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Correlation

Hypothesis testing+ Graphic Methods

Session 9

Programación Estadística con Python

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MASTER EN DATA ANALYTICS PARA LA EMPRESA

Goals

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- Hypothesis testing over the relatioship of two quantitative variables by the means of regression.
  - Graphic approach (Scatterplot)
  - Numeric approach (r coefficient & p.values)

- Beyond the numbers and plots:
  - Reflections on correlation and non linearity
  - The False Discovery Rate experiment

Correlation

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- Always **DESCRIBE** the two variables involved in the correlation.
  - Check and validate the integrity of the data prior to any analysis.

- **EXPLORE** of bivariate relation:
  - Graphically: **Scatterplot**
  - Numerically: Pearson's **r** & **p.value**

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Research Question

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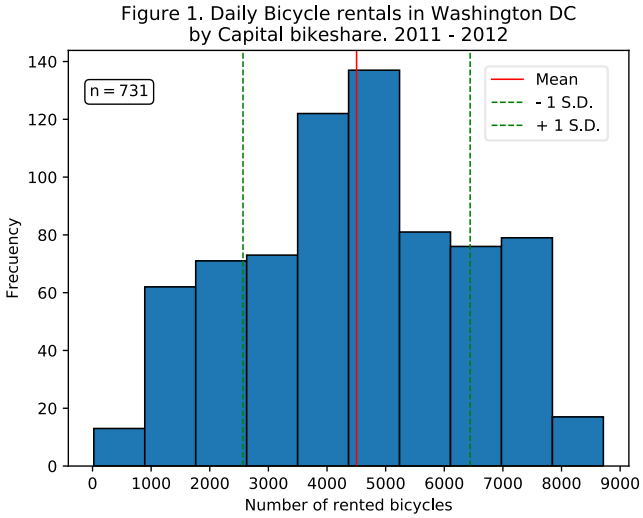
Why some days are rent *more* bikes?

- Temperature ?



- H0.: There is no linear association ($r=0$) between the *number of rentals* and the *temperature*.

- H1.: There is a linear association ($r\neq0$) between the *number of rentals* and the *temperature*.

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Describing quantitative variables

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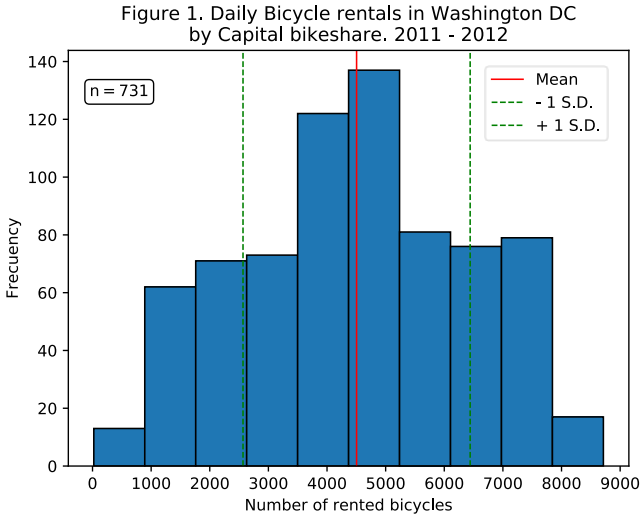
```
x=wbr['cnt']
plt.hist(x, bins=10,
edgecolor='black')
plt.xticks(np.arange(0, 10000,
step=1000))
plt.title('Figure 4. Daily Bicycle
rentals in Washington DC'
          '\n'
          'by Capital bikeshare.
2011 - 2012')
plt.ylabel('Frecuency')
plt.xlabel('Number of rented
bicycles')
```




```
props = dict(boxstyle='round',
facecolor='white', lw=0.5)
textstr = '$\mathrm{n}=%.0f$'%(n)
plt.text (-50,128, textstr ,
bbox=props)
```

Describing quantitative variables

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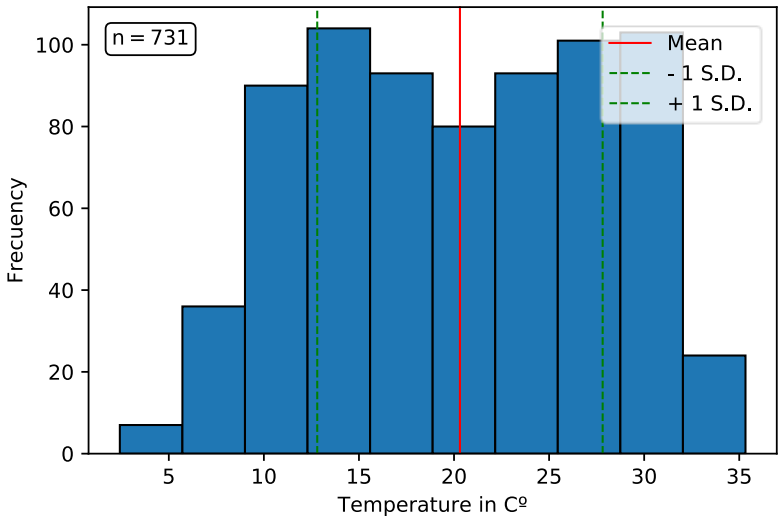
```
##histogram ver4
x=wbr['temp_celsius']
plt.hist(x, bins=10,
edgecolor='black')
#plt.xticks(np.arange(0, 10000,
step=1000))
plt.title('Figure 5. Temperature in
Celsius'
          '\n')
plt.ylabel('Frecuency')
plt.xlabel('Temperature in C°')
props = dict(boxstyle='round',
facecolor='white', lw=0.5)
textstr = '$\mathrm{n}=%.0f$'%(n)
plt.text (2,100, textstr ,
bbox=props)
```

Figure 5. Temperature in Celsius



Describing quantitative variables

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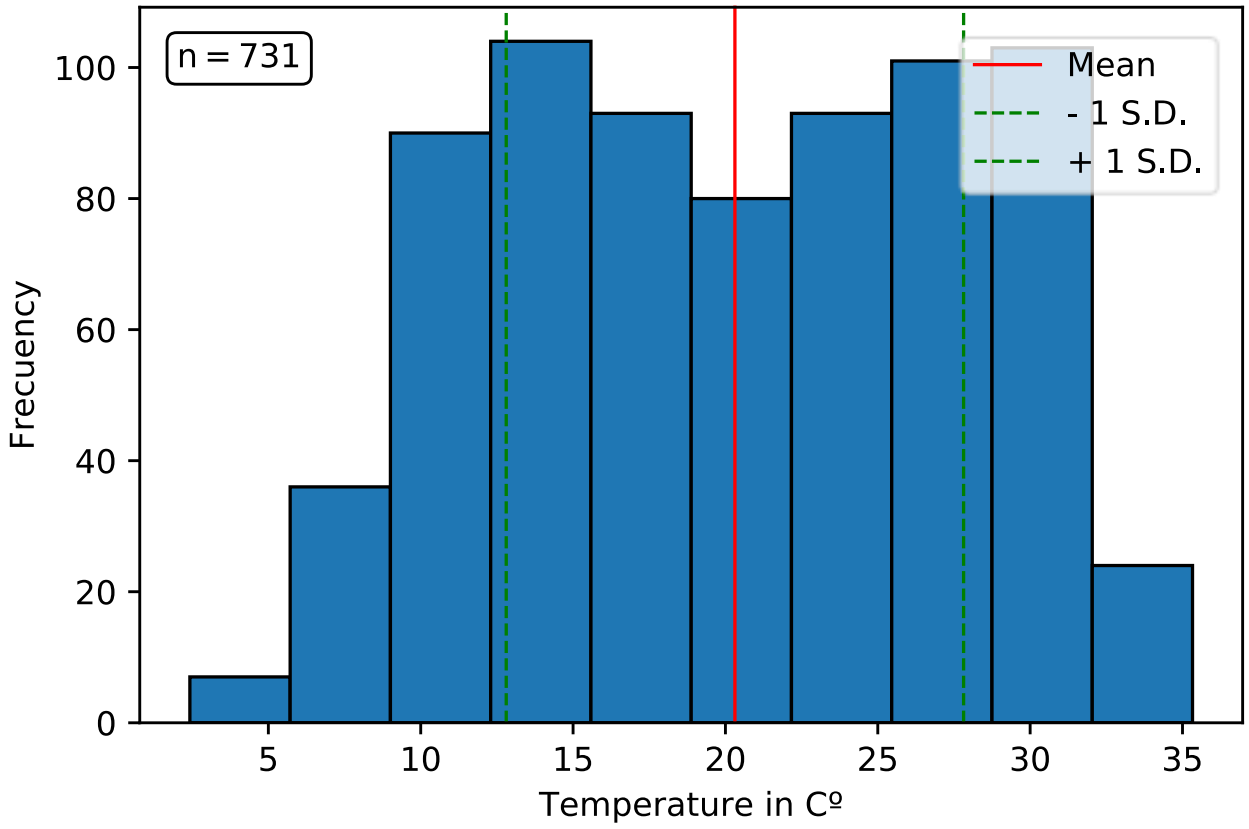
Figure 5. Temperature in Celsius



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Regression

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1. Describe the two variables involved in hypothesis

Temperature

Rentals

Figure 5. Temperature in Celsius

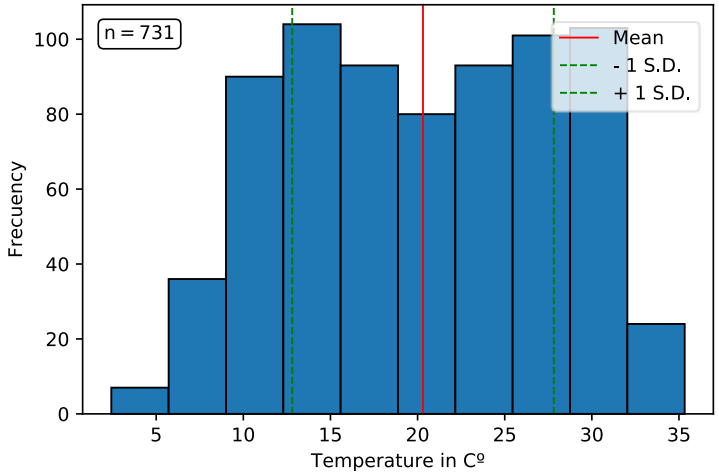
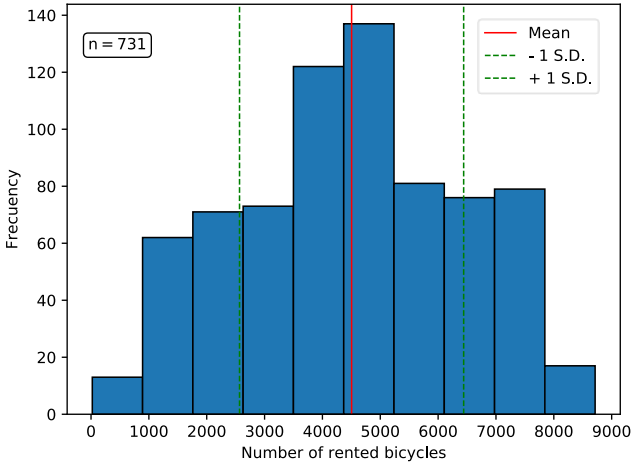


Figure 1. Daily Bicycle rentals in Washington DC
by Capital bikeshare. 2011 - 2012



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Correlation

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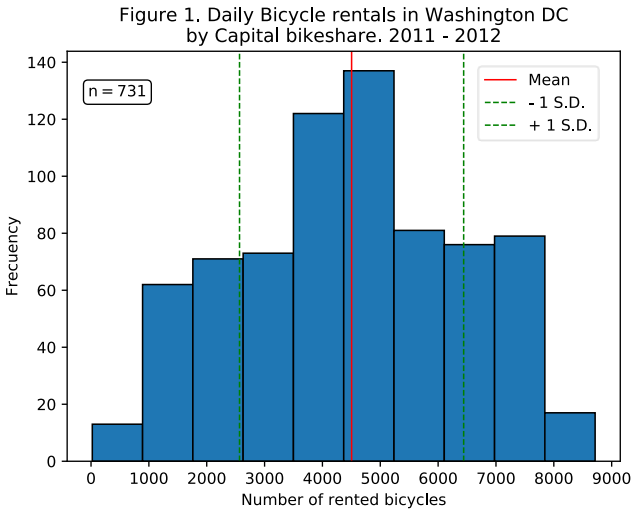
1. Describe the two variables involved in hypothesis

Windspeed

Rentals



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Regression

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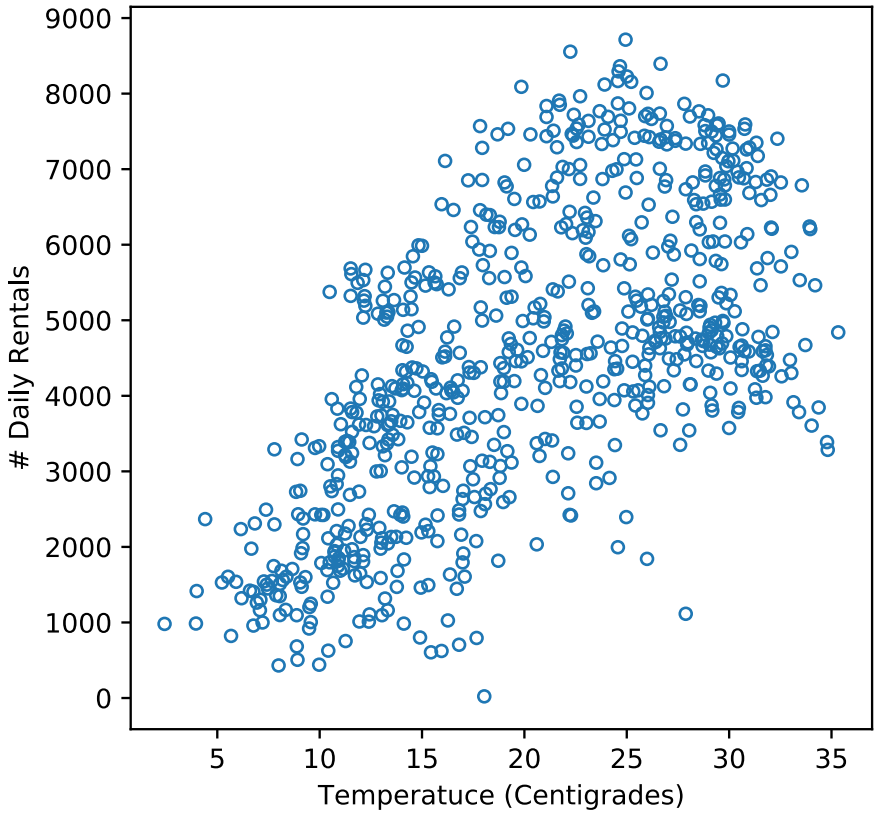
2. Scatterplot

```
x=wbr.temp_Celsius
y=wbr.cnt
plt.scatter (x,y)
```

Figure 9. Daily bicycle rentals, by temperature.



Regression

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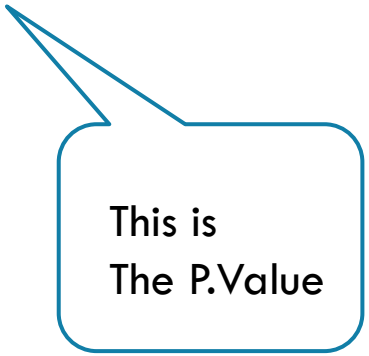
3. Pearson's r

```
from scipy.stats.stats import pearsonr
res = pearsonr(x, y)
print (res)

[1] (0.62749400903349195, 2.8106223975901415e-81)
```



Scatterplot + Pearson's r + test

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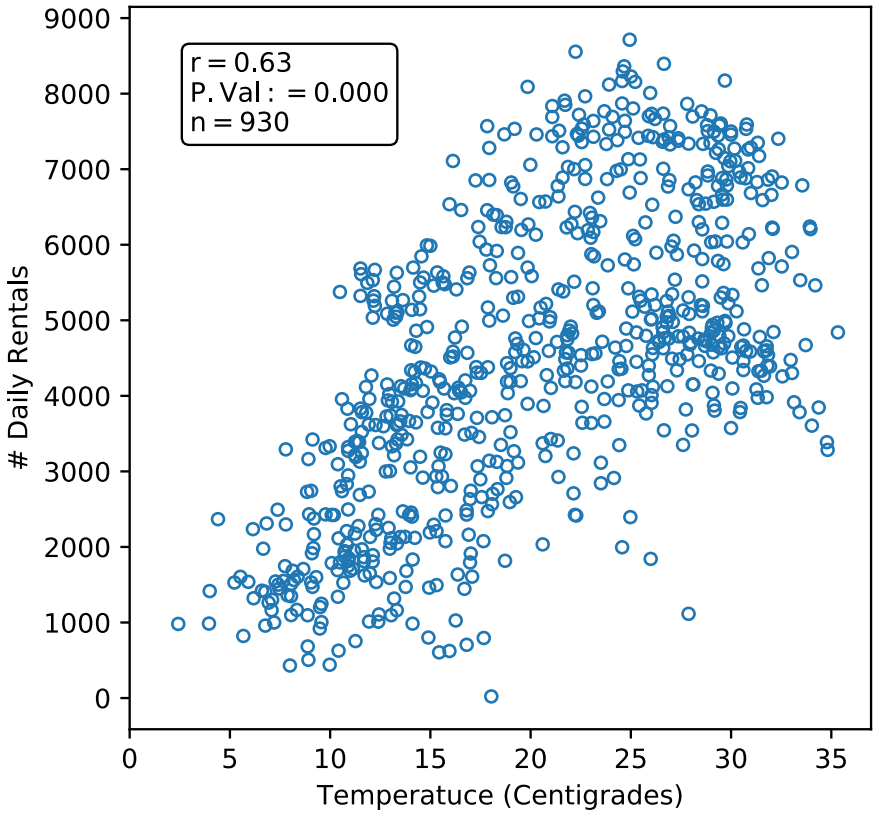
Figure 9. Daily bicycle rentals, by temperature.



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Conclussion

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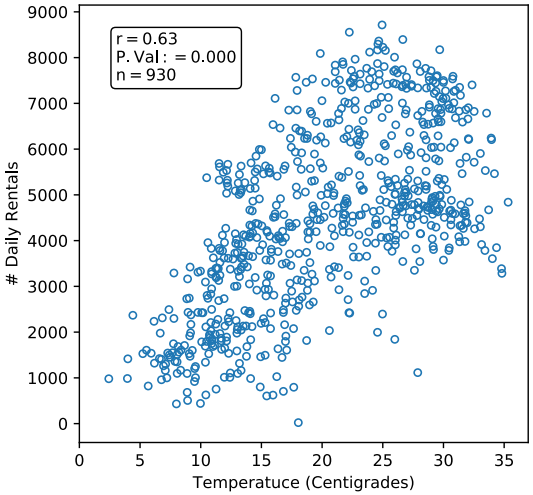
Figure 9. Daily bicycle rentals, by temperature.



Conclussion:

As P. