Basic Plotly Charts

Objectives

In this lab, you will learn about creating plotly charts using plotly.graph_objects and plotly.express.

Learn more about:

- Plotly python
- Plotly Graph Objects
- Plotly Express
- Handling data using Pandas

We will be using the airline dataset from Data Asset eXchange.

Airline Reporting Carrier On-Time Performance Dataset

The Reporting Carrier On-Time Performance Dataset contains information on approximately 200 million domestic US flights reported to the United States Bureau of Transportation Statistics. The dataset contains basic information about each flight (such as date, time, departure airport, arrival airport) and, if applicable, the amount of time the flight was delayed and information about the reason for the delay. This dataset can be used to predict the likelihood of a flight arriving on time.

Preview data, dataset metadata, and data glossary here.

In [1]:
```
# Import required libraries
import pandas as pd
import plotly.express as px
import plotly.graph_objects as go
```

Read Data

In [2]:

```
# Read the airline data into pandas dataframe
airline_data =  pd.read_csv('https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101
                            encoding = "ISO-8859-1",
                            dtype={'Div1Airport': str, 'Div1TailNum': str,
                                   'Div2Airport': str, 'Div2TailNum': str})
```

In [3]:

```
# Preview the first 5 lines of the loaded data
airline_data.head()
```

Out[3]:

	Unnamed: 0	Year	Quarter	Month	DayofMonth	DayOfWeek	FlightDate	Reporting_Airline	DOT_ID_Reporting_Airline	IATA_CODE_Reporting_Airline	.
0	1295781	1998	2	4	2	4	1998-04-02	AS	19930	AS	
1	1125375	2013	2	5	13	1	2013-05-13	EV	20366	EV	
2	118824	1993	3	9	25	6	1993-09-25	UA	19977	UA	
3	634825	1994	4	11	12	6	1994-11-12	HP	19991	HP	
4	1888125	2017	3	8	17	4	2017-08-17	UA	19977	UA	

5 rows × 110 columns

In [4]:

```
# Shape of the data
airline_data.shape
```

Out[4]:

```
(27000, 110)
```

In [5]:

```
# Randomly sample 500 data points. Setting the random state to be 42 so that we get same result.
data = airline_data.sample(n=500, random_state=42)
```

In [6]:

```
# Get the shape of the trimmed data
data.shape
```

Out[6]:
```
(500, 110)
```

Lab structure

plotly.graph_objects

1. Review scatter plot creation

   Theme: How departure time changes with respect to airport distance

2. **To do** - Create line plot

   Theme: Extract average monthly delay time and see how it changes over the year

plotly.express

1. Review bar chart creation

   Theme: Extract number of flights from a specific airline that goes to a destination

2. **To do** - Create bubble chart

   Theme: Get number of flights as per reporting airline

3. **To do** - Create histogram

   Theme: Get distribution of arrival delay

4. Review pie chart

   Theme: Proportion of distance group by month (month indicated by numbers)

5. **To do** - Create sunburst chart

   Theme: Hierarchical view in othe order of month and destination state holding value of number of flights

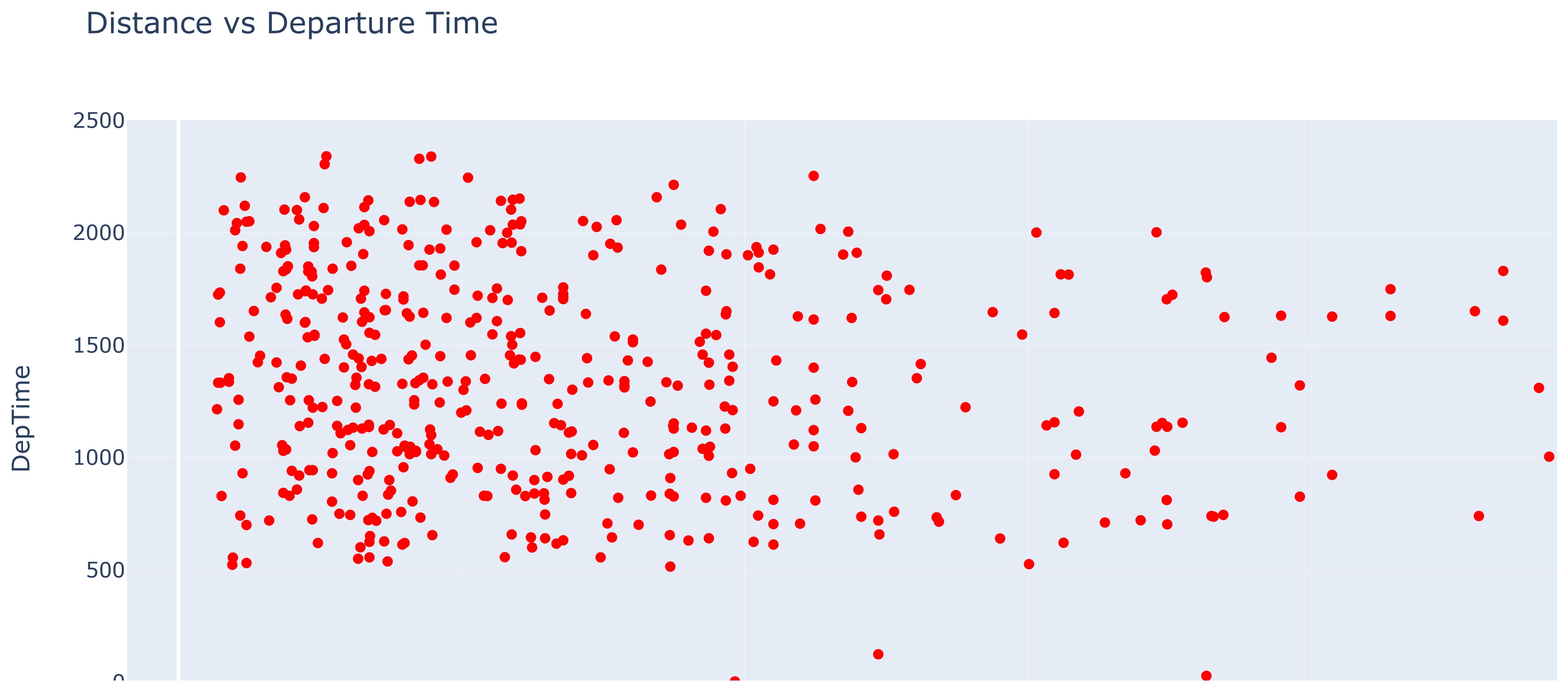
plotly.graph_objects¶

1. Scatter Plot

Learn more about usage of scatter plot here

Idea: How departure time changes with respect to airport distance

In [7]:
```
# First we create a figure using go.Figure and adding trace to it through go.scatter
fig = go.Figure(data=go.Scatter(x=data['Distance'], y=data['DepTime'], mode='markers', marker=dict(color='red')))
# Updating layout through `update_layout`. Here we are adding title to the plot and providing title to x and y axis.
fig.update_layout(title='Distance vs Departure Time', xaxis_title='Distance', yaxis_title='DepTime')
# Display the figure
fig.show()
```



2. Line Plot

Learn more about line plot here

Idea: Extract average monthly arrival delay time and see how it changes over the year.

```
In [8]:  # Group the data by Month and compute average over arrival delay time.
         line_data = data.groupby('Month')['ArrDelay'].mean().reset_index()
```

```
In [9]: # Display the data
        line_data
```

