Step 1: Business and Data Understanding

1. What decisions needs to be made?

Ans: Perform an analysis to recommend the city for Pawdacity's newest store, based on predicted yearly sales. But this project is just to get the data ready before the prediction.

... ...: Awesome!

2. What data is needed to inform those decisions?

Ans: The manager gives 4 csv files with the following info:

1. monthly sales for all Pawdacity stores in 2010
2. NAICS(North American Industry Classification System) data of competitors
3. partially parsed data for population
4. demographic data in wyoming

... ...: Awesome!

Step 2: Building the Training Set

Column	Sum	Mean	median
Census Population	213,862	19,442	12,359
Total Pawdacity Sales	3,773,304	290,254	273,024
Households with Under 18	34,064	3096.73	2646.0
Land Area	33,071	3006.49	2748.85
Population Density	63	5.71	2.78
Total Families	62,653	5695.71	5556.49

... ...: Awesome : All averages are correct!

The calucation details are as follows

In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
% matplotlib inline
store = pd.read_csv("p2-2010-pawdacity-monthly-sales.csv")
nakes = pd.read_csv("p2-wy-453910-naics-data.csv")
popul = pd.read_csv("p2-partially-parsed-wy-web-scrape.csv")
demog = pd.read_csv("p2-wy-demographic-data.csv")
```

calculate total Pawdacity sales and collect city names

In [2]:
```
print(store.iloc[:,5:].sum(axis=1).sum())  # 3773304
print(store.iloc[:,5:].sum(axis=1).median()) #  290254
```

```
3773304
273024.0
```

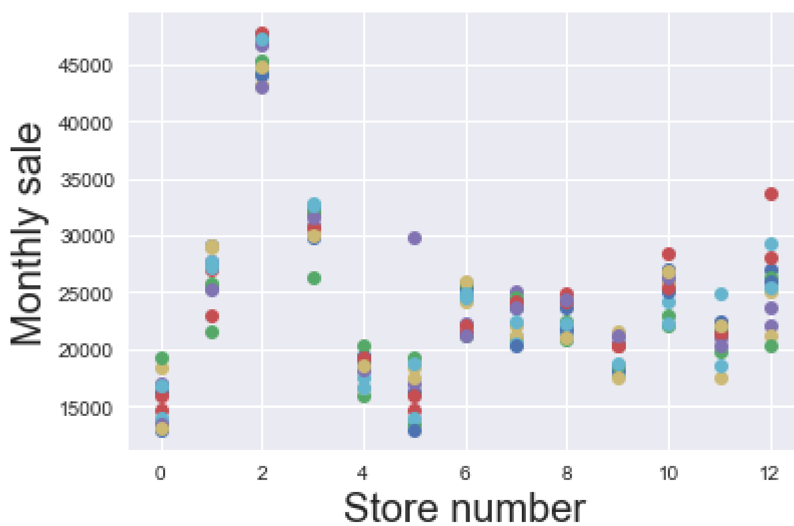
In [3]:
```
store.head()
```

Out[3]:

	NAME	ADDRESS	CITY	STATE	ZIP	January	February	March	April	May
0	Pawdacity	509 Fort St # A	Buffalo	WY	82834	16200	13392	14688	17064	183
1	Pawdacity	601 SE Wyoming Blvd Unit 252	Casper	WY	82609	29160	21600	27000	27648	291
2	Pawdacity	1400 Dell Range Blvd	Cheyenne	WY	82009	47520	44280	47088	46656	432
3	Pawdacity	3769 E Lincolnway	Cheyenne	WY	82001	32400	26352	31968	30888	304
4	Pawdacity	2625 Big Horn Ave	Cody	WY	82414	19440	15984	19008	18144	166

In [4]:
```
plt.plot(store[store.columns[5:]],'o')
plt.xlabel("Store number",fontsize=20)
plt.ylabel("Monthly sale",fontsize=20)
```

Out[4]: <matplotlib.text.Text at 0x10e5a4f28>



In [5]:
```
store.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 13 entries, 0 to 12
Data columns (total 17 columns):
NAME         13 non-null object
ADDRESS      13 non-null object
CITY         13 non-null object
STATE        13 non-null object
ZIP          13 non-null int64
January      13 non-null int64
February     13 non-null int64
March        13 non-null int64
April        13 non-null int64
May          13 non-null int64
June         13 non-null int64
July         13 non-null int64
August       13 non-null int64
September    13 non-null int64
October      13 non-null int64
November     13 non-null int64
December     13 non-null int64
dtypes: int64(13), object(4)
memory usage: 1.8+ KB
```

In [6]:
```
store["CITY"].value_counts()
```

Out[6]:
```
Gillette        2
Cheyenne        2
Evanston        1
Casper          1
Douglas         1
Powell          1
Rock Springs    1
Sheridan        1
Riverton        1
Cody            1
Buffalo         1
Name: CITY, dtype: int64
```

In [7]:
```
cities = store["CITY"].unique()  # nump array of shape 11
```

calculate census population

In [8]:
```
popul.dropna(axis=0, how='any', thresh=None, subset=None, inplace=True)
```

In [9]:
```
popul['Pawdacity'] = False
```

In [10]:
```
popul.tail()
```

Out[10]:

	City|County	2014 Estimate	2010 Census	2000 Census	Pawdacity
94	Wamsutter|Sweetwater	<td>503</td>	<td>451</td>	<td>261</td>	False
95	Wheatland ?|Platte	<td>3,659</td>	<td>3,627</td>	<td>3,548</td>	False
96	Worland ?|Washakie	<td>5,366</td>	<td>5,487</td>	<td>5,250</td>	False
97	Wright|Campbell	<td>1,847</td>	<td>1,807</td>	<td>1,347</td>	False
98	Yoder|Goshen	<td>161</td>	<td>151</td>	<td>169</td>	False

In [11]:
```
import re
s="|".join(cities)
s="^("+s+")"
pool = re.compile(s)

from bs4 import BeautifulSoup
def parsenum(text):
    if str(text).isnumeric():
        return text
    soup = BeautifulSoup(text,'html.parser')
    num =""
    for digit in soup.find("td").text:
        if digit.isnumeric():
            num += digit
        if digit =="[":
            break
    if num.isnumeric():
        return int(num)
    else:
        return 0
cnt = 0
for i in range(popul.shape[0]):
    row = popul.iloc[i,:]
    popul.set_value(i,"2014 Estimate",parsenum(row["2014 Estimate"]))
    popul.set_value(i,"2010 Census",parsenum(row["2010 Census"]))
    popul.set_value(i,"2000 Census",parsenum(row["2000 Census"]))
    if  pool.search(row["City|County"]):
        popul.set_value(i,"Pawdacity",True)  # set value to True when fo
und
        cnt +=1
print("found {} cities with Pawdacity".format(cnt))
```

```
found 11 cities with Pawdacity
```

In [12]:
```
popul.iloc[:,1:-1]=popul.iloc[:,1:-1].astype(int)
```

In [13]:
```
popul[popul["Pawdacity"] == True]
```

Out[13]:

	City|County	2014 Estimate	2010 Census	2000 Census	Pawdacity
9	Buffalo ?|Johnson	4615	4585	3900	True
13	Casper ?|Natrona	40086	35316	32644	True
14	Cheyenne ??|Laramie	62845	59466	53011	True
17	Cody ?|Park	9740	9520	8835	True
24	Douglas ?|Converse	6423	6120	5288	True
29	Evanston ?|Uinta	12190	12359	11507	True
33	Gillette ?|Campbell	31971	29087	19646	True
73	Powell|Park	6407	6314	5373	True
77	Riverton|Fremont	10953	10615	9310	True
79	Rock Springs|Sweetwater	24045	23036	18708	True
82	Sheridan ?|Sheridan	17916	17444	15804	True

In [14]:
```
popul.groupby("Pawdacity").median()
```

Out[14]:

	2014 Estimate	2010 Census	2000 Census
Pawdacity			
False	529.5	526.5	446.0
True	12190.0	12359.0	11507.0

calcualte demographic info

In [15]:
```
demog['Pawdacity']= False
for i in range(demog.shape[0]):
    if pool.search(demog.iloc[i,:]["City"]):
        demog.set_value(i,"Pawdacity",True)
```

In [16]:
```
demog.groupby("Pawdacity").median()
```

Out[16]:

	Land Area	Households with Under 18	Population Density	Total Families
Pawdacity				
False	218.720727	124.5	0.285	274.735
True	2748.852900	2646.0	2.780	5556.490

In [17]:
```
demog[demog['Pawdacity']]
```

Out[17]:

	City	County	Land Area	Households with Under 18	Population Density	Total Families	Pawdacity
10	Gillette	Campbell	2748.852900	4052	5.80	7189.43	True
22	Douglas	Converse	1829.465100	832	1.46	1744.08	True
34	Riverton	Fremont	4796.859815	2680	2.34	5556.49	True
44	Buffalo	Johnson	3115.507500	746	1.55	1819.50	True
48	Cheyenne	Laramie	1500.178400	7158	20.34	14612.64	True
60	Casper	Natrona	3894.309100	7788	11.16	8756.32	True
68	Cody	Park	2998.956960	1403	1.82	3515.62	True
71	Powell	Park	2673.574550	1251	1.62	3134.18	True
80	Sheridan	Sheridan	1893.977048	2646	8.98	6039.71	True
87	Rock Springs	Sweetwater	6620.201916	4022	2.78	7572.18	True
92	Evanston	Uinta	999.497100	1486	4.95	2712.64	True

Step 3: Dealing with Outliers

Are there any cities that are outliers in the training set? Which outlier have you chosen to remove or impute?

Ans: As shown in the following table and boxplot, the top outlier is the City "Cheyenne", whose **"Total Families"** eight time of the average. The next outlier will be "Casper".

2nd reviewer: We should find one outlier for multiple variables (Cheyenne), and two other outliers which will be flagged for less variables. One of these outliers will be a typo, and the other is really an outlier.

My response:
I will insist my answer. I guess the reviewer will want "Rock Spring" as a outlier because its "Land Area" is the largest. But it really depends what are the predictor variables. I think "Total Families" and "Households with Under 18" weights much more than land.

In additon, I don't find any typo in my mining data from "p2-partially-parsed-wy-web-scrape.csv"

... ...: Required : We do not insist on any one particular answer. There can be 2 or 3 possible outliers in this answer. We just want you to identify atleast 2 potential outliers correctly and then discuss and justify your choice of the outlier city in the report.Post that, you also need to justify the best course of action (imputation/removal) for your choice of outlier city. We accept all the possible outlier choices, provided your reasons are sound. We expect that outliers are calculated by analyzing the Interquartile Range of the data set and calculating the Upper and Lower Fences of the distribution in the training dataset.(As per the lessons in the course). And based on these calculations, we are informing you, that Casper is not an outlier city in any of the fields of your dataset.

... ...: Suggestion: To help you with the outlier calculations - Go to 'Creating an Analytical Dataset' section in the course and then go to the Data Issues section, and then go to "what is an outlier" video. Going through the next five video's you arrive at "Identifying Outliers" video. There are formulae mentioned below that video to help you calculate outliers.Apply these formulae to the data in each of the columns of the table you built as per step 2 above. Through this

In [18]:
```
selector = (demog["Land Area"]> 5000) | (demog["Population Density"]>
10) |\
            (demog["Total Families"] > 10000)
demog[selector]
```

Out[18]:

	City	County	Land Area	Households with Under 18	Population Density	Total Families	Pawdacity
18	Rawlins	Carbon	5322.661628	1307	1.32	2722.43	False
48	Cheyenne	Laramie	1500.178400	7158	20.34	14612.64	True
60	Casper	Natrona	3894.309100	7788	11.16	8756.32	True
87	Rock Springs	Sweetwater	6620.201916	4022	2.78	7572.18	True

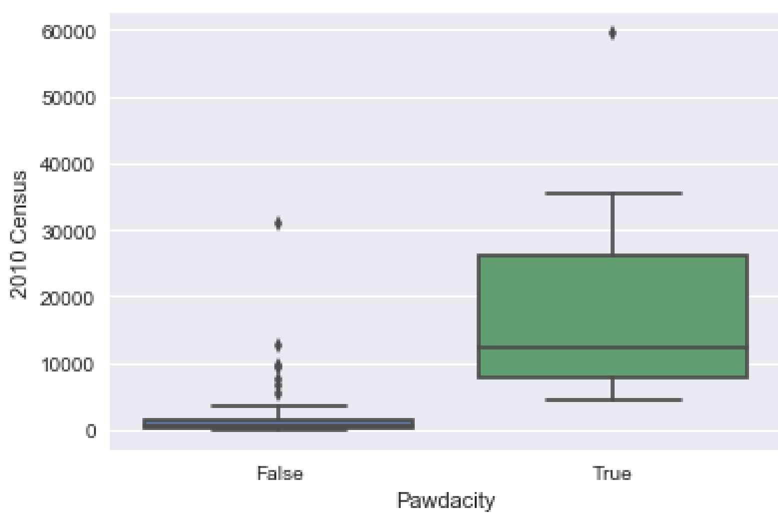
In [19]:
```
popul[popul["2010 Census"]>30000]
```

Out[19]:

	City|County	2014 Estimate	2010 Census	2000 Census	Pawdacity
13	Casper ?|Natrona	40086	35316	32644	True
14	Cheyenne ??|Laramie	62845	59466	53011	True
52	Laramie ?|Albany	32081	30816	27204	False

In [20]:
```
sns.boxplot(y="2010 Census", x = "Pawdacity",data = popul)
```

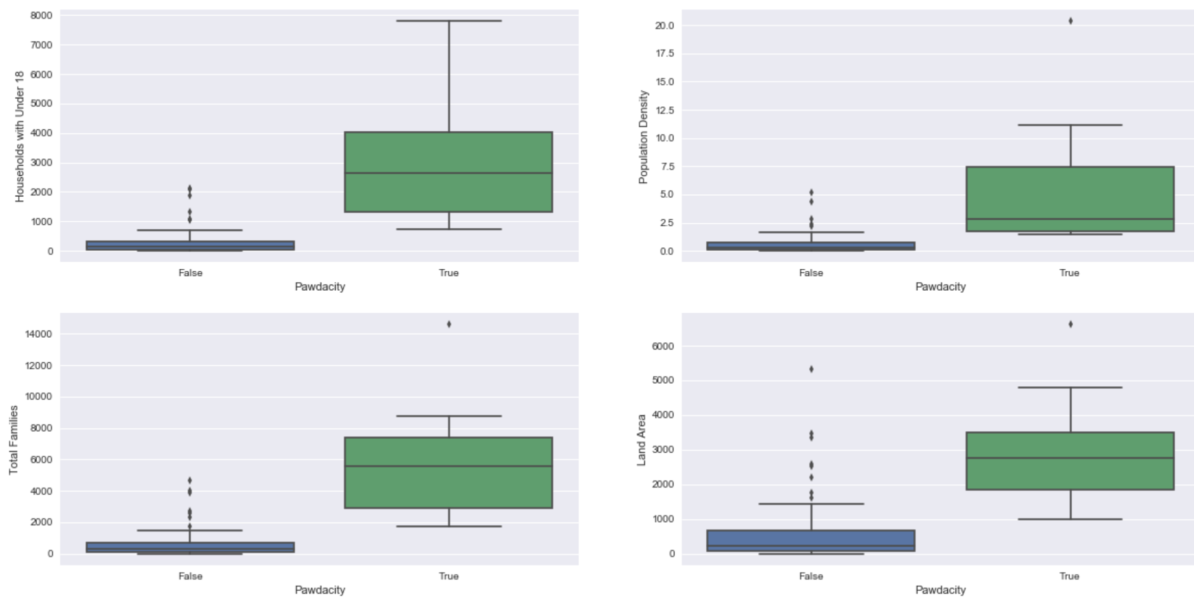
Out[20]: <matplotlib.axes._subplots.AxesSubplot at 0x10e6d7320>



process ,you will determine the outlier positions of the cities with respect to each of the columns of the data-set you built.You can then go ahead and choose an outlier and take a call to impute or remove the outlier as per the requirement of the project and justify the same in your answer.

... ...: Suggestion : "Largest" Land area should not be the criteria of identifying Rock Springs as an outlier. You should check if its above the Upper Fence.

In [21]:
```
plt.figure(figsize=(20,10))

plt.subplot(221)
sns.boxplot(x="Pawdacity", y = "Households with Under 18",data = demog)

plt.subplot(222)
sns.boxplot(x="Pawdacity", y = "Population Density",data = demog)

plt.subplot(223)
sns.boxplot(x="Pawdacity", y = "Total Families",data = demog)

plt.subplot(224)
sns.boxplot(x="Pawdacity", y = "Land Area",data = demog)

plt.show()
```



Next up

I expect there is a follow-up project to do the actual prediction. But it seems to be removed or somewhere else. So my steps for such prediciton is:

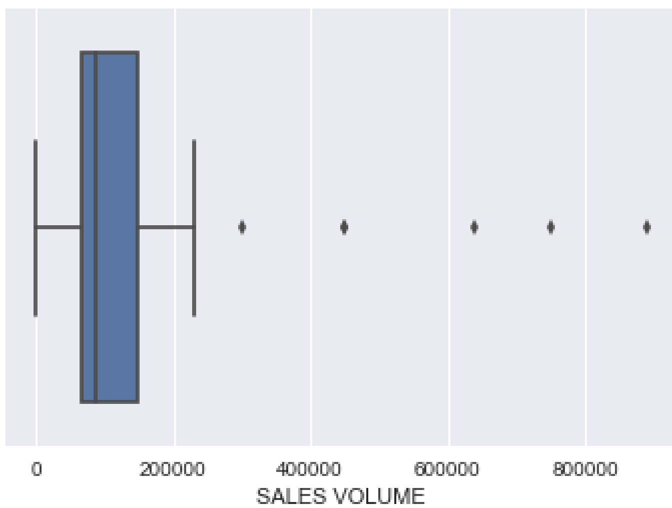
1. With the demographic statistics, figure out which city is above the average but without a Pawdacity store
2. Dig into NAICS to see whether competitors are already in the market of target cities.
3. Use existing data to predict the sales in the target cities, figure out which one will have the best sales.

In [22]:
```
nakes["SALES VOLUME"].describe()
```

Out[22]:
```
count        32.000000
mean     173630.875000
std      222548.908781
min           0.000000
25%       65500.000000
50%       86000.000000
75%      147743.250000
max      890000.000000
Name: SALES VOLUME, dtype: float64
```

In [23]:
```
sns.boxplot(nakes["SALES VOLUME"])
```

Out[23]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x10e87b9e8>
```



In [24]:
```
nakes[nakes["SALES VOLUME"]>2e5]
```

Out[24]:

	BUSINESS NAME	PHYSICAL CITY NAME	SALES VOLUME	CASS_LastLine
0	Mile High Mobile Pet LLC	Cheyenne	300000	Cheyenne, WY 82007-3528
1	Pets City Inc	Cheyenne	640000	Cheyenne, WY 82009-4851
7	Don Bruner Sales LLC	Torrington	750000	Torrington, WY 82240-3516
19	L and C Pets and Gifts LLC	Evansville	210000	Evansville, WY 82636
20	All Gods Creatures	Gillette	450000	Gillette, WY 82716-2919
21	Camelot Pet Castle	Gillette	230000	Gillette, WY 82716-1704
23	Pet Food Outlet	Gillette	450000	Gillette, WY 82718-6330
26	Zoobecks Inc	Rock Springs	890000	Rock Springs, WY 82901-5105

In [ ]: