

Practice Assignment

Objectives

After completing the lab you will be able to:

- Create a dash board layout
- Add a bar chart

Estimated time needed: 45 minutes

About Skills Network Cloud IDE

This Skills Network Labs Cloud IDE (Integrated Development Environment) provides a hands-on environment in your web browser for completing course and project related labs. It utilizes Theia, an open-source IDE platform, that can be run on desktop or on the cloud.

So far in the course you have been using Jupyter notebooks to run your python code. This IDE provides an alternative for editing and running your Python code. In this lab you will be using this alternative Python runtime to create and launch your Dash applications.

Important Notice about this lab environment

Please be aware that sessions for this lab environment are not persisted. When you launch the Cloud IDE, you are presented with a ‘dedicated computer on the cloud’ exclusively for you. This is available to you as long as you are actively working on the labs.

Once you close your session or it is timed out due to inactivity, you are logged off, and this ‘dedicated computer on the cloud’ is deleted along with any files you may have created, downloaded or installed. The next time you launch this lab, a new environment is created for you.

If you finish only part of the lab and return later, you may have to start from the beginning. So, it is a good idea to plan to your time accordingly and finish your labs in a single session.

Get the tool ready

1. Install python packages required to run the application. Copy and paste the below command to the terminal.

```
1. 1
```

```
1. python3 -m pip install packaging
```

Copied!

```
1. 1
```

```
1. python3 -m pip install pandas dash
```

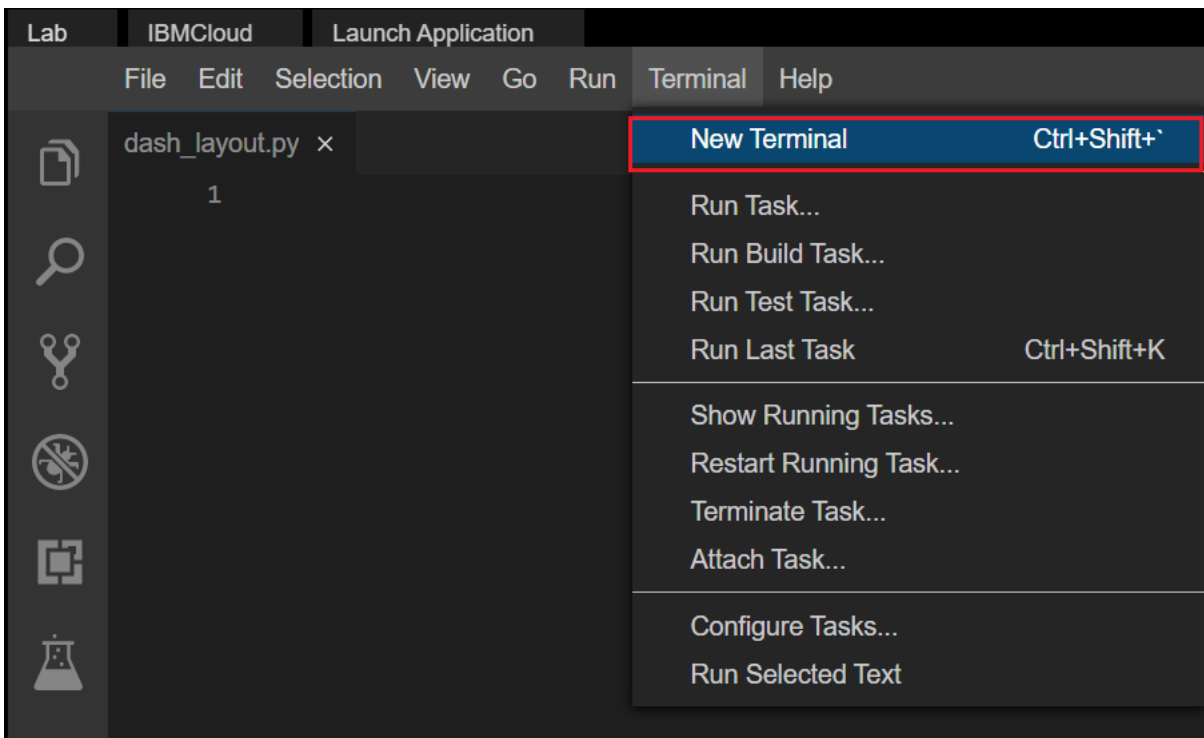
Copied!

```
1. 1
```

```
1. pip3 install httpx==0.20 dash plotly
```

Copied!