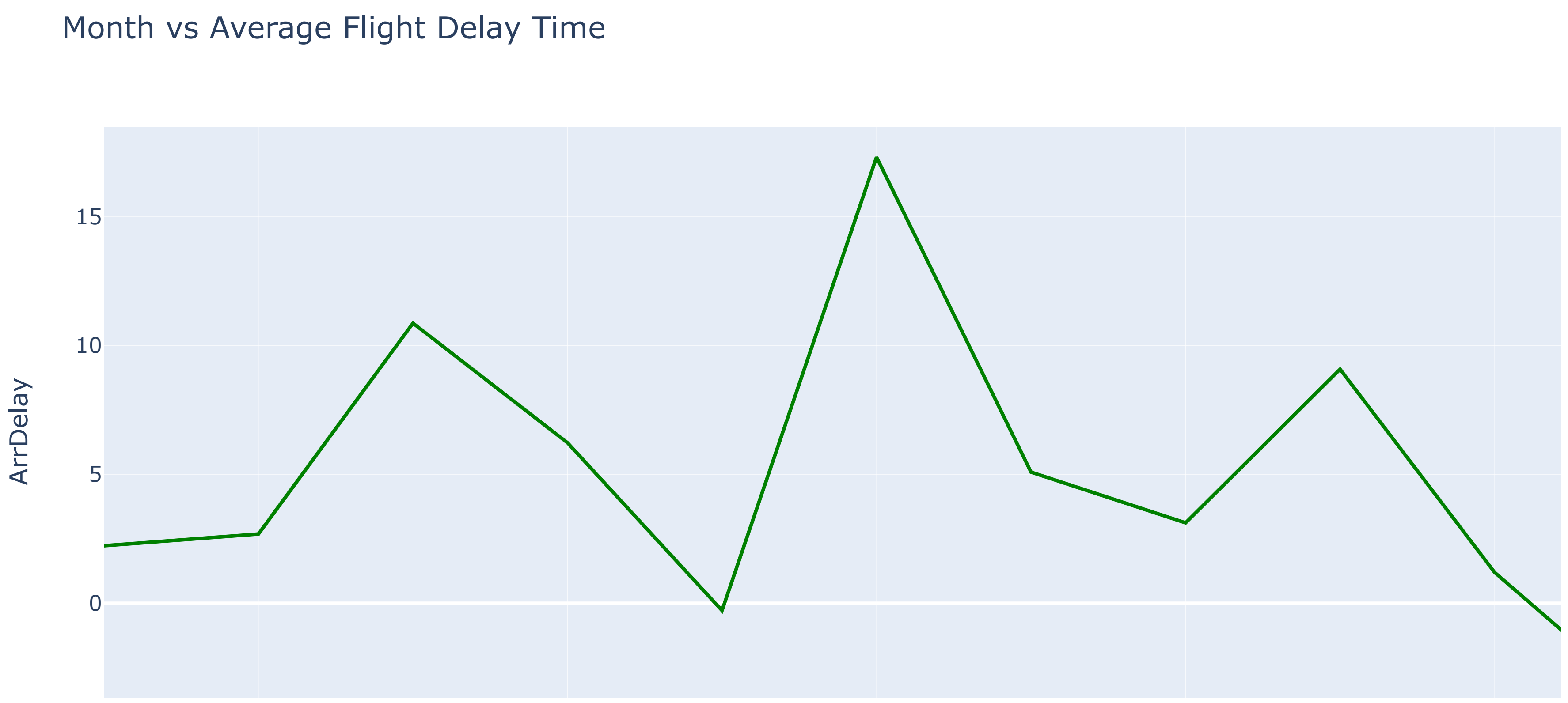
Out[9]:

	Month	ArrDelay
0	1	2.232558
1	2	2.687500
2	3	10.868421
3	4	6.229167
4	5	-0.279070
5	6	17.310345
6	7	5.088889
7	8	3.121951
8	9	9.081081
9	10	1.200000
10	11	-3.975000
11	12	3.240741

To do:

- Create a line plot with x-axis being the month and y-axis being computed average delay time. Update plot title,\ xaxis, and yaxis title.
- Hint: Scatter and line plot vary by updating mode parameter.

```
In [10]: fig = go.Figure(data=go.Scatter(x=line_data['Month'], y=line_data['ArrDelay'], mode='lines', marker=dict(color='green')))
         fig.update_layout(title='Month vs Average Flight Delay Time', xaxis_title='Month', yaxis_title='ArrDelay')
         fig.show()
```



plotly.express¶

1. Bar Chart

Learn more about bar chart here

Idea: Extract number of flights from a specific airline that goes to a destination

In [11]:
```python
# Group the data by destination state and reporting airline. Compute total number of flights in each combination
bar_data = data.groupby(['DestState'])['Flights'].sum().reset_index()
```

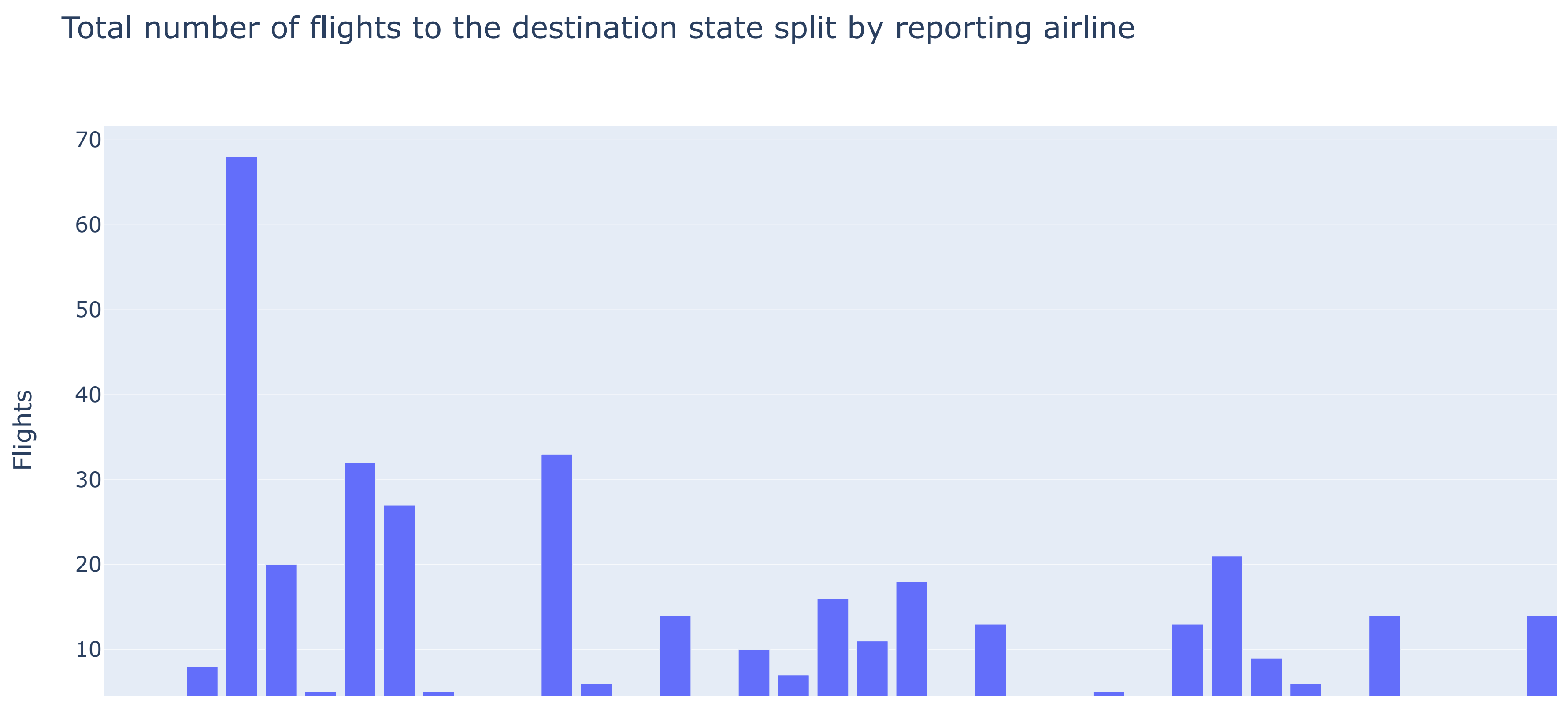
In [12]:
```python
# Display the data
bar_data
```

Out[12]:

	DestState	Flights
0	AK	4.0
1	AL	3.0
2	AZ	8.0
3	CA	68.0
4	CO	20.0
5	CT	5.0
6	FL	32.0
7	GA	27.0
8	HI	5.0
9	IA	1.0
10	ID	1.0
11	IL	33.0
12	IN	6.0
13	KS	1.0
14	KY	14.0
15	LA	4.0
16	MA	10.0
17	MD	7.0
18	MI	16.0
19	MN	11.0
20	MO	18.0
21	MT	3.0
22	NC	13.0
23	NE	2.0

	DestState	Flights
24	NH	1.0
25	NJ	5.0
26	NM	1.0
27	NV	13.0
28	NY	21.0
29	OH	9.0
30	OK	6.0
31	OR	3.0
32	PA	14.0
33	PR	2.0
34	RI	1.0
35	SC	1.0
36	TN	14.0
37	TX	60.0
38	UT	7.0
39	VA	11.0
40	VI	1.0
41	WA	10.0
42	WI	8.0

In [13]:
```
# Use plotly express bar chart function px.bar. Provide input data, x and y axis variable, and title of the chart.
# This will give total number of flights to the destination state.
fig = px.bar(bar_data, x="DestState", y="Flights", title='Total number of flights to the destination state split by reporting ai
fig.show()
```



2. Bubble Chart

Learn more about bubble chart here

Idea: Get number of flights as per reporting airline

In [14]:
```
# Group the data by reporting airline and get number of flights
bub_data = data.groupby('Reporting_Airline')['Flights'].sum().reset_index()
```

In [15]:

```
bub_data
```

Out[15]:

