Task 1

Install the plotly and other data visualization packages using either pip or conda.

In [ ]:
```
%pip install "jupyterlab>=3" "ipywidgets>=7.6"
```

```
Requirement already satisfied: jupyterlab>=3 in c:\users\amyca\anaconda3\lib\site-pack
ages (3.4.4)
Requirement already satisfied: ipywidgets>=7.6 in c:\users\amyca\anaconda3\lib\site-pa
ckages (7.6.5)
Requirement already satisfied: jupyter-core in c:\users\amyca\anaconda3\lib\site-packa
ges (from jupyterlab>=3) (4.11.1)
Requirement already satisfied: jupyterlab-server~=2.10 in c:\users\amyca\anaconda3\li
b\site-packages (from jupyterlab>=3) (2.10.3)
Requirement already satisfied: tornado>=6.1.0 in c:\users\amyca\anaconda3\lib\site-pac
kages (from jupyterlab>=3) (6.1)
Requirement already satisfied: packaging in c:\users\amyca\anaconda3\lib\site-packages
(from jupyterlab>=3) (21.3)
Requirement already satisfied: jinja2>=2.1 in c:\users\amyca\anaconda3\lib\site-packag
es (from jupyterlab>=3) (2.11.3)
Requirement already satisfied: jupyter-server~=1.16 in c:\users\amyca\anaconda3\lib\si
te-packages (from jupyterlab>=3) (1.18.1)
Requirement already satisfied: notebook<7 in c:\users\amyca\anaconda3\lib\site-package
s (from jupyterlab>=3) (6.4.12)
Requirement already satisfied: nbclassic in c:\users\amyca\anaconda3\lib\site-packages
(from jupyterlab>=3) (0.3.5)
Requirement already satisfied: ipython in c:\users\amyca\anaconda3\lib\site-packages
(from jupyterlab>=3) (7.31.1)
Requirement already satisfied: ipykernel>=4.5.1 in c:\users\amyca\anaconda3\lib\site-p
ackages (from ipywidgets>=7.6) (6.15.2)
Requirement already satisfied: nbformat>=4.2.0 in c:\users\amyca\anaconda3\lib\site-pa
ckages (from ipywidgets>=7.6) (5.5.0)
Requirement already satisfied: traitlets>=4.3.1 in c:\users\amyca\anaconda3\lib\site-p
ackages (from ipywidgets>=7.6) (5.1.1)
Requirement already satisfied: jupyterlab-widgets>=1.0.0 in c:\users\amyca\anaconda3\l
ib\site-packages (from ipywidgets>=7.6) (1.0.0)
Requirement already satisfied: ipython-genutils~=0.2.0 in c:\users\amyca\anaconda3\li
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Requirement already satisfied: widgetsnbextension~=3.5.0 in c:\users\amyca\anaconda3\l
ib\site-packages (from ipywidgets>=7.6) (3.5.2)
Requirement already satisfied: jupyter-client>=6.1.12 in c:\users\amyca\anaconda3\lib\
site-packages (from ipykernel>=4.5.1->ipywidgets>=7.6) (7.3.4)
Requirement already satisfied: matplotlib-inline>=0.1 in c:\users\amyca\anaconda3\lib\
site-packages (from ipykernel>=4.5.1->ipywidgets>=7.6) (0.1.6)
Requirement already satisfied: nest-asyncio in c:\users\amyca\anaconda3\lib\site-packa
ges (from ipykernel>=4.5.1->ipywidgets>=7.6) (1.5.5)
Requirement already satisfied: pyzmq>=17 in c:\users\amyca\anaconda3\lib\site-packages
(from ipykernel>=4.5.1->ipywidgets>=7.6) (23.2.0)
Requirement already satisfied: psutil in c:\users\amyca\anaconda3\lib\site-packages (f
rom ipykernel>=4.5.1->ipywidgets>=7.6) (5.9.0)
Requirement already satisfied: debugpy>=1.0 in c:\users\amyca\anaconda3\lib\site-packa
ges (from ipykernel>=4.5.1->ipywidgets>=7.6) (1.5.1)
Requirement already satisfied: backcall in c:\users\amyca\anaconda3\lib\site-packages
(from ipython->jupyterlab>=3) (0.2.0)
Requirement already satisfied: jedi>=0.16 in c:\users\amyca\anaconda3\lib\site-package
s (from ipython->jupyterlab>=3) (0.18.1)
Requirement already satisfied: decorator in c:\users\amyca\anaconda3\lib\site-packages
(from ipython->jupyterlab>=3) (5.1.1)
Requirement already satisfied: colorama in c:\users\amyca\anaconda3\lib\site-packages
(from ipython->jupyterlab>=3) (0.4.5)
Requirement already satisfied: pickleshare in c:\users\amyca\anaconda3\lib\site-packag