2. Open a new terminal, by clicking on the menu bar and selecting **Terminal->New Terminal**, as in the image below.

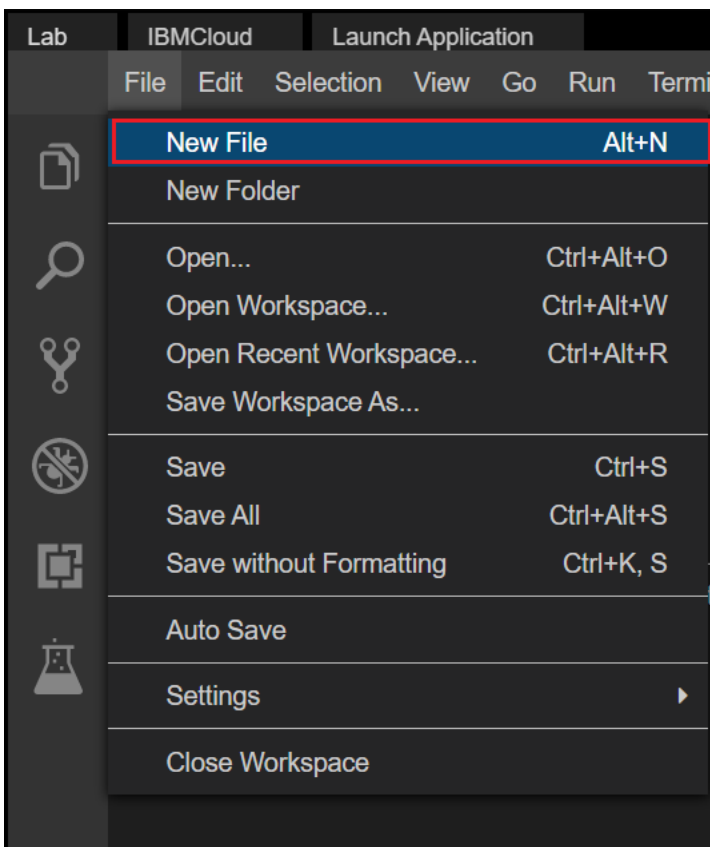


TASK 1 - Dash Application layout

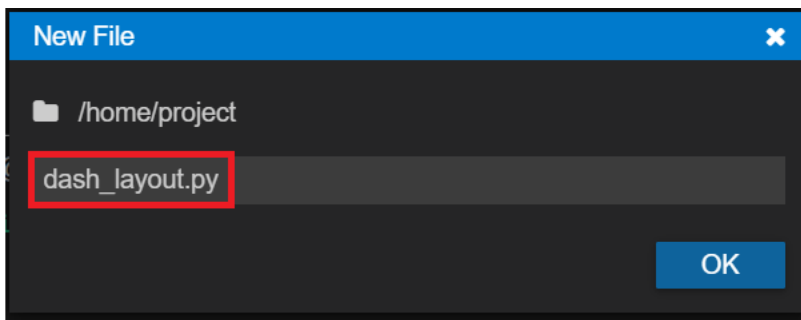
Let's start with

- Importing necessary libraries
- Title added using `html.H1()` tag

1. Create a new python script, by clicking on the menu bar and selecting **File->New File**, as in the image below.



2. Provide the file name as `dash_layout.py`



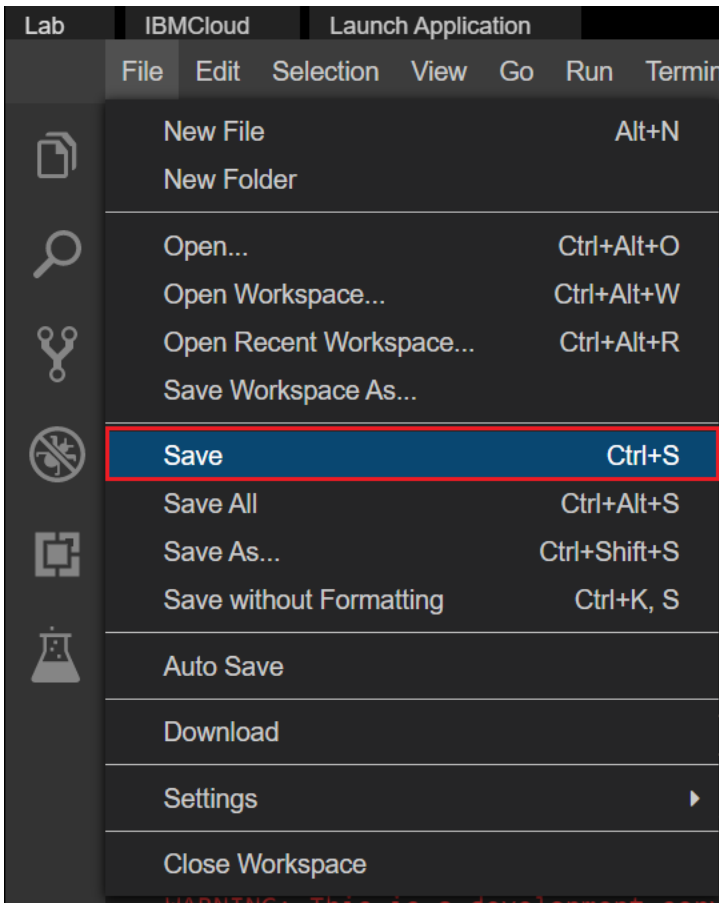
3. Copy the below code to the `dash_layout.py` script and review the code.

```
1. 1
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7
8. 8
9. 9
10. 10
11. 11
12. 12
13. 13
14. 14
15. 15
16. 16
17. 17
18. 18
19. 19
20. 20
21. 21
22. 22
23. 23
24. 24
25. 25
26. 26
27. 27
28. 28
29. 29

1. # Import required packages
2. import pandas as pd
3. import dash
4. import dash_core_components as dcc
5. import dash_html_components as html
6. import plotly.express as px
7. from dash.dependencies import Input, Output
8.
9. # Add Dataframe
10.
11. # Add a bar graph figure
12.
13. app = dash.Dash()
14. app.layout = html.Div(children=[
15.     html.H1(
16.         children='Dashboard',
17.         style={
18.             'textAlign': 'center'
19.         }
20.     )
21. ])
22. # Create dropdown
23.
24. # Bar graph
25. ])
26.
27. # Run Application
28. if __name__ == '__main__':
29.     app.run_server()
```

