Quantitative comparisons: bar-charts

Olympic medals

```
,Gold, Silver, Bronze
United States, 137, 52, 67
Germany, 47, 43, 67
Great Britain, 64, 55, 26
Russia, 50, 28, 35
China, 44, 30, 35
France, 20, 55, 21
Australia, 23, 34, 25
Italy, 8, 38, 24
Canada, 4, 4, 61
Japan, 17, 13, 34
```

Olympic medals: visualizing the data

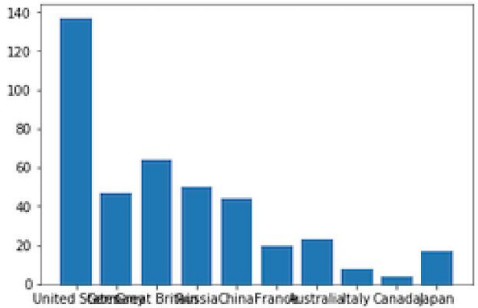
```
medals = pd.read_csv('medals_by_country_2016.csv', index_col=0)
```

Olympic medals: visualizing the data

```
medals = pd.read_csv('medals_by_country_2016.csv', index_col=0)
fig, ax = plt.subplots()
```

Olympic medals: visualizing the data

```
medals = pd.read_csv('medals_by_country_2016.csv', index_col=0)
fig, ax = plt.subplots()
ax.bar(medals.index, medals["Gold"])
plt.show()
```



Interlude: rotate the tick labels

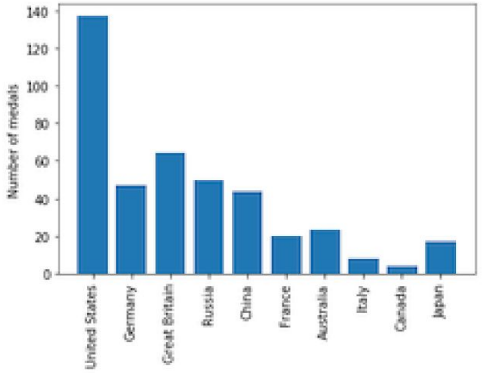
```
fig, ax = plt.subplots()
ax.bar(medals.index, medals["Gold"])
```

Interlude: rotate the tick labels

```
fig, ax = plt.subplots()
ax.bar(medals.index, medals["Gold"])
ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")
```

Interlude: rotate the tick labels

```
fig, ax = plt.subplots()
ax.bar(medals.index, medals["Gold"])
ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")
plt.show()
```



Olympic medals: visualizing the other medals

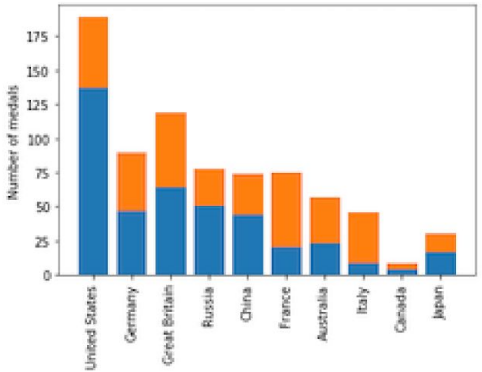
```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"])
```

Olympic medals: visualizing the other medals

```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"])
ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"])
```

Olympic medals: visualizing the other medals

```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"])
ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"])
ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")
plt.show()
```



Olympic medals: visualizing all three

```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"])

ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"])
```

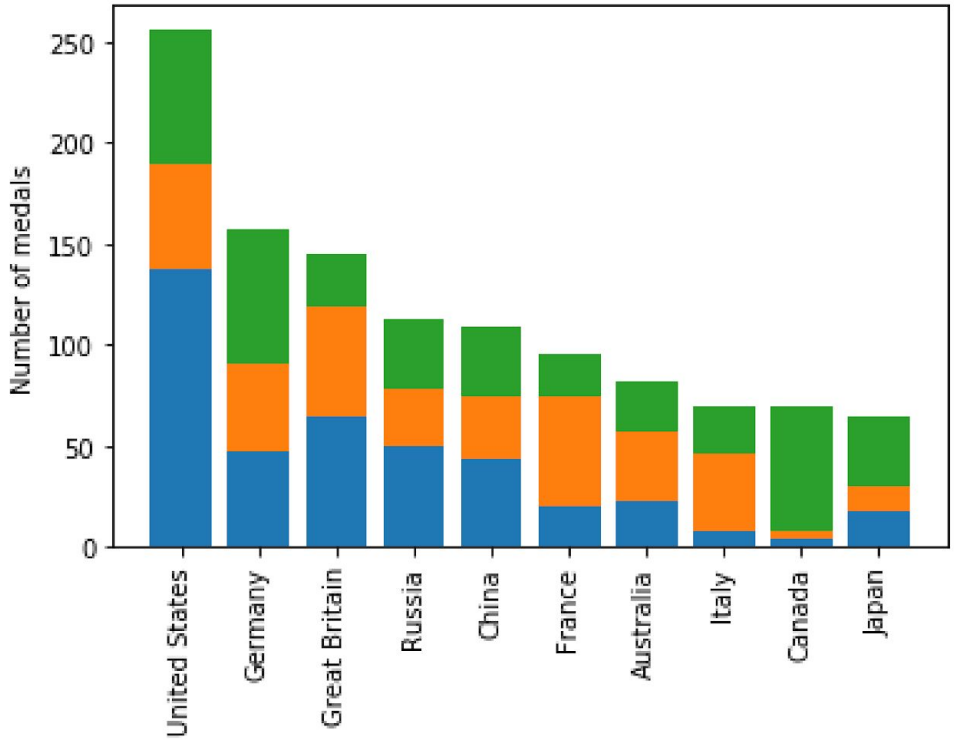
Olympic medals: visualizing all three

```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"])

ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"])
ax.bar(medals.index, medals["Bronze"],
       bottom=medals["Gold"] + medals["Silver"])
```

Olympic medals: visualizing all three

```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"])

ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"])
ax.bar(medals.index, medals["Bronze"],
       bottom=medals["Gold"] + medals["Silver"])
ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")
plt.show()
```

Stacked bar chart



Adding a legend

```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"])
ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"])
ax.bar(medals.index, medals["Bronze"],
       bottom=medals["Gold"] + medals["Silver"])

ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")
```

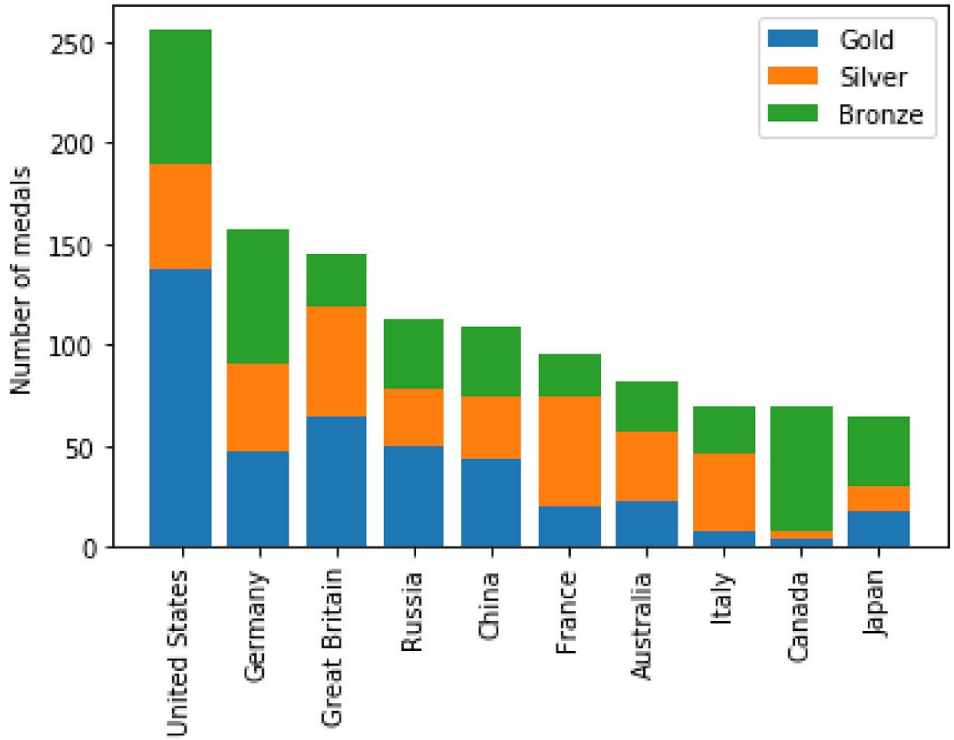
Adding a legend

```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"], label="Gold")
ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"],
       label="Silver")
ax.bar(medals.index, medals["Bronze"],
       bottom=medals["Gold"] + medals["Silver"],
       label="Bronze")

ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")
```