es (from ipython->jupyterlab>=3) (0.7.5)
Requirement already satisfied: setuptools>=18.5 in c:\users\amyca\anaconda3\lib\site-p
ackages (from ipython->jupyterlab>=3) (63.4.1)
Requirement already satisfied: pygments in c:\users\amyca\anaconda3\lib\site-packages
(from ipython->jupyterlab>=3) (2.11.2)
```

```
Requirement already satisfied: prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0 in c:\user
s\amyca\anaconda3\lib\site-packages (from ipython->jupyterlab>=3) (3.0.20)
Requirement already satisfied: MarkupSafe>=0.23 in c:\users\amyca\anaconda3\lib\site-p
ackages (from jinja2>=2.1->jupyterlab>=3) (2.0.1)
Requirement already satisfied: nbconvert>=6.4.4 in c:\users\amyca\anaconda3\lib\site-p
ackages (from jupyter-server~=1.16->jupyterlab>=3) (6.4.4)
Requirement already satisfied: terminado>=0.8.3 in c:\users\amyca\anaconda3\lib\site-p
ackages (from jupyter-server~=1.16->jupyterlab>=3) (0.13.1)
Requirement already satisfied: prometheus-client in c:\users\amyca\anaconda3\lib\site-
packages (from jupyter-server~=1.16->jupyterlab>=3) (0.14.1)
Requirement already satisfied: pywinpty in c:\users\amyca\anaconda3\lib\site-packages
(from jupyter-server~=1.16->jupyterlab>=3) (2.0.2)
Requirement already satisfied: websocket-client in c:\users\amyca\anaconda3\lib\site-p
ackages (from jupyter-server~=1.16->jupyterlab>=3) (0.58.0)
Requirement already satisfied: argon2-cffi in c:\users\amyca\anaconda3\lib\site-packag
es (from jupyter-server~=1.16->jupyterlab>=3) (21.3.0)
Requirement already satisfied: anyio<4,>=3.1.0 in c:\users\amyca\anaconda3\lib\site-pa
ckages (from jupyter-server~=1.16->jupyterlab>=3) (3.5.0)
Requirement already satisfied: Send2Trash in c:\users\amyca\anaconda3\lib\site-package
s (from jupyter-server~=1.16->jupyterlab>=3) (1.8.0)
Requirement already satisfied: pywin32>=1.0 in c:\users\amyca\anaconda3\lib\site-packa
ges (from jupyter-core->jupyterlab>=3) (302)
Requirement already satisfied: requests in c:\users\amyca\anaconda3\lib\site-packages
(from jupyterlab-server~=2.10->jupyterlab>=3) (2.28.1)
Requirement already satisfied: json5 in c:\users\amyca\anaconda3\lib\site-packages (fr
om jupyterlab-server~=2.10->jupyterlab>=3) (0.9.6)
Requirement already satisfied: jsonschema>=3.0.1 in c:\users\amyca\anaconda3\lib\site-
packages (from jupyterlab-server~=2.10->jupyterlab>=3) (4.16.0)
Requirement already satisfied: babel in c:\users\amyca\anaconda3\lib\site-packages (fr
om jupyterlab-server~=2.10->jupyterlab>=3) (2.9.1)
Requirement already satisfied: entrypoints>=0.2.2 in c:\users\amyca\anaconda3\lib\site
-packages (from jupyterlab-server~=2.10->jupyterlab>=3) (0.4)
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kages (from nbformat>=4.2.0->ipywidgets>=7.6) (2.16.2)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in c:\users\amyca\anaconda3\li
b\site-packages (from packaging->jupyterlab>=3) (3.0.9)
Requirement already satisfied: idna>=2.8 in c:\users\amyca\anaconda3\lib\site-packages
(from anyio<4,>=3.1.0->jupyter-server~=1.16->jupyterlab>=3) (3.3)
Requirement already satisfied: sniffio>=1.1 in c:\users\amyca\anaconda3\lib\site-packa
ges (from anyio<4,>=3.1.0->jupyter-server~=1.16->jupyterlab>=3) (1.2.0)
Requirement already satisfied: parso<0.9.0,>=0.8.0 in c:\users\amyca\anaconda3\lib\sit
e-packages (from jedi>=0.16->ipython->jupyterlab>=3) (0.8.3)
Requirement already satisfied: pyrsistent!=0.17.0,!=0.17.1,!=0.17.2,>=0.14.0 in c:\use
rs\amyca\anaconda3\lib\site-packages (from jsonschema>=3.0.1->jupyterlab-server~=2.10-
>jupyterlab>=3) (0.18.0)
Requirement already satisfied: attrs>=17.4.0 in c:\users\amyca\anaconda3\lib\site-pack