Copied!

4. Save the application using Save option from File menu.



5. Run the python file using the following command in the terminal

1. 1

1. `python3 dash_layout.py`

Copied!

6. Observe the port number shown in the terminal.

```
theia@theia-malikas:/home/project$ python3 dash_layout.py
Dash is running on http://127.0.0.1:8050/

* Serving Flask app 'dash_layout' (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: on
```

7. Click on the Launch Application option from the side menu bar. Provide the port number and click OK

Note: If you are not able to see the application after launching just check the pop up window for your browser is enabled.

9. The app will open in a new browser tab like below:

← → ↻ <https://malikas-8050.theia-3-labs-prod-misc-tools-us-east-0.proxy.cognitiveclass.ai>

Dashboard

Add dropdown

1. You can generate a drop down as shown below. You do by calling `Dropdown` off `dash_core_components` and passing the options as a list of dictionaries. You can set the default value using the `value` attribute and passing in the default option.

Note:

- Add a comma (,) before the placeholder in the skeleton file and then place the code.
- The placeholder here is “# Create dropdown “ in the skeleton file.
- Add small letter “u” just before the city name “MontrÃ©al” like this `u'MontrÃ©al'` as it contains special characters.

```
1. 1
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7
8. 8
9. 9

1.
2. # Create dropdown
3. dcc.Dropdown(options=[
4.     {'label': 'New York City', 'value': 'NYC'},
5.     {'label': 'MontrÃ©al', 'value': 'MTL'},
6.     {'label': 'San Francisco', 'value': 'SF'}
7. ],
8.     value='NYC' # Providing a vallue to dropdown
9. )
```

Copied!

2. After adding the dropdown the dashboard is displayed as below.

← → ↻
 https://malikas-8050.theia-3-labs-prod-misc-tools-us-east-0.proxy.cognitiveclass.ai

Dashboard

New York City

Adding a dataframe

Assume you have a dataframe as:

Note: Place the code under the placeholder # Add Dataframe in the skeleton file copied before.

```
1. 1
2. 2
3. 3
4. 4
5. 5
6. 6

1. # Add Dataframe
2. df = pd.DataFrame({
3.     "Fruit": ["Apples", "Oranges", "Bananas", "Apples", "Oranges", "Bananas"],
4.     "Amount": [4, 1, 2, 2, 4, 5],
5.     "City": ["SF", "SF", "SF", "NYC", "MTL", "NYC"]
6. })
```

Copied!

Task 2: Create Bar graph

The `plotly.express` module (usually imported as `px`) contains functions that can create entire figures at once, and is referred to as `Plotly Express` or `PX`. `Plotly Express` is a built-in part of the `plotly` library, and is the recommended starting point for creating most common figures

In order to create a graph on our layout, we use the `Graph` class from `dash_core_components`.

Note: Place the code under the placeholder # Add a bar graph figure in the skeleton file copied before.

```
1. 1
2. 2
3. 3
```

```
1. # Add a bar graph figure
2.
3. fig = px.bar(df, x="Fruit", y="Amount", color="City", barmode="group")
```

Copied!

Note: Place the code under the placeholder # Bar graph figure in the skeleton file copied before and also add a comma , before the placeholder.

```
1. 1
2. 2
3. 3

1.
2. # Bar graph
3. dcc.Graph(id='example-graph-2',figure=fig)
```