Adding a legend

```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"], label="Gold")
ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"],
       label="Silver")
ax.bar(medals.index, medals["Bronze"],
       bottom=medals["Gold"] + medals["Silver"],
       label="Bronze")

ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")
ax.legend()
plt.show()
```

Stacked bar chart with legend



Create a bar chart!

Quantitative comparisons: histograms

Histograms

	ID	Name	Sex	Age	Height	Weight	Team	NOC	Games	Year	Season	City	Sport	Event	Medal
158	62	Giovanni Abagnale	M	21.0	198.0	90.0	Italy	ITA	2016 Summer	2016	Summer	Rio de Janeiro	Rowing	Rowing Men's Coxless Pairs	Bronze
11648	6346	Jrmie Azou	M	27.0	178.0	71.0	France	FRA	2016 Summer	2016	Summer	Rio de Janeiro	Rowing	Rowing Men's Lightweight Double Sculls	Gold
14871	8025	Thomas Gabriel Jrmie Baroukh	M	28.0	183.0	70.0	France	FRA	2016 Summer	2016	Summer	Rio de Janeiro	Rowing	Rowing Men's Lightweight Coxless Fours	Bronze
15215	8214	Jacob Jepsen Barse	M	27.0	188.0	73.0	Denmark	DEN	2016 Summer	2016	Summer	Rio de Janeiro	Rowing	Rowing Men's Lightweight Coxless Fours	Silver
18441	9764	Alexander Belonogoff	M	26.0	187.0	90.0	Australia	AUS	2016 Summer	2016	Summer	Rio de Janeiro	Rowing	Rowing Men's Quadruple Sculls	Silver

A bar chart again

```
fig, ax = plt.subplots()
```

A bar chart again

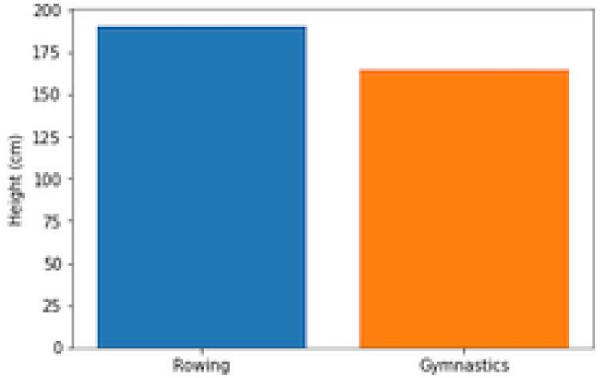
```
fig, ax = plt.subplots()
ax.bar("Rowing", mens_rowing["Height"].mean())
```

A bar chart again

```
fig, ax = plt.subplots()
ax.bar("Rowing", mens_rowing["Height"].mean())
ax.bar("Gymnastics", mens_gymnastics["Height"].mean())
```

A bar chart again

```
fig, ax = plt.subplots()
ax.bar("Rowing", mens_rowing["Height"].mean())
ax.bar("Gymnastics", mens_gymnastics["Height"].mean())
ax.set_ylabel("Height (cm)")
plt.show()
```



Introducing histograms

```
fig, ax = plt.subplots()
```

Introducing histograms

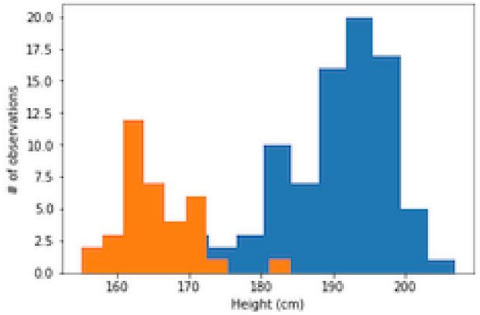
```
fig, ax = plt.subplots()
ax.hist(mens_rowing["Height"])
```

Introducing histograms

```
fig, ax = plt.subplots()
ax.hist(mens_rowing["Height"])
ax.hist(mens_gymnastic["Height"])
```

Introducing histograms

```
fig, ax = plt.subplots()
ax.hist(mens_rowing["Height"])
ax.hist(mens_gymnastic["Height"])
ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")
plt.show()
```

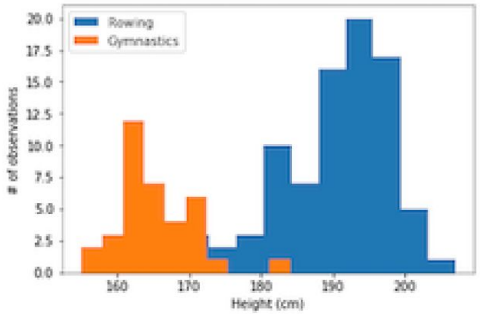


Labels are needed

```
ax.hist(mens_rowing["Height"], label="Rowing")
ax.hist(mens_gymnastic["Height"], label="Gymnastics")
ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")
```

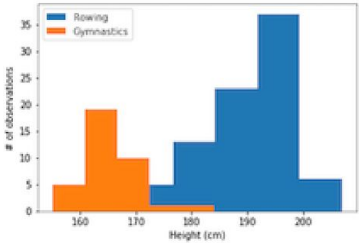
Labels are needed

```
ax.hist(mens_rowing["Height"], label="Rowing")
ax.hist(mens_gymnastic["Height"], label="Gymnastics")
ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")
ax.legend()
plt.show()
```



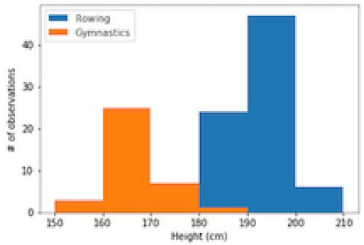
Customizing histograms: setting the number of bins

```
ax.hist(mens_rowing["Height"], label="Rowing", bins=5)
ax.hist(mens_gymnastic["Height"], label="Gymnastics", bins=5)
ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")
ax.legend()
plt.show()
```



Customizing histograms: setting bin boundaries

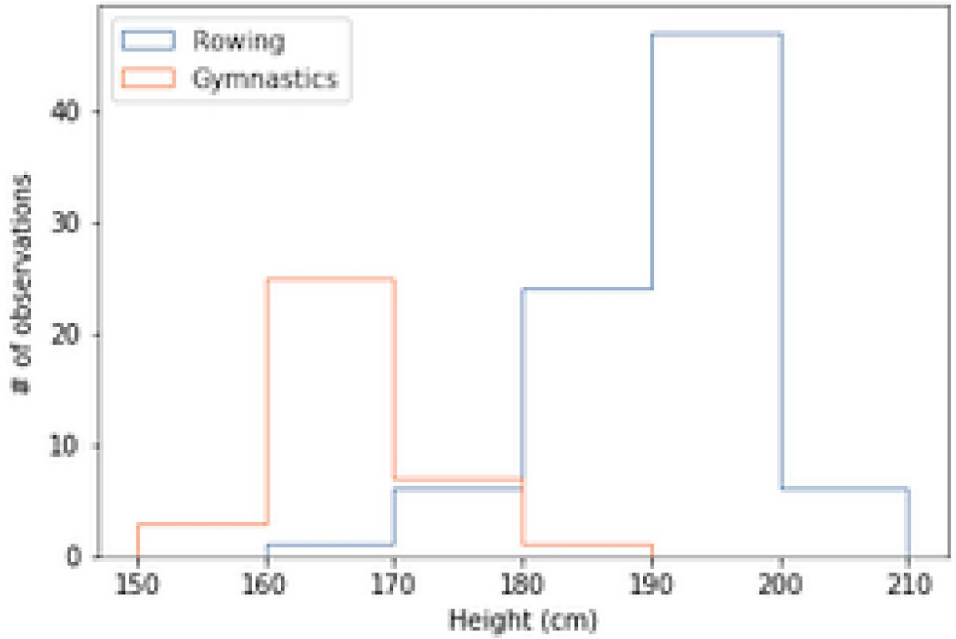
```
ax.hist(mens_rowing["Height"], label="Rowing",
        bins=[150, 160, 170, 180, 190, 200, 210])

ax.hist(mens_gymnastic["Height"], label="Gymnastics",
        bins=[150, 160, 170, 180, 190, 200, 210])

ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")
ax.legend()
plt.show()
```



Customizing histograms: transparency

```
ax.hist(mens_rowing["Height"], label="Rowing",
        bins=[150, 160, 170, 180, 190, 200, 210],
        histtype="step")

ax.hist(mens_gymnastic["Height"], label="Gymnastics",
        bins=[150, 160, 170, 180, 190, 200, 210],
        histtype="step")

ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")
ax.legend()
plt.show()
```

Histogram with a histtype of step



Create your own histogram!

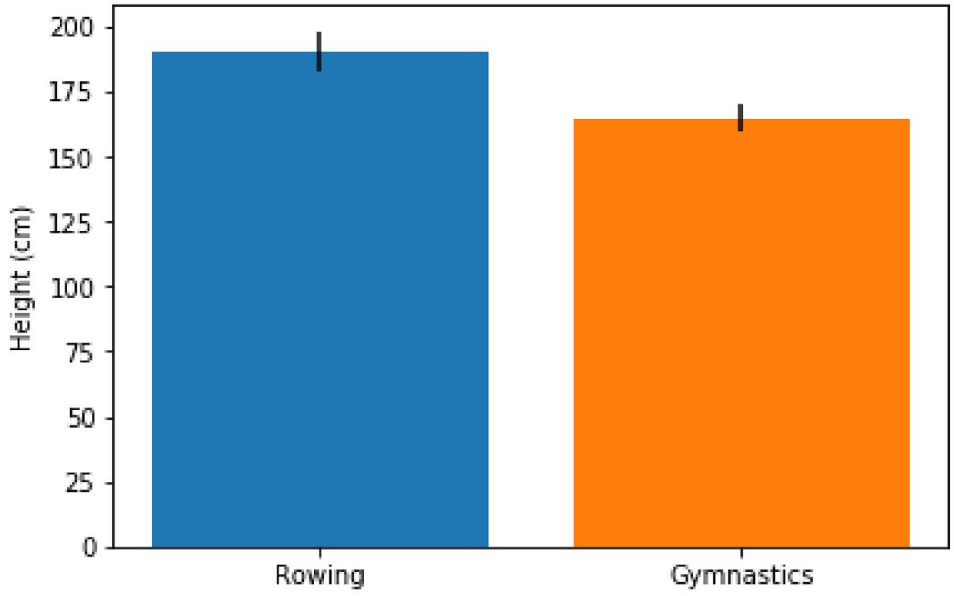
Statistical plotting

Adding error bars to bar charts

Adding error bars to bar charts

```
fig, ax = plt.subplots()

ax.bar("Rowing",
       mens_rowing["Height"].mean(),
       yerr=mens_rowing["Height"].std())

ax.bar("Gymnastics",
       mens_gymnastics["Height"].mean(),
       yerr=mens_gymnastics["Height"].std())

ax.set_ylabel("Height (cm)")

plt.show()
```

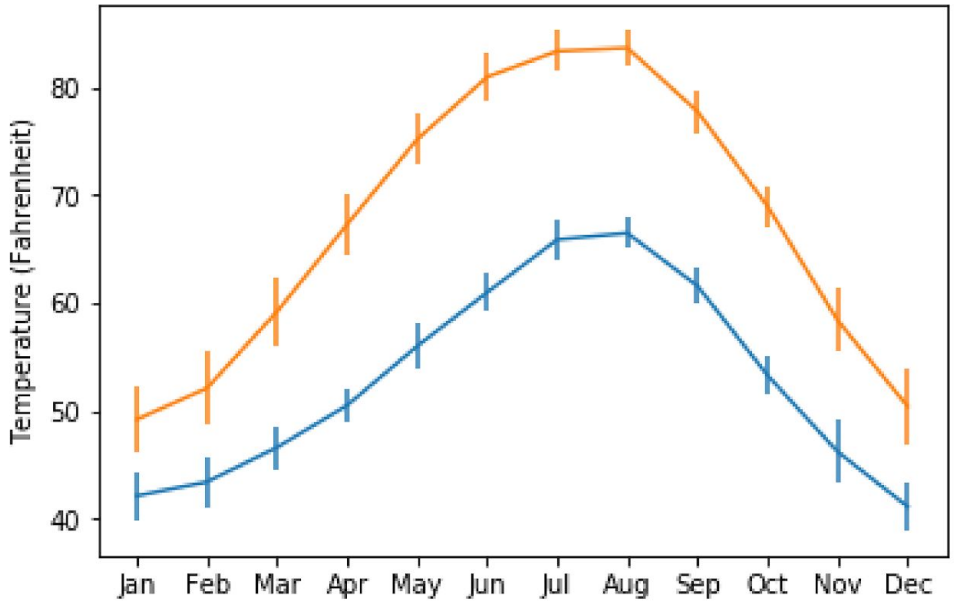
Error bars in a bar chart



Adding error bars to plots

```
fig, ax = plt.subplots()

ax.errorbar(seattle_weather["MONTH"],
            seattle_weather["MLY-TAVG-NORMAL"],
            yerr=seattle_weather["MLY-TAVG-STDDEV"])

ax.errorbar(austin_weather["MONTH"],
            austin_weather["MLY-TAVG-NORMAL"],
            yerr=austin_weather["MLY-TAVG-STDDEV"])

ax.set_ylabel("Temperature (Fahrenheit)")

plt.show()
```

Error bars in plots



Adding boxplots

```
fig, ax = plt.subplots()
```

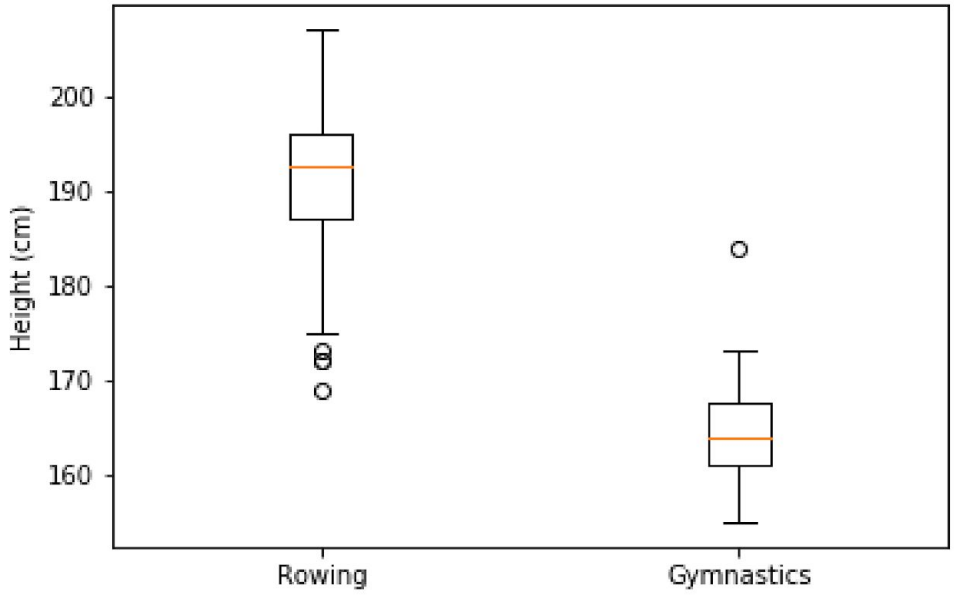
Adding boxplots

```
fig, ax = plt.subplots()

ax.boxplot([mens_rowing["Height"],
            mens_gymnastics["Height"]])
```

Adding boxplots

```
fig, ax = plt.subplots()

ax.boxplot([mens_rowing["Height"],
            mens_gymnastics["Height"]])

ax.set_xticklabels(["Rowing", "Gymnastics"])
ax.set_ylabel("Height (cm)")


plt.show()
```

Interpreting boxplots



Try it yourself!

Quantitative comparisons: scatter plots

Introducing scatter plots

```
fig, ax = plt.subplots()
```

Introducing scatter plots

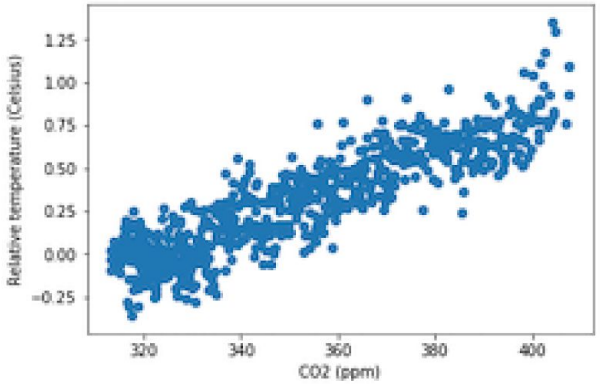
```
fig, ax = plt.subplots()
ax.scatter(climate_change["co2"], climate_change["relative_temp"])
```

Introducing scatter plots

```
fig, ax = plt.subplots()
ax.scatter(climate_change["co2"], climate_change["relative_temp"])
ax.set_xlabel("CO2 (ppm)")
ax.set_ylabel("Relative temperature (Celsius)")
plt.show()
```

Introducing scatter plots

```
fig, ax = plt.subplots()
ax.scatter(climate_change["co2"], climate_change["relative_temp"])
ax.set_xlabel("CO2 (ppm)")
ax.set_ylabel("Relative temperature (Celsius)")
plt.show()
```



Customizing scatter plots

```
eighties = climate_change["1980-01-01":"1989-12-31"]
nineties = climate_change["1990-01-01":"1999-12-31"]

fig, ax = plt.subplots()
```

Customizing scatter plots

```
eighties = climate_change["1980-01-01":"1989-12-31"]
nineties = climate_change["1990-01-01":"1999-12-31"]

fig, ax = plt.subplots()

ax.scatter(eighties["co2"], eighties["relative_temp"],
           color="red", label="eighties")
```

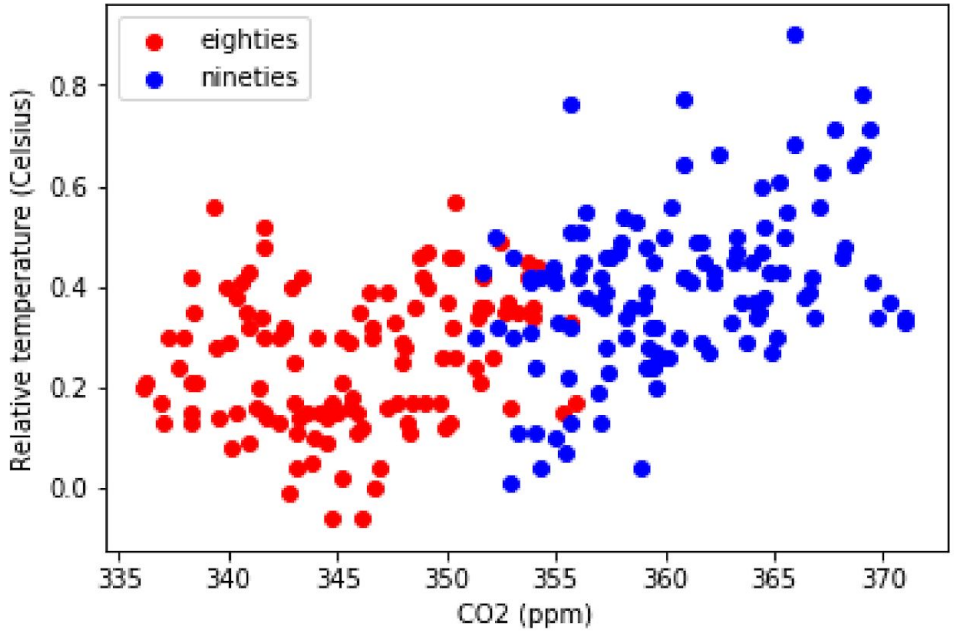
Customizing scatter plots

```
eighties = climate_change["1980-01-01":"1989-12-31"]
nineties = climate_change["1990-01-01":"1999-12-31"]

fig, ax = plt.subplots()

ax.scatter(eighties["co2"], eighties["relative_temp"],
           color="red", label="eighties")

ax.scatter(nineties["co2"], nineties["relative_temp"],
           color="blue", label="nineties")
```

Customizing scatter plots

```
eighties = climate_change["1980-01-01":"1989-12-31"]
nineties = climate_change["1990-01-01":"1999-12-31"]

fig, ax = plt.subplots()

ax.scatter(eighties["co2"], eighties["relative_temp"],
           color="red", label="eighties")

ax.scatter(nineties["co2"], nineties["relative_temp"],
           color="blue", label="nineties")

ax.legend()


ax.set_xlabel("CO2 (ppm)")
ax.set_ylabel("Relative temperature (Celsius)")


plt.show()
```

Encoding a comparison by color



Encoding a third variable by color

```
fig, ax = plt.subplots()
```

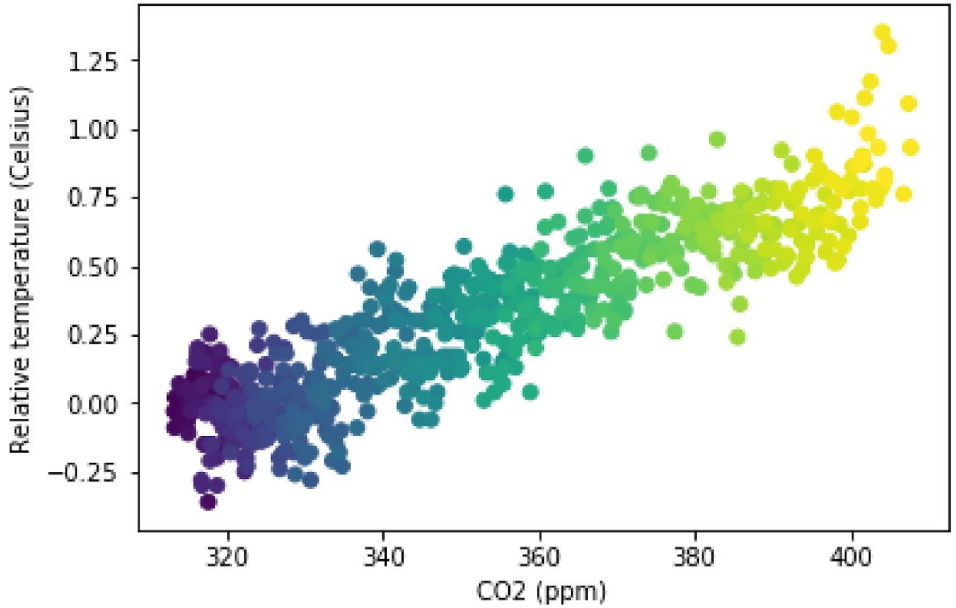
Encoding a third variable by color

```
fig, ax = plt.subplots()
ax.scatter(climate_change["co2"], climate_change["relative_temp"],
           c=climate_change.index)
```

Encoding a third variable by color

```
fig, ax = plt.subplots()
ax.scatter(climate_change["co2"], climate_change["relative_temp"],
           c=climate_change.index)
ax.set_xlabel("CO2 (ppm)")
ax.set_ylabel("Relative temperature (Celsius)")
plt.show()
```

Encoding time in color



Practice making your own scatter plots!