ages (from jsonschema>=3.0.1->jupyterlab-server~=2.10->jupyterlab>=3) (21.4.0)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\amyca\anaconda3\lib\
site-packages (from jupyter-client>=6.1.12->ipykernel>=4.5.1->ipywidgets>=7.6) (2.8.2)
Requirement already satisfied: pandocfilters>=1.4.1 in c:\users\amyca\anaconda3\lib\si
te-packages (from nbconvert>=6.4.4->jupyter-server~=1.16->jupyterlab>=3) (1.5.0)
Requirement already satisfied: nbclient<0.6.0,>=0.5.0 in c:\users\amyca\anaconda3\lib\
site-packages (from nbconvert>=6.4.4->jupyter-server~=1.16->jupyterlab>=3) (0.5.13)
Requirement already satisfied: mistune<2,>=0.8.1 in c:\users\amyca\anaconda3\lib\site-
packages (from nbconvert>=6.4.4->jupyter-server~=1.16->jupyterlab>=3) (0.8.4)
Requirement already satisfied: defusedxml in c:\users\amyca\anaconda3\lib\site-package
s (from nbconvert>=6.4.4->jupyter-server~=1.16->jupyterlab>=3) (0.7.1)
Requirement already satisfied: beautifulsoup4 in c:\users\amyca\anaconda3\lib\site-pac
kages (from nbconvert>=6.4.4->jupyter-server~=1.16->jupyterlab>=3) (4.11.1)
Requirement already satisfied: bleach in c:\users\amyca\anaconda3\lib\site-packages (f
```

```
rom nbconvert>=6.4.4->jupyter-server~=1.16->jupyterlab>=3) (4.1.0)
Requirement already satisfied: testpath in c:\users\amyca\anaconda3\lib\site-packages
(from nbconvert>=6.4.4->jupyter-server~=1.16->jupyterlab>=3) (0.6.0)
Requirement already satisfied: jupyterlab-pygments in c:\users\amyca\anaconda3\lib\sit
e-packages (from nbconvert>=6.4.4->jupyter-server~=1.16->jupyterlab>=3) (0.1.2)
Requirement already satisfied: wcwidth in c:\users\amyca\anaconda3\lib\site-packages
(from prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0->ipython->jupyterlab>=3) (0.2.5)
Requirement already satisfied: argon2-cffi-bindings in c:\users\amyca\anaconda3\lib\si
te-packages (from argon2-cffi->jupyter-server~=1.16->jupyterlab>=3) (21.2.0)
Requirement already satisfied: pytz>=2015.7 in c:\users\amyca\anaconda3\lib\site-packa
ges (from babel->jupyterlab-server~=2.10->jupyterlab>=3) (2022.1)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\amyca\anaconda3\lib\site
-packages (from requests->jupyterlab-server~=2.10->jupyterlab>=3) (2022.9.14)
Requirement already satisfied: charset-normalizer<3,>=2 in c:\users\amyca\anaconda3\li
b\site-packages (from requests->jupyterlab-server~=2.10->jupyterlab>=3) (2.0.4)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\amyca\anaconda3\lib\s
ite-packages (from requests->jupyterlab-server~=2.10->jupyterlab>=3) (1.26.11)
Requirement already satisfied: six in c:\users\amyca\anaconda3\lib\site-packages (from
websocket-client->jupyter-server~=1.16->jupyterlab>=3) (1.16.0)
Requirement already satisfied: cffi>=1.0.1 in c:\users\amyca\anaconda3\lib\site-packag
es (from argon2-cffi-bindings->argon2-cffi->jupyter-server~=1.16->jupyterlab>=3) (1.1
5.1)
Requirement already satisfied: soupsieve>1.2 in c:\users\amyca\anaconda3\lib\site-pack
ages (from beautifulsoup4->nbconvert>=6.4.4->jupyter-server~=1.16->jupyterlab>=3) (2.
3.1)
Requirement already satisfied: webencodings in c:\users\amyca\anaconda3\lib\site-packa
ges (from bleach->nbconvert>=6.4.4->jupyter-server~=1.16->jupyterlab>=3) (0.5.1)
Requirement already satisfied: pycparser in c:\users\amyca\anaconda3\lib\site-packages
(from cffi>=1.0.1->argon2-cffi-bindings->argon2-cffi->jupyter-server~=1.16->jupyterlab
>=3) (2.21)
Note: you may need to restart the kernel to use updated packages.
WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-pack
ages)
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WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-pack
ages)
WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-pack
ages)
```

Task 2

- Using the data from Assignment 2, produce at least three types of charts using plotlyor other packages of you own preference. For example, you can plot the distribution of state or county areas, the distribution of common county names, and the distribution of thenumber of counties in states. Directly show those charts in Jupyter Notebook, if applies.
- Alternatively, you can use pandas to load some tabular data, such as in csv file, for the charts.
- The fallback option is to use the sample data available from the plotly package. However,two points, i.e., 20%, will be taken off if you choose this option because those onlineexamples are using such data.

In [ ]:
```
import pandas as pd #for data preperation
import plotly.express as px #for data visualization
```

In [ ]:
```
dff=pd.read_csv('Amazon_Deforestation.csv')
dff.columns
```

Out[ ]:
```
Index(['Ano/Estados', 'AC', 'AM', 'AP', 'MA', 'MT', 'PA', 'RO', 'RR', 'TO',
       'AMZ LEGAL'],
      dtype='object')
```

In [ ]:
```
df = dff.rename(columns={'Ano/Estados':'YEAR', 'AC':'ACRE', 'AM':'AMAZONAS', 'AP':'AMA
                         'MA':'MARANHAO','MT':'MATO GROSSO', 'PA':'PARA', 'RO':'RONDON
                         'RR':'RORAIMA', 'TO':'TOCANTINS', 'AMZ LEGAL':'TOTAL_DEFOREST
```

In [ ]:
```
df
```

Out[ ]:

	YEAR	ACRE	AMAZONAS	AMAPA	MARANHAO	MATO GROSSO	PARA	RONDONIA	RORAIMA	TOCAI
0	2004	728	1232	46	755	11814	8870	3858	311	
1	2005	592	775	33	922	7145	5899	3244	133	
2	2006	398	788	30	674	4333	5659	2049	231	
3	2007	184	610	39	631	2678	5526	1611	309	
4	2008	254	604	100	1271	3258	5607	1136	574	
5	2009	167	405	70	828	1049	4281	482	121	
6	2010	259	595	53	712	871	3770	435	256	
7	2011	280	502	66	396	1120	3008	865	141	
8	2012	305	523	27	269	757	1741	773	124	
9	2013	221	583	23	403	1139	2346	932	170	
10	2014	309	500	31	257	1075	1887	684	219	
11	2015	264	712	25	209	1601	2153	1030	156	
12	2016	372	1129	17	258	1489	2992	1376	202	
13	2017	257	1001	24	265	1561	2433	1243	132	
14	2018	444	1045	24	253	1490	2744	1316	195	
15	2019	688	1421	8	215	1685	3862	1245	617	

1. Simple bar graph

In [ ]:
```
import plotly.express as px
fig = px.bar(df, y="TOTAL_DEFORESTED_AREA", x="YEAR",
                 labels=dict(TOTAL_DEFORESTED_AREA='Total Deforested Area (acres)', YE
                 title="Yearly Amazon Deforestation")
fig.show()
```