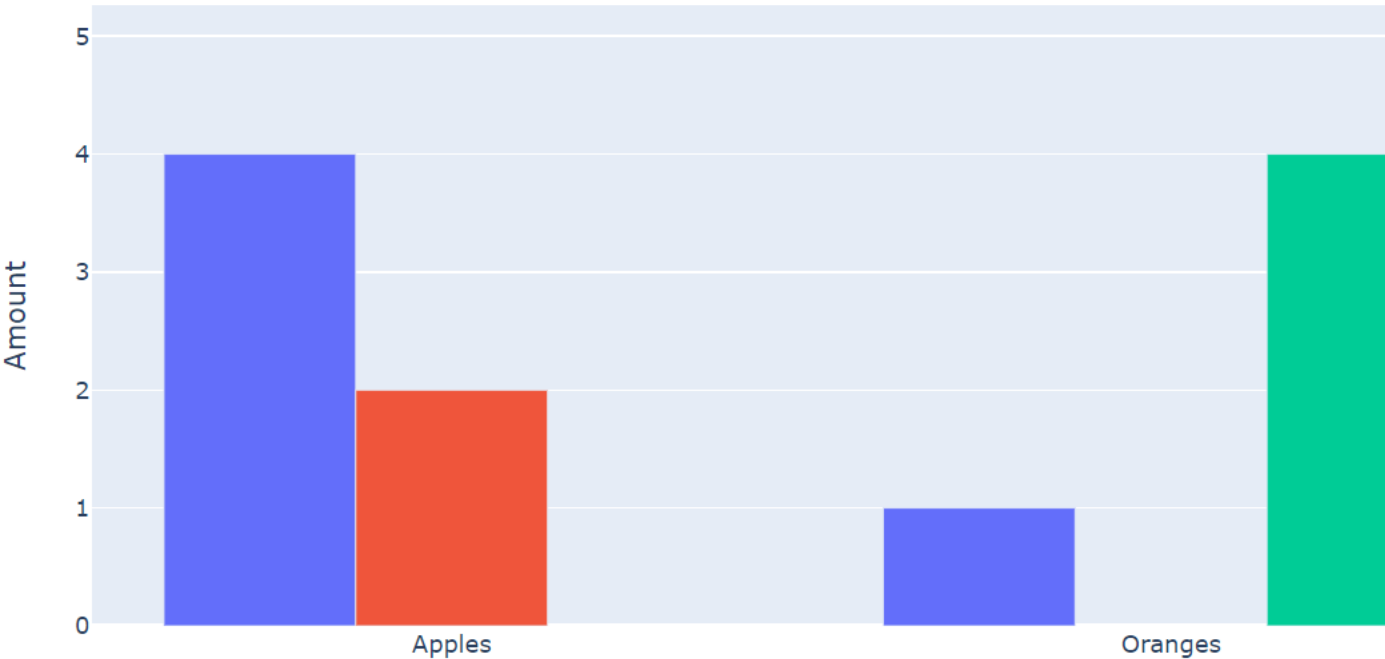
Copied!

The dashboard with the dropdown and the bar graph is displayed as below.

https://malikas-8050.theia-3-labs-prod-misc-tools-us-east-0.proxy.cognitiveclass.ai

Dashboard

New York City



Note: Here we are just creating the dropdown and bar chart without any functionality. Let’s start with the real dataset to get the dropdown functionality with the graph. When you finish running the application press thekey Ctrl+C near the terminal window to stop the running application and begin with the new application.

For complete code click [HERE](#).

Task 3: Practice Exercise

Story:

Here we are looking into an **automobile dataset** which has various attributes like **drive-wheels,body-style and price**.

Lets view the snapshot of our selected dataset.

	symboling	normalized-losses	make	aspiration	num-of-doors	body-style	drive-wheels	engine-location	wheel-base	length	...	compression-ratio	horsepower	peak-rpm	...
0	3	122	alfa-romero	std	two	convertible	rwd	front	88.6	0.811148	...	9.0	111.0	5000.0	...
1	3	122	alfa-romero	std	two	convertible	rwd	front	88.6	0.811148	...	9.0	111.0	5000.0	...
2	1	122	alfa-romero	std	two	hatchback	rwd	front	94.5	0.822681	...	9.0	154.0	5000.0	...
3	2	164	audi	std	four	sedan	fwd	front	99.8	0.848630	...	10.0	102.0	5500.0	...
4	2	164	audi	std	four	sedan	4wd	front	99.4	0.848630	...	8.0	115.0	5500.0	...

Here let’s say we are selecting 3 important features **drive-wheels, body-style and Price**.

- The possible values of drive-wheels are **4 wheel Drive(4wd),Front WheelDrive(fwd) and Rear wheel Drive(rwd)**.
- The different body styles of the cars are **hardtop, sedan, convertible** and so on.
- There are 2 types of people here:
 - A customer who wants to purchase the cars with less price , different body styles and wants to look for the drive wheel with this arrangement.
 - A dealer who wants to showcase the prices for the cars with different body styles and drive wheels.
- As a data analyst, you have been given a task to visually show the **body-style and prices** with respect to each **drive wheel** selected.
- So ideally you want to showcase this in the form of 2 interactive charts such as **pie chart** and **bar chart** on selection of drive wheel.

Below is the key item,

- Drive wheels

Components of the item

1. Drive Wheel Type

For the chosen Drive wheel,

- Pie Chart showing body style and price.
- Bar Chart showing body style and price.

