Gaya - BSPCB
4	4	Bihar	None	None	MULTIPOLYGON (((84.50720 24.26323, 84.50355 24...	India	Gaya	Collectorate, Gaya - BSPCB

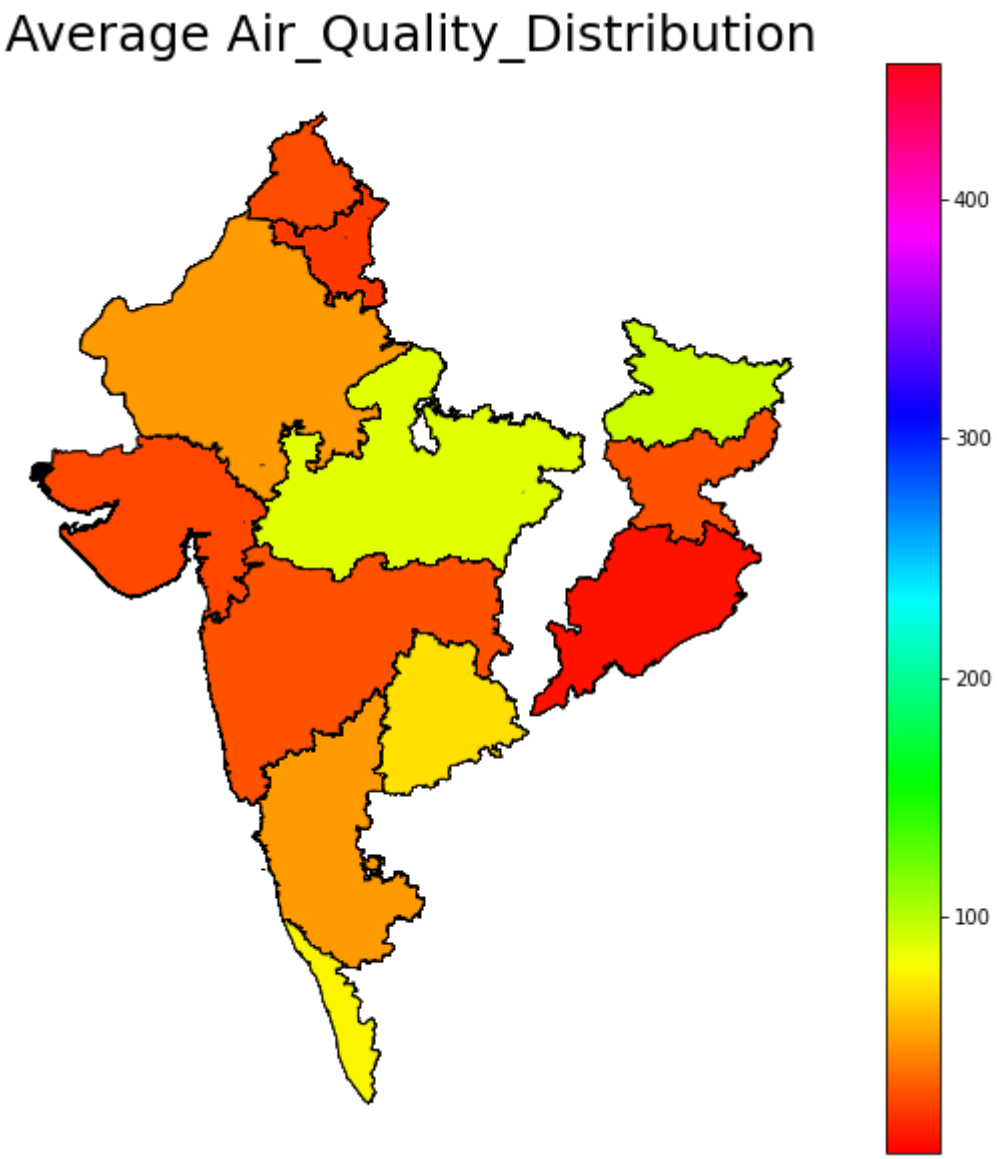
In [ ]:

```
fig, ax = plt.subplots(1, figsize=(10, 10))
ax.axis('off')
ax.set_title('Average Air_Quality_Distribution',fontdict={'fontsize':'25',
'fontweight':'10'})

merged.plot(column='Avg',cmap='hsv',linewidth=0.8,ax=ax, edgecolor='0', le
gend=True,markersize=[39.739192, -104.990337])
```

Out[ ]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f0a4ae25fd0>
```



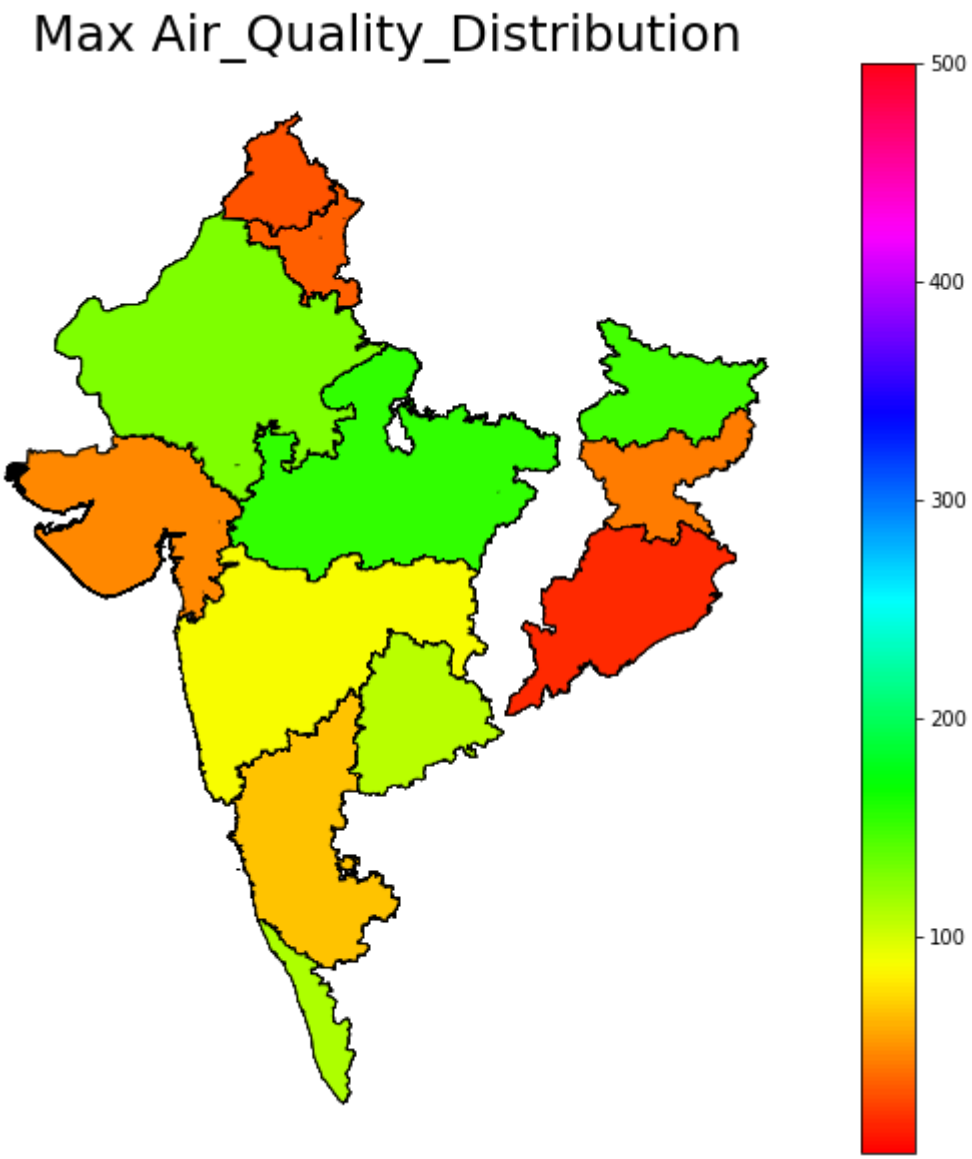
In [ ]:

```
fig, ax = plt.subplots(1, figsize=(10, 10))
ax.axis('off')
ax.set_title('Max Air_Quality_Distribution',fontdict={'fontsize':'25', 'fo
ntweight':'10'})

merged.plot(column='Max',cmap='hsv',linewidth=0.8,ax=ax, edgecolor='0', le
gend=True,markersize=[39.739192, -104.990337])
```

Out[ ]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f0a4ab8c550>
```