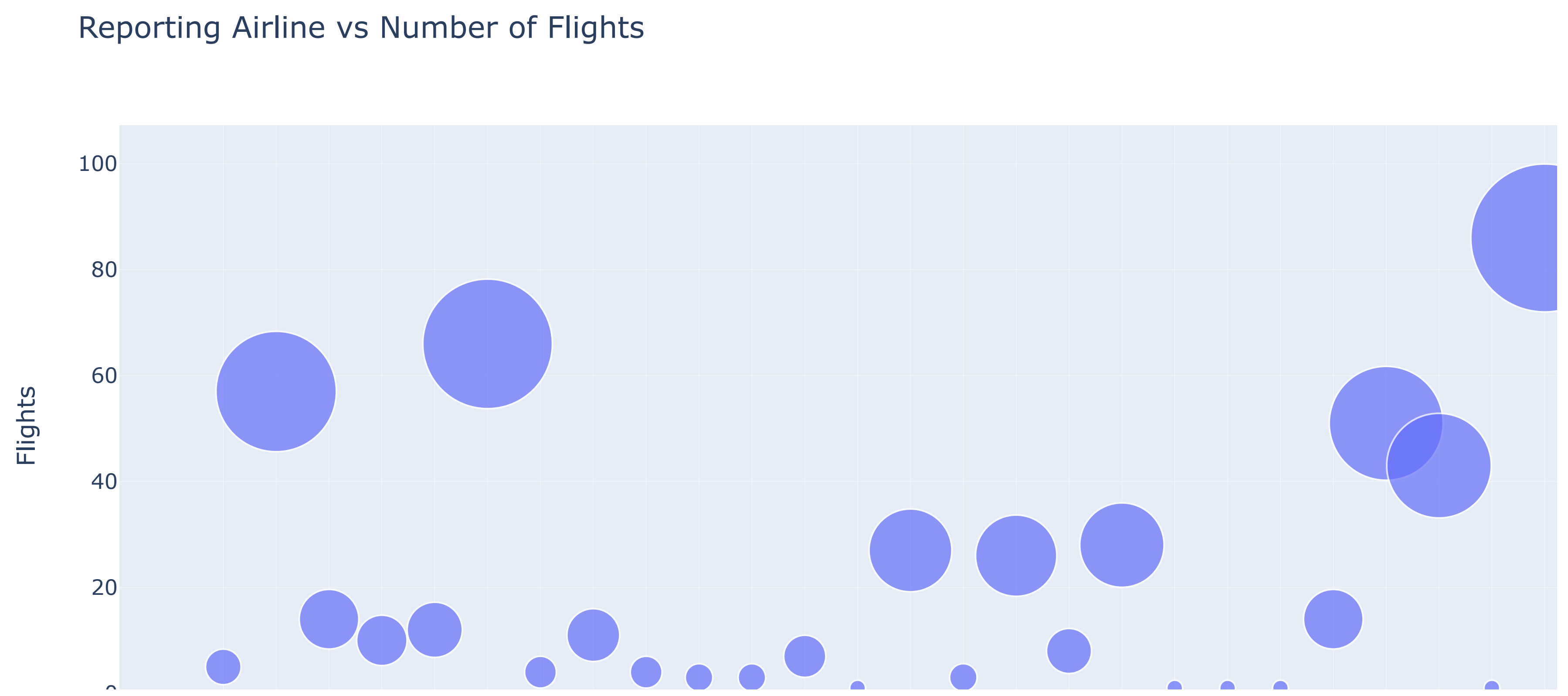
	Reporting_Airline	Flights
0	9E	5.0
1	AA	57.0
2	AS	14.0
3	B6	10.0
4	CO	12.0
5	DL	66.0
6	EA	4.0
7	EV	11.0
8	F9	4.0
9	FL	3.0
10	HA	3.0
11	HP	7.0
12	KH	1.0
13	MQ	27.0
14	NK	3.0
15	NW	26.0
16	OH	8.0
17	OO	28.0
18	PA (1)	1.0
19	PI	1.0
20	PS	1.0
21	TW	14.0
22	UA	51.0
23	US	43.0

	Reporting_Airline	Flights
24	VX	1.0
25	WN	86.0
26	XE	6.0
27	YV	6.0
28	YX	1.0

To do

- Create a bubble chart using the `bub_data` with x-axis being reporting airline and y-axis being flights.
- Provide title to the chart
- Update size of the bubble based on the number of flights. Use `size` parameter.
- Update name of the hover tooltip to `reporting_airline` using `hover_name` parameter.

In [16]:
```
fig = px.scatter(bub_data, x="Reporting_Airline", y="Flights", size="Flights",
                 hover_name="Reporting_Airline", title='Reporting Airline vs Number of Flights', size_max=60)
fig.show()
```



Histogram

Learn more about histogram here

Idea: Get distribution of arrival delay

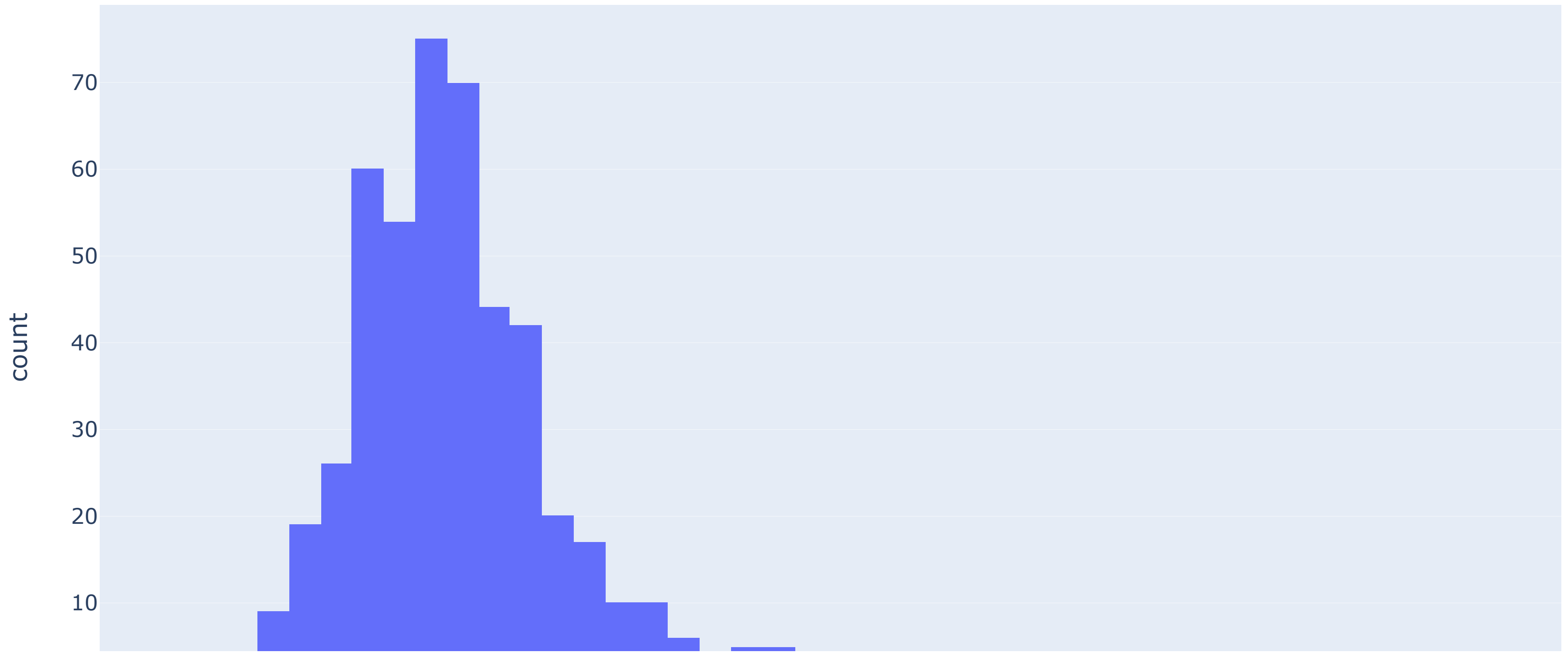
```
In [17]: # Set missing values to 0
```

```
data['ArrDelay'] = data['ArrDelay'].fillna(0)
```

To do

- Use px.histogram and pass the dataset.
- Pass `ArrDelay` to x parameter.

In [18]:
```
fig = px.histogram(data, x="ArrDelay")
fig.show()
```



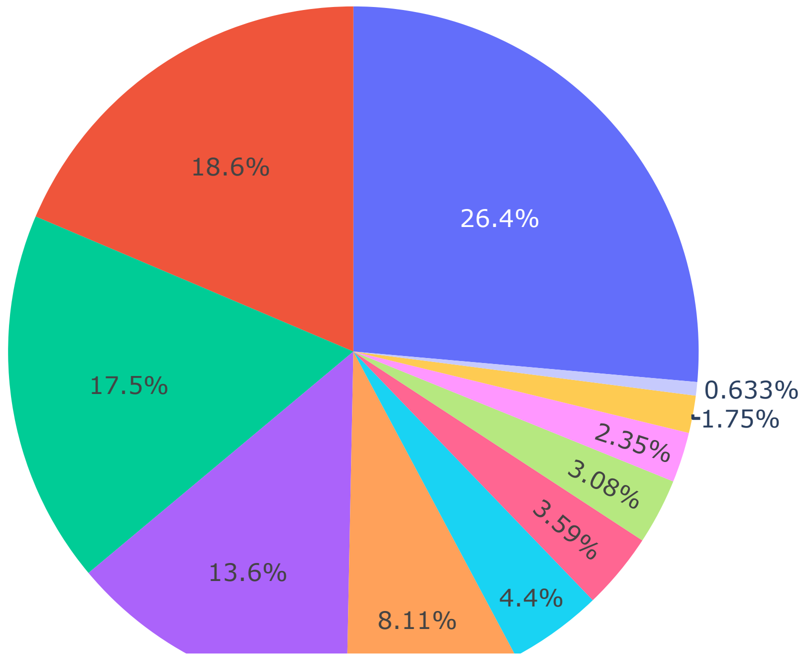
Pie Chart

Learn more about pie chart here

Idea: Proportion of distance group by month (month indicated by numbers)

```
In [19]: # Use px.pie function to create the chart. Input dataset.
         # Values parameter will set values associated to the sector. 'Month' feature is passed to it.
         # labels for the sector are passed to the `names` parameter.
         fig = px.pie(data, values='Month', names='DistanceGroup', title='Distance group proportion by month')
         fig.show()
```

Distance group proportion by month



Sunburst Charts

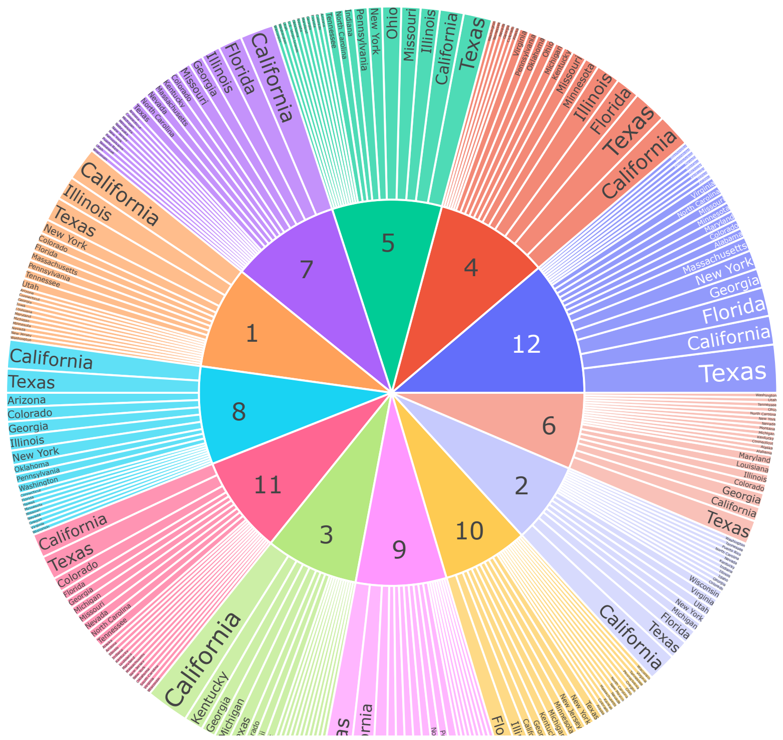
Learn more about sunburst chart here

Idea: Hierarchical view in othe order of month and destination state holding value of number of flights

To do

- Create sunburst chart using `px.sunburst`.
- Define hierarchy of sectors from root to leaves in `path` parameter. Here, we go from `Month` to `DestStateName` feature.
- Set sector values in `values` paramter. Here, we can pass in `Flights` feature.
- Show the figure.

In [20]:
```
fig = px.sunburst(data, path=['Month', 'DestStateName'], values='Flights')
fig.show()
```



Summary

In this lab, you have learnt how to use `plotly.graph_objects` and `plotly.express` for creating plots and charts.