Expected Layout

Car Automobile Compone

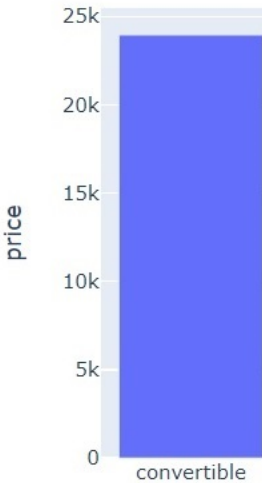
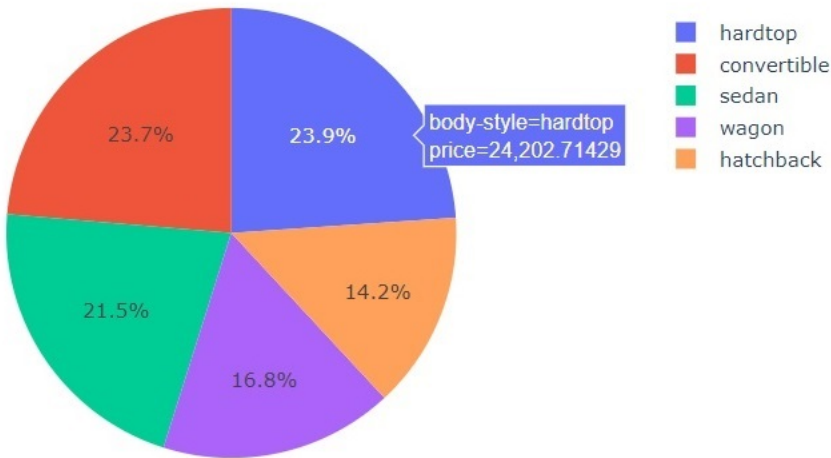
Drive Wheels Type:

Rear Wheel Drive



Pie Chart

Bar Chart



Requirements to create the expected result

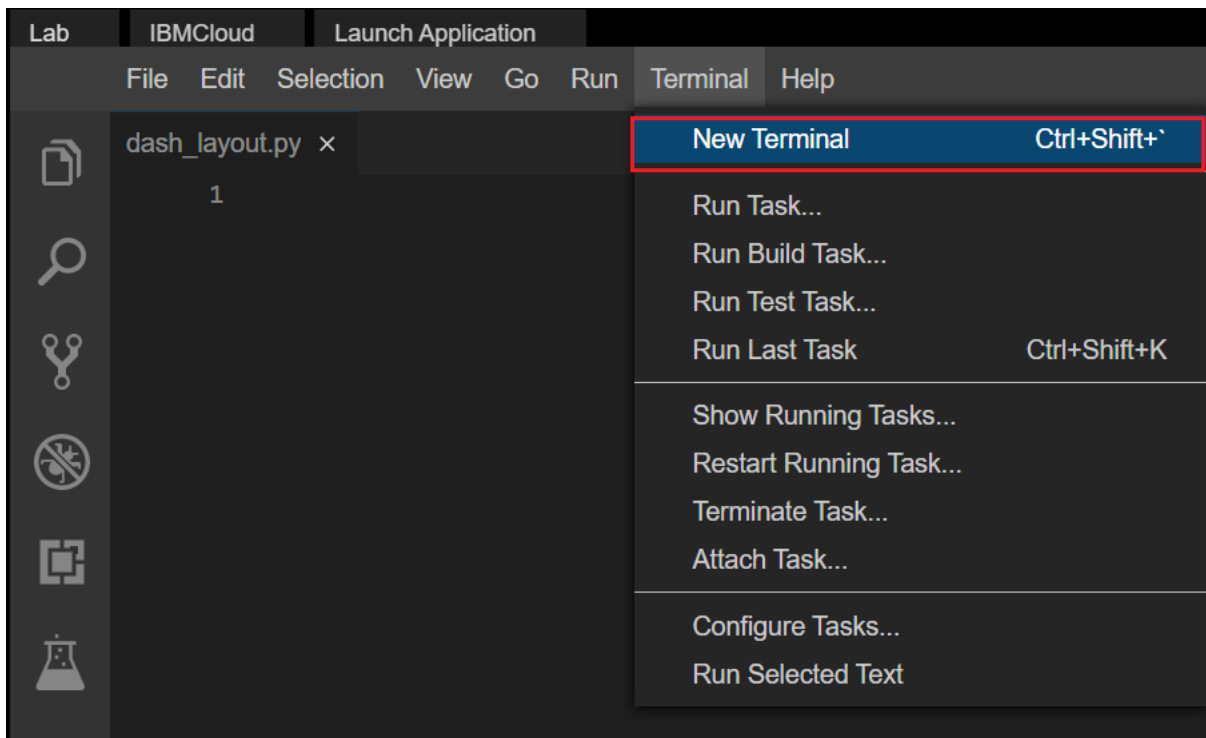
- A dropdown [menu](#): For choosing Drive wheel type
- The layout will be designed as follows:
- An outer division with two inner divisions (as shown in the expected layout)
- One of the inner divisions will have information about the dropdown(which is the input) and the other one is for adding graphs(the 2 output graphs).
- Callback function to compute data, create graph and return to the layout.

To do:

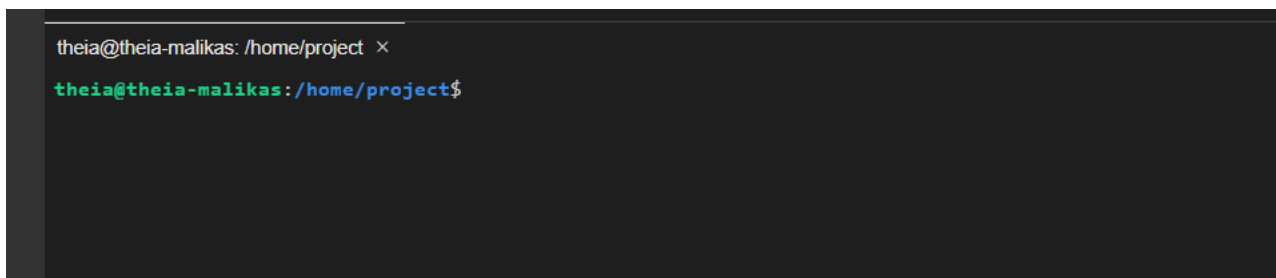
1. Import required libraries and read the dataset
2. Create an application layout
3. Add title to the dashboard using HTML H1 component
4. Add a dropdown using dcc.dropdown
5. Add the pie chart and bar chart core graph components.
6. Run the app

Get the tool ready

- Open a new terminal, by clicking on the menu bar and selecting **Terminal->New Terminal**, as in the image below.



- Now, you have a terminal ready to start the lab.



Get the application skeleton

- Copy and paste the command in the terminal to download the csv.

1. 1
 2. 2
1. wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDDeveloperSkillsNetwork-DA0101EN-SkillsNetwork/labs/Data%20files/automobile

Copied!

The csv gets downloaded.

The screenshot shows a terminal window in the IBM Cloud Theia IDE. The terminal title is 'theia@theia-lakshmih: /home/proiect'. The command executed is `wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDevelopersSkillsNetwork-DA0101EN-SkillsNetwork/labs/Data%20files/automobileEDA.csv`. The output shows the file was successfully downloaded from the specified URL, resolving the domain to 169.63.118.104, and saving it as 'automobileEDA.csv'.

```

theia@theia-lakshmih: /home/proiect
theia@theia-lakshmih: /home/project$ wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain
.cloud/IBMDevelopersSkillsNetwork-DA0101EN-SkillsNetwork/labs/Data%20files/automobileEDA.csv
--2021-07-21 11:45:52-- https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDevelo
perSkillsNetwork-DA0101EN-SkillsNetwork/labs/Data%20files/automobileEDA.csv
Resolving cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud (cf-courses-data.s3.us.cloud-obj
ect-storage.appdomain.cloud)... 169.63.118.104
Connecting to cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud (cf-courses-data.s3.us.cloud
-object-storage.appdomain.cloud)|169.63.118.104|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 35648 (35K) [text/csv]
Saving to: 'automobileEDA.csv'

```

You can use this as a base code to complete the task below.

Let's create the application

- Create a new file called `Dash_Auto.py`
- Copy the code mentioned in the skeleton file and save it.

Structure of the skeleton file

```

1. 1
2. 2
3. 3
4. 4
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31. 31

```

```

32. 32
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43. 43
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46. 46
47. 47
48. 48
49. 49
50. 50
51. 51
52. 52
53. 53
54. 54
55. 55
56. 56
57. 57
58. 58

1. import pandas as pd
2. import dash
3. import dash_html_components as html
4. import dash_core_components as dcc
5. from dash.dependencies import Input, Output, State
6. import plotly.graph_objects as go
7. import plotly.express as px
8. from dash import no_update
9.
10. app = dash.Dash(__name__)
11.
12. # REVIEW1: Clear the layout and do not display exception till callback gets executed
13. app.config.suppress_callback_exceptions = True
14.
15. # Read the automobiles data into pandas dataframe
16. auto_data = pd.read_csv('automobileEDA.csv',
17.                          encoding = "ISO-8859-1",
18.                          )
19.
20. #Layout Section of Dash
21.
22. app.layout = html.Div(children=[#TASK 3A
23.
24.     #outer division starts
25.     html.Div([
26.         # First inner division for adding dropdown helper text for Selected Drive wheels
27.         html.Div(
28.             #TASK 3B
29.         ),
30.
31.
32.         #TASK 3C
33.
34.         #Second Inner division for adding 2 inner divisions for 2 output graphs
35.         html.Div([
36.
37.             #TASK 3D
38.
39.         ], style={'display': 'flex'}),
40.
41.     ])
42.     #outer division ends
43.
44. ])
45. #layout ends
46.
47. #Place to add @app.callback Decorator
48. #TASK 3E
49.
50.
51. #Place to define the callback function .
52. #TASK 3F
53.
54.
55.
56. if __name__ == '__main__':
57.     app.run_server()
58.

```

Copied!

Hints to complete TASKS

Search/Look for TASK word in the script to identify places where you need to complete the code.

TASK 3A: Add title to the dashboard

Update the `html.H1()` tag to hold the application title.

- Application title is Car Automobile Components
- Use style parameter provided below to make the title center aligned, with color code #503D36, and font-size as 24

1. 1
2. 2
3. 3

```
1. html.H1('Car Automobile Components',
2.           style={'textAlign': 'center', 'color': '#503D36',
3.                 'font-size': 24}),
```

Copied!