2. Line graph with each Amazonian Region's Deforestation Area

In [ ]:
```
fig2 = px.line(df, x='YEAR', y = 'AMAZONAS',
               labels = dict(AMAZONAS='Deforested Area (acres)', YEAR = 'Year'),
               title = "Yearly Regional Deforested Area in the Amazon")
fig2.add_scatter(x = df['YEAR'], y = df['AMAZONAS'], name = 'Amazonas')
fig2.add_scatter(x = df['YEAR'], y = df['AMAPA'], name = 'Amapa' )
fig2.add_scatter(x = df['YEAR'], y = df['MARANHAO'], name = 'Maranhoa')
fig2.add_scatter(x = df['YEAR'], y = df['MATO GROSSO'], name = 'Mato Graso')
fig2.add_scatter(x = df['YEAR'], y = df['PARA'], name = 'Para')
fig2.add_scatter(x = df['YEAR'], y = df['RONDONIA'], name = 'Rondonia')
fig2.add_scatter(x = df['YEAR'], y = df['RORAIMA'], name = 'Roraima')
fig2.add_scatter(x = df['YEAR'], y = df['TOCANTINS'], name = 'Tocantins')

fig2.show()
```

3. Subplots

In [ ]:
```
from plotly.subplots import make_subplots

fig3 = make_subplots(rows=1, cols=2)

fig3.add_scatter(x = df['YEAR'], y = df['MATO GROSSO'], mode = "lines", row = 1, col =
fig3.add_scatter(x = df['YEAR'], y = df['PARA'], mode = "lines", row = 1, col = 2, nam
fig3.show()
```

4. Histogram of Amazon Firespots

In [ ]:
```
df2=pd.read_csv('inpe_brazilian_amazon_fires_1999_2019.csv')
df2.columns
```

Out[ ]:
```
Index(['year', 'month', 'state', 'latitude', 'longitude', 'firespots'], dtype='object
')
```

In [ ]:
```
import plotly.graph_objects as go

fig4 = px.histogram(df2, x='firespots',
               labels = dict(TOTAL_DEFORESTED_AREA = 'Deforested Area (acres)'),
               title = "Firespots Histogram")

# The two histograms are drawn on top of another
fig4.show()
```

5. Bubble Chart of Amazon Firespots

In [ ]:
```
fig5 = px.scatter(df2.query("year==2019"), x="month", y="firespots",
                  title = "Firespots in the Amazon during 2019",
                      size="firespots", color="state",
                  hover_name="state", size_max=60)
fig5.show()
```

Task 3

Export at least one chart to a static image and one chart to an HTML page, using Pythoncode.

In [ ]:
```
#Notes
#Using kaleido to create a file path for html
%pip install -U kaleido
import os

#create an output directory to store our image
if not os.path.exists("images"):
    os.mkdir("images")

#html
fig.write_html("images/fig1_file.html")
fig2.write_html("images/fig2_file.html")
fig3.write_html("images/fig3_file.html")
fig4.write_html("images/fig4_file.html")
fig5.write_html("images/fig5_file.html")
```

```
Collecting kaleido
  Using cached kaleido-0.2.1-py2.py3-none-win_amd64.whl (65.9 MB)
Installing collected packages: kaleido
Successfully installed kaleido-0.2.1
Note: you may need to restart the kernel to use updated packages.
WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-pack
ages)
WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-pack
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ages)
WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-pack
ages)
```

In [ ]:
```
# The write_image wasn't working (same problem in class) so I was looking online and f
# https://community.plotly.com/t/static-image-export-hangs-using-kaleido/61519/3

%pip install kaleido-0.1.0.post1-py2.py3-none-win_amd64.whl
```

```
Processing c:\users\amyca\gtech-hw\assignment_5\kaleido-0.1.0.post1-py2.py3-none-win_a
md64.whl
Installing collected packages: kaleido
  Attempting uninstall: kaleido
    Found existing installation: kaleido 0.2.1
    Uninstalling kaleido-0.2.1:
      Successfully uninstalled kaleido-0.2.1
Successfully installed kaleido-0.1.0.post1
Note: you may need to restart the kernel to use updated packages.
```

```
WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-pack
ages)
WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-pack
ages)
WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-pack
ages)
    WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-
packages)
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ages)
WARNING: Ignoring invalid distribution -aleido (c:\users\amyca\anaconda3\lib\site-pack
ages)
```

In [ ]:
```
#Static image
fig.write_image("images/fig1_pythoncode.png")
fig2.write_image("images/fig2_pythoncode.png")
fig3.write_image("images/fig3_pythoncode.png")
fig4.write_image("images/fig4_pythoncode.png")
fig5.write_image("images/fig5_pythoncode.png")
```