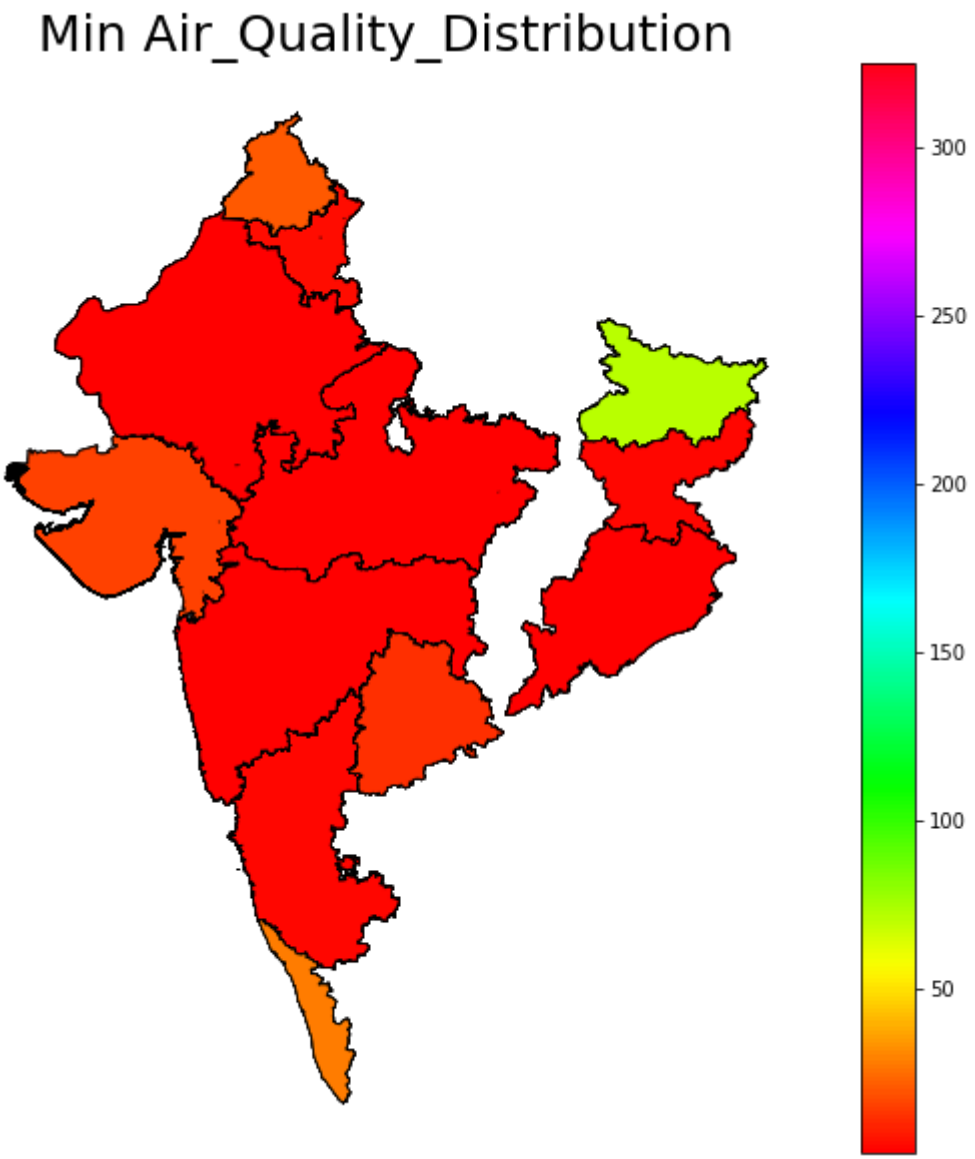
In [ ]:

```
fig, ax = plt.subplots(1, figsize=(10, 10))
ax.axis('off')
ax.set_title('Min Air_Quality_Distribution',fontdict={'fontsize':'25', 'fo
ntweight':'10'})

merged.plot(column='Min',cmap='hsv',linewidth=0.8,ax=ax, edgecolor='0', le
gend=True,markersize=[39.739192, -104.990337])
```

Out[ ]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f0a4b0a0a10>
```



In [ ]: