Pandas and Dataset Inspection

An Example Problem

Let's assume we want to estimate real-estate prices in Taiwan

Loading the Data

We have data about this problem in a csv file in the `data` directory

In [10]:
```
data = pd.read_csv(os.path.join('..', 'data', 'real_estate.csv'), sep=',')
data.head()
```

Out[10]:

	house age	dist to MRT	#stores	latitude	longitude	price per area
0	14.8	393.2606	6	24.96172	121.53812	7.6
1	17.4	6488.0210	1	24.95719	121.47353	11.2
2	16.0	4066.5870	0	24.94297	121.50342	11.6
3	30.9	6396.2830	1	24.94375	121.47883	12.2
4	16.5	4082.0150	0	24.94155	121.50381	12.8

The first 4 columns contain easy-to-obtain quantities, the last does not

Obtaining price information requires actual houses to be sold and bought

- Therefore, it might be useful to learn a machine model
- ...That can estimate the price based on the easily available information

Using Histograms

Since our goal is roughly defined, it's a good idea to inspect the dataset

We will start by using histograms, i.e. plots with:

- On the x-axis: values for one attribute
- On the y-axis: occurrency count in the dataset

They are useful to display the distribution of each column

Some comments:

- Continuous attributes are typically discretized (i.e. binned) first
- The counts can be normalized to obtain frequencies

Histograms can be built directly from `pandas`

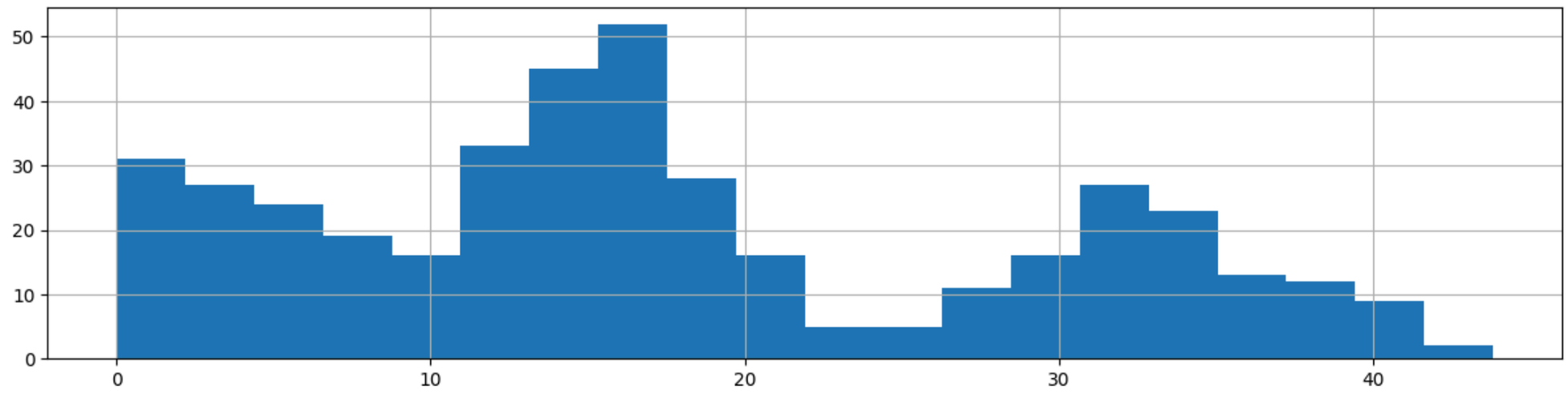
...By using the hist method.

- `matplotlib` is used behind the scens and can be employed to add details
- ...Or as an alernative, if we need a more complex plot

Dataset Inspection via Histograms

Let's inspect the "house age" attribute

In [11]:
```
data['house age'].hist(figsize=figsize, bins=20);
```

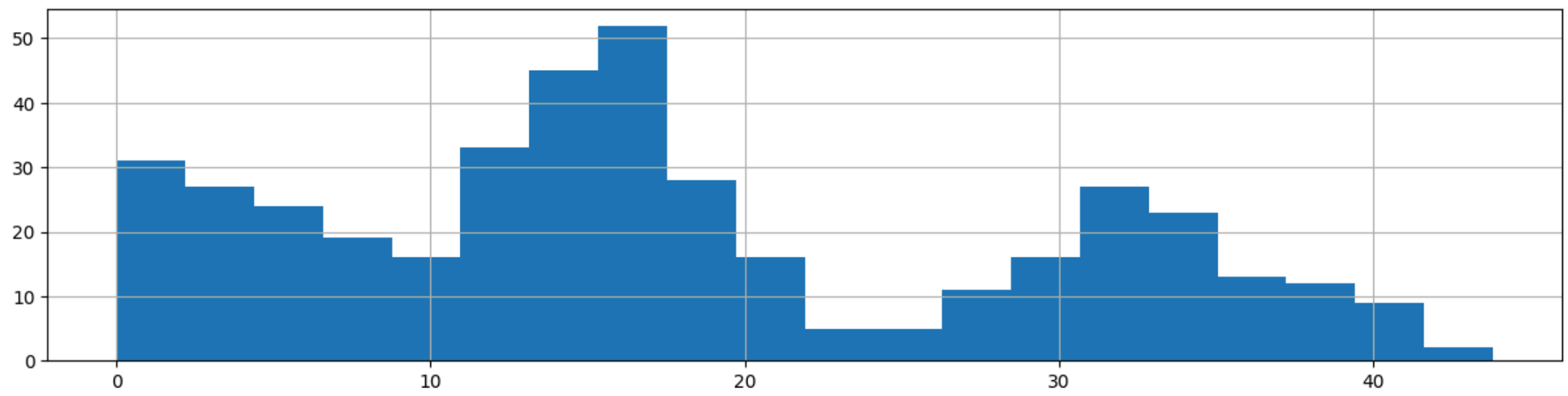


What can you say about that?

Using Histograms

Let's inspect the "house age" attribute

In [12]:
```
data['house age'].hist(figsize=figsize, bins=20);
```



- There seems to be two main clusters, roughly normally distributed
- Lower age values are roughly uniformly likely

Now, try building histograms for the other columns

Dataset Inspection via Cartesian Plots

We can obtain information about the distribution of each column

...By using statistics. For example we can call:

In [13]:
```
data.describe()
```

Out[13]:

	house age	dist to MRT	#stores	latitude	longitude	price per area
count	414.000000	414.000000	414.000000	414.000000	414.000000	414.000000
mean	17.712560	1083.885689	4.094203	24.969030	121.533361	37.980193
std	11.392485	1262.109595	2.945562	0.012410	0.015347	13.606488
min	0.000000	23.382840	0.000000	24.932070	121.473530	7.600000
25%	9.025000	289.324800	1.000000	24.963000	121.528085	27.700000
50%	16.100000	492.231300	4.000000	24.971100	121.538630	38.450000
75%	28.150000	1454.279000	6.000000	24.977455	121.543305	46.600000
max	43.800000	6488.021000	10.000000	25.014590	121.566270	117.500000

- Statistics are a very compact way to convey information
- ...But they are also less rich than using a histogram

Dataset Inspection via Scatter Plots

The fourth tool we'll use for dataset inspection

...Is given by scatter plots, which have:

- On the x-axis: the values for one attribute
- On the y-axis: the values for anotehr attribute (usually the target)
- Points in scatter plot are not connected by a line

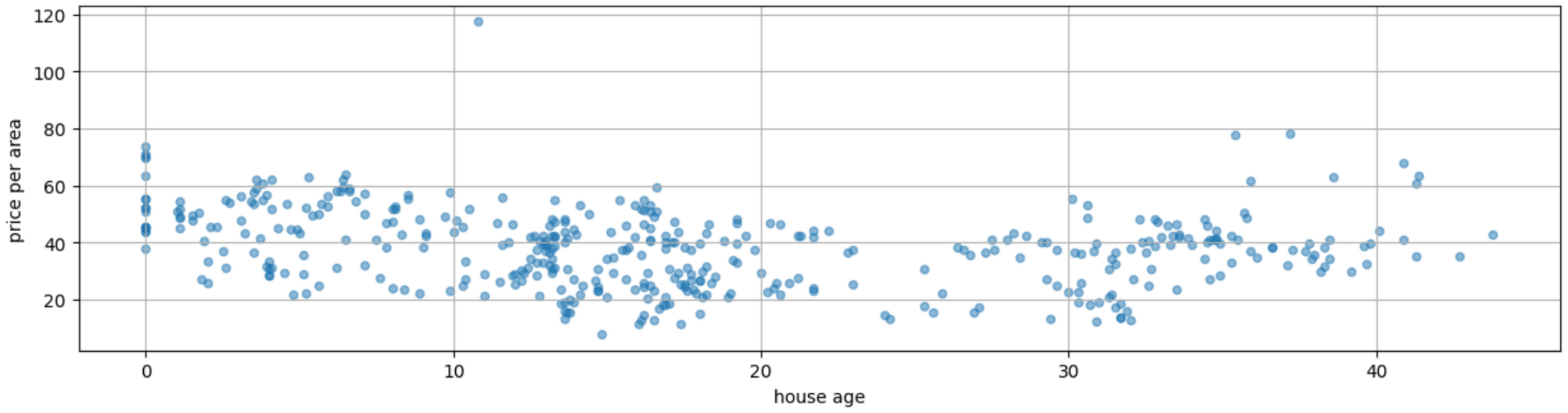
Some comments:

- These are great for the visual identification of correlations
- By looking at the shape of the "cloud of points"
- ...It is possible to get insight on how the attributes are connected

Using Scatter Plots

Let's inspect how "house age" and the target are linked

In [18]:
```
data.plot.scatter(x='house age', y='price per area', figsize=figsize, grid=':', alpha=0.5);
```

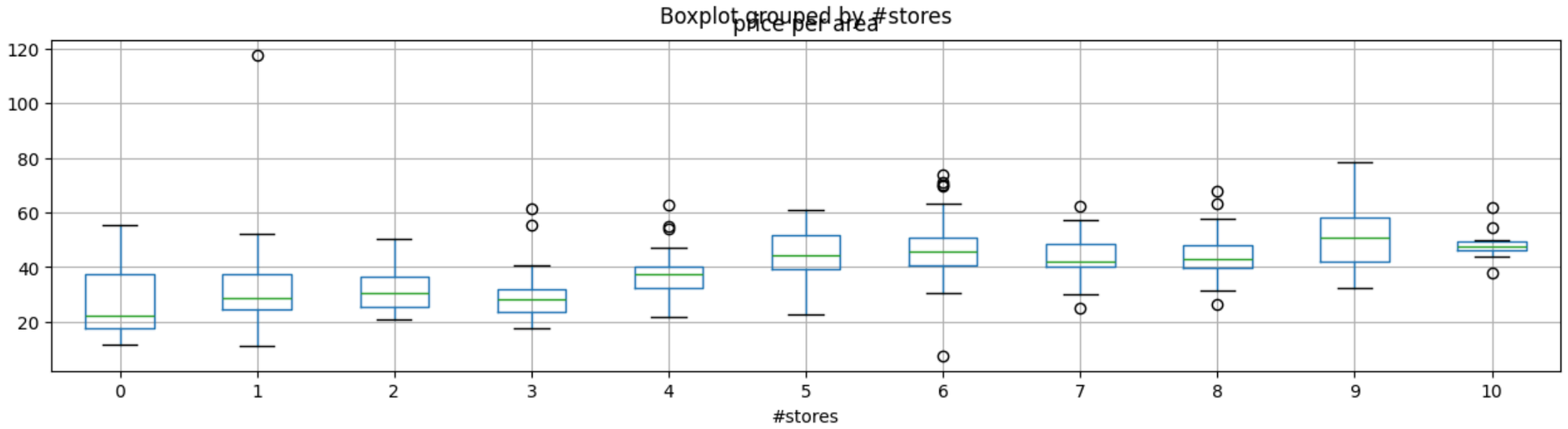


- There does not seem to be a strong correlation here
- ...But it's worth checking other columns, too

Addendum: Using Boxplots

For categorical attributes, a box plot may be more appropriate

In [19]:
```
data.boxplot(by='#stores', column='price per area', figsize=figsize);
```

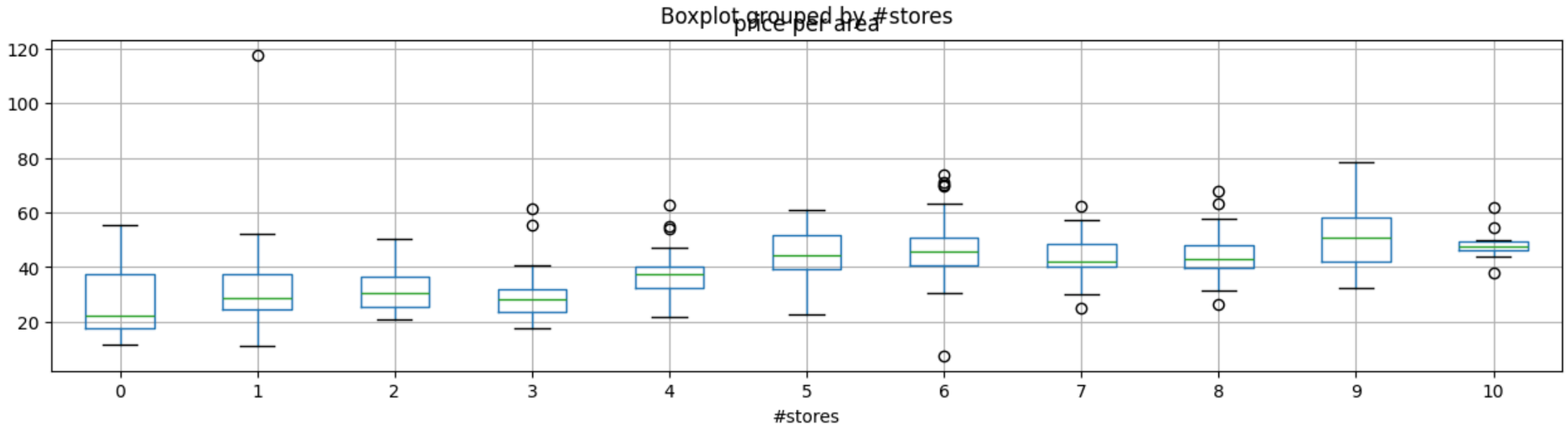


- We have one box per value of an attribute
- On the y axis, we have a second attribute (usually the target)

Addendum: Using Boxplots

For categorical attributes, a box plot may be more appropriate

In [20]:
```
data.boxplot(by='#stores', column='price per area', figsize=figsize);
```

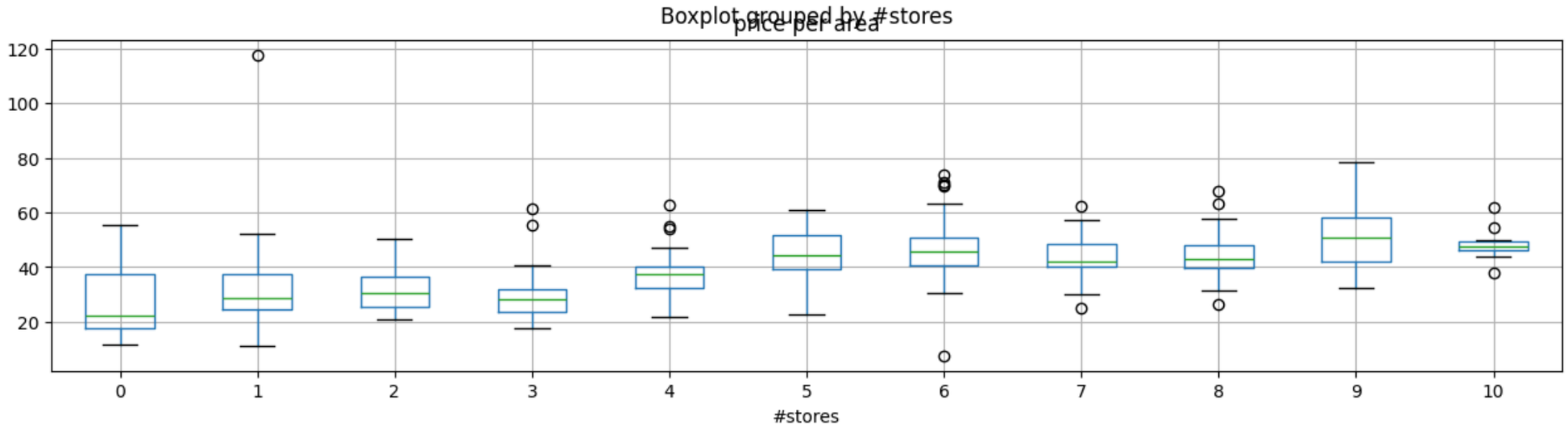


- The box boundaries are the 1st and 3rd quartile
- The green line represents the mean

Addendum: Using Boxplots

For categorical attributes, a box plot may be more appropriate

In [21]:
```
data.boxplot(by='#stores', column='price per area', figsize=figsize);
```

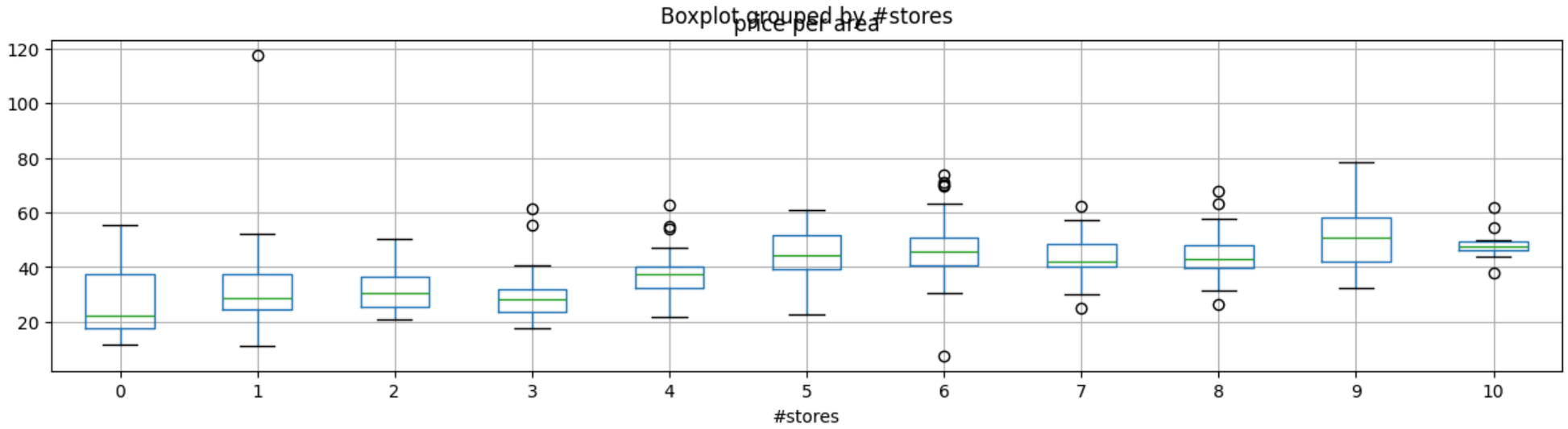


- The "whiskers" extend for 1.5 the inter-quartile range
- Values outside the whiskers are plotted directly

Addendum: Using Boxplots

For categorical attributes, a box plot may be more appropriate

In [22]:
```
data.boxplot(by='#stores', column='price per area', figsize=figsize);
```



- Box plots are great to see how the distribution of a y depends on x
- They can be used with continuous attributes, if we first discretize them