After updating the `html.H1()` with the application title, the `app.layout` will look like:

```
html.H1('Car Automobile Components',
        style={'textAlign': 'center', 'color': '#503D36',
              'font-size': 24}),
```

Reference Links:

[H1 component](#)

[Dash HTML Components](#)

TASK 3B: Add a Label to the dropdown

- Use the `html.H2()` tag to hold the label for the dropdown inside the first inner division
 - Label is Drive Wheels Type:
 - Use style parameter provided below to align the label `margin-right` with value `2em` which means 2 times the size of the current font.

1. 1

```
1. html.H2('Drive Wheels Type:', style={'margin-right': '2em'}),
```

Copied!

After updating the label the `app.layout` will now look like this

```
html.Div(
    [
        html.H2('Drive Wheels Type:', style={'margin-right': '2em'}),
    ]
),
```

TASK 3C: Next lets add the dropdown right below the first inner division.

- The dropdown has an `id` as `demo-dropdown`.
- These options have the labels as Rear Wheel Drive ,Front Wheel Drive and Four Wheel Drive
- The values allowed in the dropdown are `rwd,fwd,4wd`
- The default value when the dropdown is displayed is `rwd`.

1. 1
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7
8. 8
9. 9

```
1. dcc.Dropdown(
2.     id='demo-dropdown',
3.     options=[
4.         {'label': 'Rear Wheel Drive', 'value': 'rwd'},
5.         {'label': 'Front Wheel Drive', 'value': 'fwd'},
6.         {'label': 'Four Wheel Drive', 'value': '4wd'}
7.     ],
8.     value='rwd'
9. ),
```

Copied!

Reference [link](#)

Once you add the dropdown the 'app.layout will appear as follows

```

    dcc.Dropdown([
        id='demo-dropdown',
        options=[
            {'label': 'Rear Wheel Drive', 'value': 'rwd'},
            {'label': 'Front Wheel Drive', 'value': 'fwd'},
            {'label': 'Four Wheel Drive', 'value': '4wd'}
        ],
        value='rwd'
    ],

```

TASK 3D: Add two empty divisions for output inside the next inner division .

- Use 2 `html.Div()` tags .
- Provide division ids as `plot1` and `plot2`.

```

1. 1
2. 2

1. html.Div([ ], id='plot1'),
2. html.Div([ ], id='plot2')
```

Copied!

Once you add the divisions the 'app.layout will appear as follows

```

    html.Div([
        html.Div([ ], id='plot1'),
        html.Div([ ], id='plot2')
    ], style={'display': 'flex'}),
    ])

```

TASK 3E: Add the Ouput and input components inside the app.callback decorator.

- The inputs and outputs of our application's interface are described declaratively as the arguments of `@app.callback` decorator.

-In Dash, the inputs and outputs of our application are simply the properties of a particular component.

- In this example, our input is the `value` property of the component that has the ID `demo-dropdown`
- Our layout has 2 outputs so we need to create 2 output components.

It is a list with 2 output parameters with component id and property. Here, the component property will be `children` as we have created empty division and passing in `dcc.Graph` (figure) after computation.

Component ids will be `plot1` , `plot2`.

```

1. 1
2. 2
3. 3

1. @app.callback([Output(component_id='plot1', component_property='children'),
2.                Output(component_id='plot2', component_property='children')],
3.                Input(component_id='demo-dropdown', component_property='value'))
```

Copied!

Once you add the callback decorator the 'app.layout will appear as follows

```

53
54 @app.callback([Output(component_id='plot1', component_property='children'),
55                Output(component_id='plot2', component_property='children')
56                ],
57                Input(component_id='demo-dropdown', component_property='value'))

```

TASK 3F: Add the callback function.

- Whenever an input property changes, the function that the callback decorator wraps will get called automatically.
- In this case let us define a function `display_selected_drive_charts()` which will be wrapped by our decorator.
- The function first filters our dataframe `auto_data` by the selected value of the drive-wheels from the dropdown as follows
- `auto_data[auto_data['drive-wheels']==value]`
- Next we will group by the drive-wheels and body-style and calculate the mean price of the dataframe.
- Use the `px.pie()` and `px.bar()` function we will plot the pie chart and bar chart

```

1. 1
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7
8. 8
9. 9
10. 10
11. 11
12. 12
13. 13
14. 14

1. def display_selected_drive_charts(value):
2.
3.
4.
5.     filtered_df = auto_data[auto_data['drive-wheels']==value].groupby(['drive-wheels', 'body-style'], as_index=False). \
6.         mean()
7.
8.     filtered_df = filtered_df
9.
10.    fig1 = px.pie(filtered_df, values='price', names='body-style', title="Pie Chart")
11.    fig2 = px.bar(filtered_df, x='body-style', y='price', title='Bar Chart')
12.
13.    return [dcc.Graph.figure=fig1),
14.            dcc.Graph.figure=fig2) ]

```

Copied!

- Here for the pie chart we pass the filtered dataframe where values correspond to price and names will be body-style
- For the bar chart also we will pass the filtered dataframe where x-axis corresponds to body-style and y-axis as price.
- Finally we return the 2 figure objects `fig1` and `fig2` in `dcc.Graph` method and finally the plots are displayed as follows

```

def display_selected_drive(value):

    filtered_df = auto_data[auto_data['drive-wheels']==value].groupby(['drive-wheels',
        'body-style'], as_index=False).mean()

    filtered_df = filtered_df

    fig1 = px.pie(filtered_df, values='price', names='body-style', title="Pie Chart")
    fig2 = px.bar(filtered_df, x='body-style', y='price', title='Bar Chart')

    return [dcc.Graph.figure=fig1),
            dcc.Graph.figure=fig2) ]

```

- Once you have finished coding save your code.

Run the Application

- Firstly, install pandas and dash using the following command

```

1. 1
1. python3 -m pip install pandas dash

```

Copied!

```

1. 1
1. pip3 install httpx==0.20 dash plotly

```

Copied!

- Next Run the python file using the command

1. 1

1. python3 Dash_Auto.py

Copied!

- Observe the port number shown in the terminal.

```
theia@theia-lakshmi:/home/project$ python3 Dash_Auto.py
Dash is running on http://127.0.0.1:8050/

* Serving Flask app "Dash_Auto" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8050/ (Press CTRL+C to quit)
```

- Click on the Launch Application option from the menu bar.
- Provide the port number and click OK

labs.cognitiveclass.ai says

What port is your application running on?

8050

OK

Cancel

- The graphs appear on selection of drive wheels.

Refer to the complete code Dash_Auto.py here

```
1. 1
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```

1. import pandas as pd
2. import dash
3. import dash_html_components as html
4. import dash_core_components as dcc
5. from dash.dependencies import Input, Output, State
6. import plotly.graph_objects as go
7. import plotly.express as px
8. from dash import no_update
9.
10. app = dash.Dash(__name__)
11.
12. # REVIEW1: Clear the layout and do not display exception till callback gets executed
13. app.config.suppress_callback_exceptions = True
14.
15. # Read the automobiles data into pandas dataframe
16. auto_data = pd.read_csv('automobileEDA.csv',
17.                          encoding = "ISO-8859-1",
18.                          )
19.
20. #Layout Section of Dash
21.
22. app.layout = html.Div(children=[html.H1('Car Automobile Components',
23.                                          style={'textAlign': 'center', 'color': '#503D36',
24.                                          'font-size': 24}),
25.
26.                                #outer division starts
27.                                html.Div([
28.                                    # First inner division for adding dropdown helper text for Selected Drive wheels
29.                                    html.Div(
30.                                        html.H2('Drive Wheels Type:', style={'margin-right': '2em'}),
31.                                    ),
32.                                    #Second Inner division for adding 2 inner divisions for 2 output graphs
33.
34.                                    dcc.Dropdown(
35.                                        id='demo-dropdown',
36.                                        options=[
37.                                            {'label': 'Rear Wheel Drive', 'value': 'rwd'},
38.                                            {'label': 'Front Wheel Drive', 'value': 'fwd'},
39.                                            {'label': 'Four Wheel Drive', 'value': '4wd'}
40.                                        ],
41.                                        value='rwd'
42.                                    ),
43.                                    #Second Inner division for adding 2 inner divisions for 2 output graphs
44.
45.                                    html.Div([
46.
47.                                        html.Div([ ], id='plot1'),
48.                                        html.Div([ ], id='plot2')
49.
50.                                    ], style={'display': 'flex'}),
51.
52.                                ])
53.
54. #outer division ends

```



```
55.
56. })
57. #layout ends
58.
59. #Place to add @app.callback Decorator
60. @app.callback([Output(component_id='plot1', component_property='children'),
61.                 Output(component_id='plot2', component_property='children')],
62.                 Input(component_id='demo-dropdown', component_property='value'))
63.
64.
65. #Place to define the callback function .
66. def display_selected_drive_charts(value):
67.
68.
69.
70.     filtered_df = auto_data[auto_data['drive-wheels']==value].groupby(['drive-wheels','body-style'],as_index=False). \
71.         mean()
72.
73.     filtered_df = filtered_df
74.
75.     fig1 = px.pie(filtered_df, values='price', names='body-style', title="Pie Chart")
76.     fig2 = px.bar(filtered_df, x='body-style', y='price', title='Bar Chart')
77.
78.     return [dcc.Graph.figure=fig1),
79.             dcc.Graph.figure=fig2) ]
80.
81.
82.
83.
84. if __name__ == '__main__':
85.     app.run_server()
86.
```

Copied!

Congratulations, you have successfully created dash application!

Author

[Malika Singla](#)

[Lakshmi Holla](#)

Changelog

Date	Version	Changed by	Change Description
2021-07-21	0.1	Lakshmi Holla, Malika Singla	Initial Version
2022-08-24	0.2	Pratiksha Verma	Updated instructions
2022-08-29	0.3	Pratiksha Verma	Updated Screenshot

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