In [9]:
```
%matplotlib notebook
import numpy as np
import numpy as np
import matplotlib
import matplotlib.animation
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
import pandas as pd
```

Dataset and visualization

The goal for this notebook is to show you some data, define terms of supervised learning, and give you confidence to go out and grab data from the wild world. Also, the first rule of machine learning: **LOOK AT YOUR DATA**.

I cannot emphasize this maxim enough: **LOOK AT YOUR DATA**

1. Housing prices are one of the most popular datasets on Kaggle--and its classical. We're going to use the Ames set (http://jse.amstat.org/v19n3/decock/DataDocumentation.txt). This is an updated dataset for the famous "Boston Housing Dataset", which has been used for many years in stats classes.
2. I also want to point out the UCI machine learning datasets (https://archive.ics.uci.edu/ml/index.php), which are amazing for ML datasets. Could be valuable for your projects!

In [2]:
```
import pandas as pd

url="https://www.openintro.org/stat/data/ames.csv"
df=pd.read_csv(url)
data=df.values
df[1:10]
```

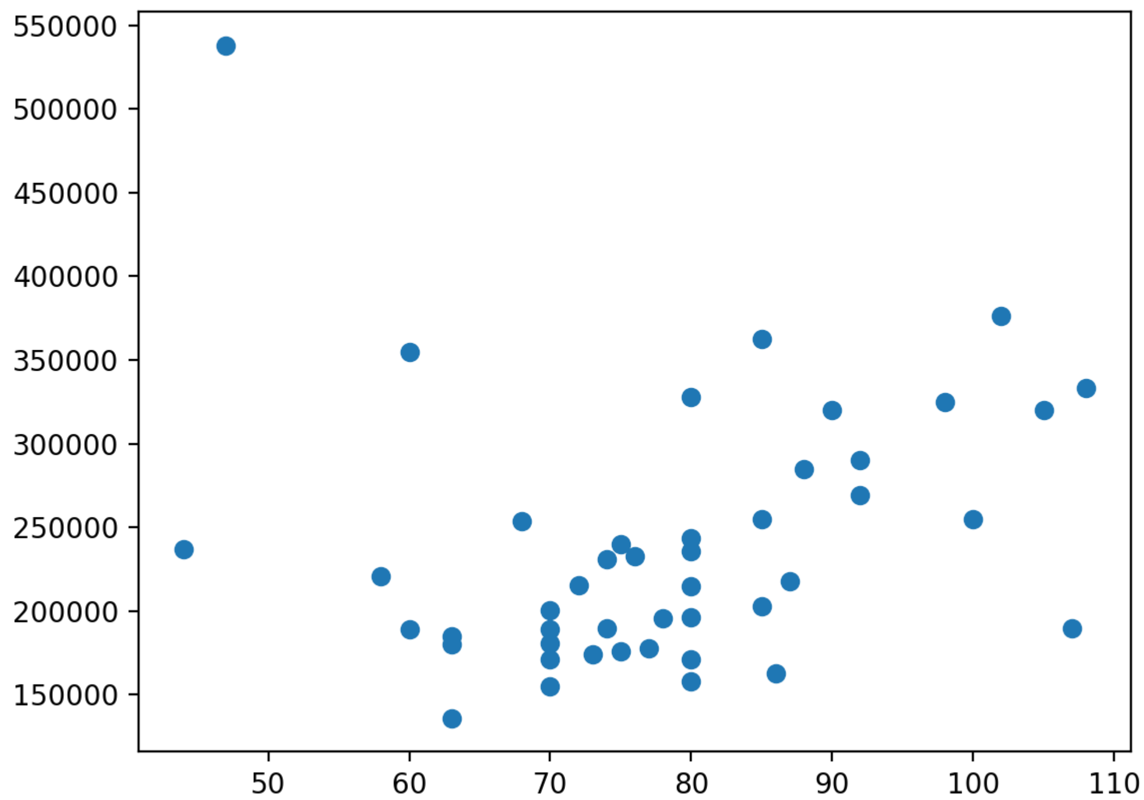
Out[2]:

	Order	PID	MS.SubClass	MS.Zoning	Lot.Frontage	Lot.Area	Street	Alley	Lot.Shape	Land.Contour	...	Pool.Area	Pool.QC	Fence	Misc.
1	2	526350040	20	RH	80.0	11622	Pave	NaN	Reg	Lvl	...	0	NaN	MnPrv	
2	3	526351010	20	RL	81.0	14267	Pave	NaN	IR1	Lvl	...	0	NaN	NaN	
3	4	526353030	20	RL	93.0	11160	Pave	NaN	Reg	Lvl	...	0	NaN	NaN	
4	5	527105010	60	RL	74.0	13830	Pave	NaN	IR1	Lvl	...	0	NaN	MnPrv	
5	6	527105030	60	RL	78.0	9978	Pave	NaN	IR1	Lvl	...	0	NaN	NaN	
6	7	527127150	120	RL	41.0	4920	Pave	NaN	Reg	Lvl	...	0	NaN	NaN	
7	8	527145080	120	RL	43.0	5005	Pave	NaN	IR1	HLS	...	0	NaN	NaN	
8	9	527146030	120	RL	39.0	5389	Pave	NaN	IR1	Lvl	...	0	NaN	NaN	
9	10	527162130	60	RL	60.0	7500	Pave	NaN	Reg	Lvl	...	0	NaN	NaN	

9 rows × 82 columns

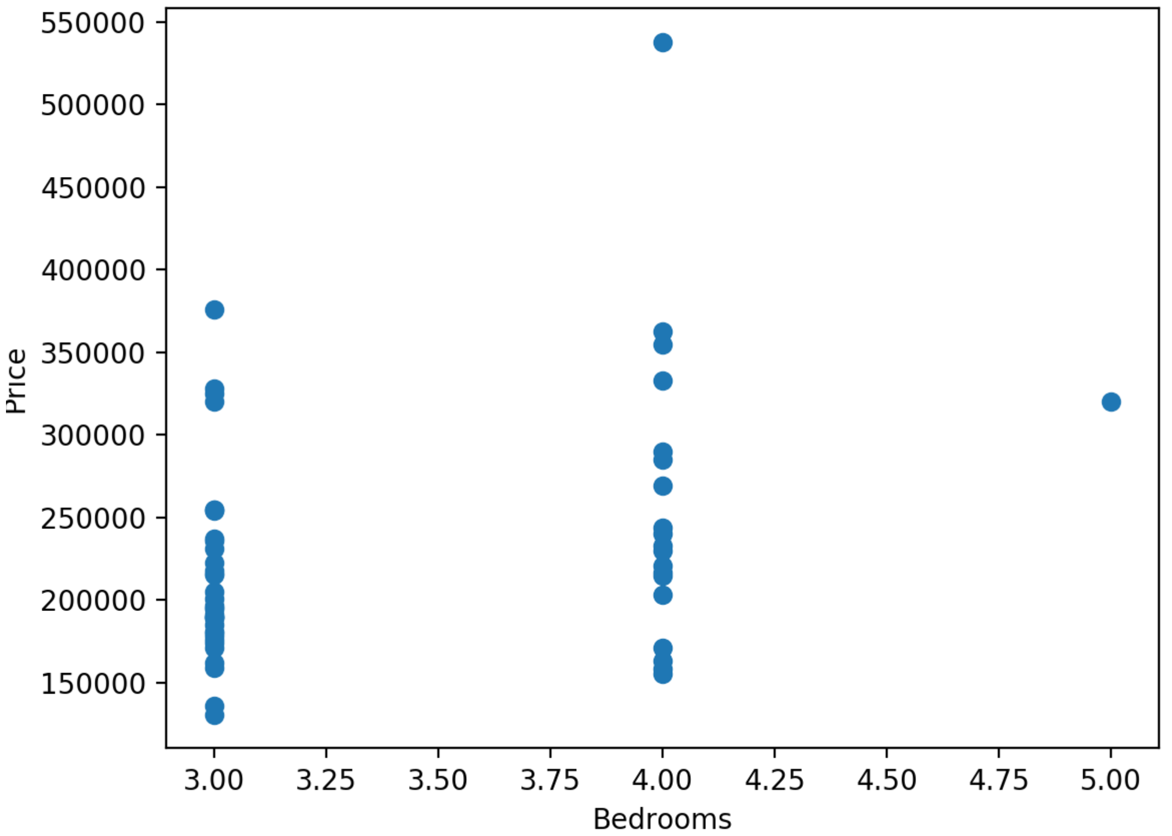
In [20]:
```
n = 50
#
# This says "let's look at two story houses sold in 2010"
#
new_house = (df["MS.SubClass"] == 60) & (df["Yr.Sold"] == 2010)
price = df['SalePrice'][new_house]
lot    = df['Lot.Frontage'][new_house]
bedroom = df['Bedroom.AbvGr'][new_house]
fig = plt.figure()
ax = fig.add_subplot(111)
ax.scatter(lot, price)
ax.scatter(bedroom, price)
plt.show()
```

<IPython.core.display.Javascript object>



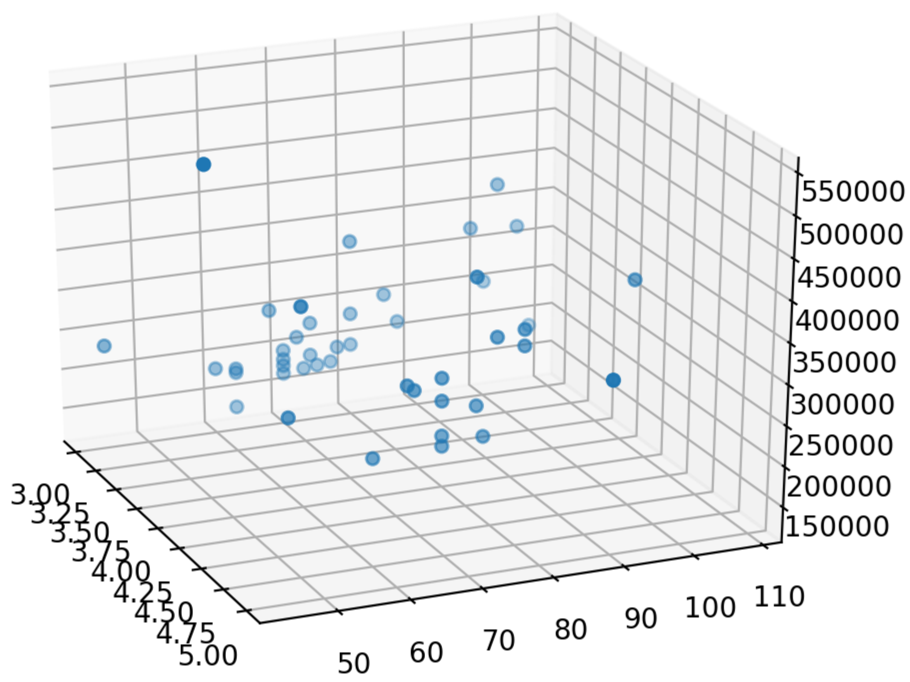
In [21]:
```
fig = plt.figure()
plt.scatter(bedroom, price)
plt.xlabel("Bedrooms")
plt.ylabel("Price")
plt.show()
```

<IPython.core.display.Javascript object>



In [22]:
```
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.scatter(bedroom, lot, price)
plt.show()
```

```
<IPython.core.display.Javascript object>
```



In [33]:
```
price[1:7], bedroom[1:7], lot[1:7]
```

Out[33]:
```
(5      195500
 9      189000
 10     175900
 12     180400
 15     538000
 22     216000
 Name: SalePrice, dtype: int64, 5      3
 9      3
 10     3
 12     3
 15     4
 22     3
 Name: Bedroom.AbvGr, dtype: int64, 5      78.0
 9      60.0
 10     75.0
 12     63.0
 15     47.0
 22      NaN
 Name: Lot.Frontage, dtype: float64)
```

There does intuitvely seem to be a correlation, but we could do a bit better if we added in another feature.

A much simpler, but still real linear relationship!

Here is another dataset, in which we do. Let's look at miles per gallon in the city to Highway Miles per Gallon of old cars. The hypothesis is that there should be a linear relationship, because some cars are just more efficient than others.

In [6]:
```python
url="https://archive.ics.uci.edu/ml/machine-learning-databases/autos/imports-85.data"
_df=pd.read_csv(url, header=None)
_df[1:10]
d = _df.values
```

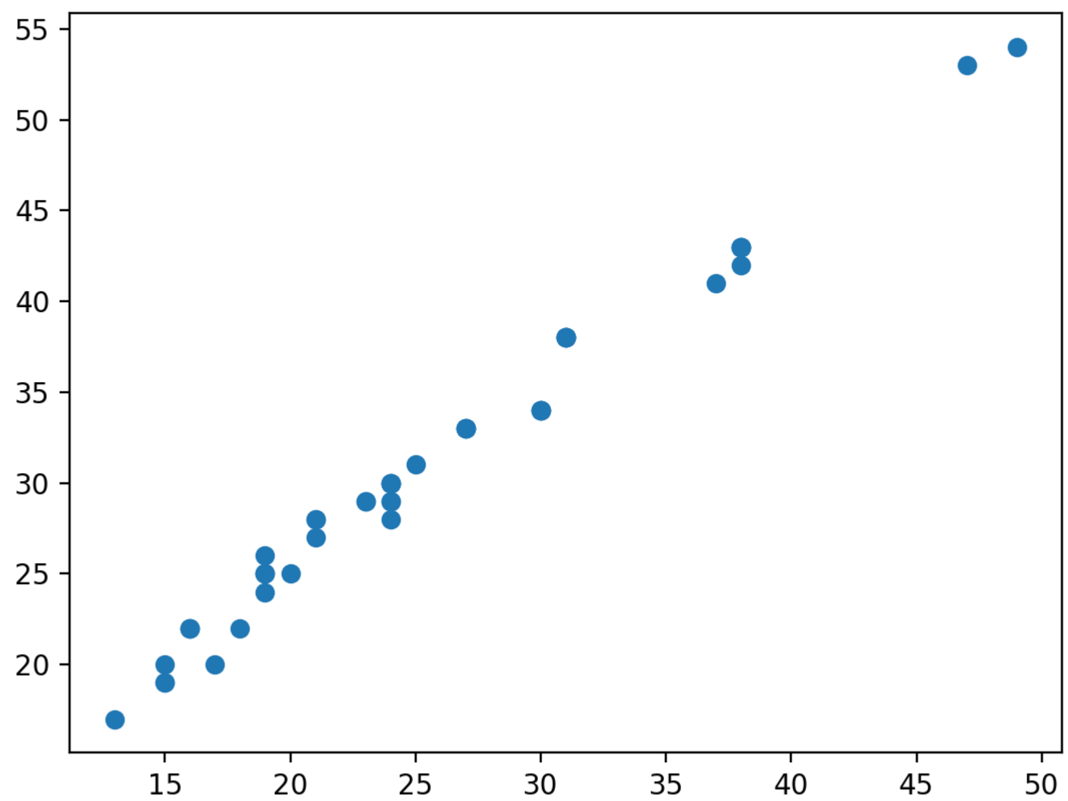
Out[6]:

	0	1	2	3	4	5	6	7	8	9	...	16	17	18	19	20	21	22	23	24	25
1	3	?	alfa-romero	gas	std	two	convertible	rwd	front	88.6	...	130	mpfi	3.47	2.68	9.0	111	5000	21	27	16500
2	1	?	alfa-romero	gas	std	two	hatchback	rwd	front	94.5	...	152	mpfi	2.68	3.47	9.0	154	5000	19	26	16500
3	2	164	audi	gas	std	four	sedan	fwd	front	99.8	...	109	mpfi	3.19	3.40	10.0	102	5500	24	30	13950
4	2	164	audi	gas	std	four	sedan	4wd	front	99.4	...	136	mpfi	3.19	3.40	8.0	115	5500	18	22	17450
5	2	?	audi	gas	std	two	sedan	fwd	front	99.8	...	136	mpfi	3.19	3.40	8.5	110	5500	19	25	15250
6	1	158	audi	gas	std	four	sedan	fwd	front	105.8	...	136	mpfi	3.19	3.40	8.5	110	5500	19	25	17710
7	1	?	audi	gas	std	four	wagon	fwd	front	105.8	...	136	mpfi	3.19	3.40	8.5	110	5500	19	25	18920
8	1	158	audi	gas	turbo	four	sedan	fwd	front	105.8	...	131	mpfi	3.13	3.40	8.3	140	5500	17	20	23875
9	0	?	audi	gas	turbo	two	hatchback	4wd	front	99.5	...	131	mpfi	3.13	3.40	7.0	160	5500	16	22	?

9 rows × 26 columns

In [32]:
```python
city_mpg, hi_mpg = 23,24
fig = plt.figure()
ax = fig.add_subplot(111)
ax.scatter(d[1:n,city_mpg], d[1:n,hi_mpg])
plt.show()
```

<IPython.core.display.Javascript object>



Now that looks like a line! Let's recall how to fit it!

In [ ]: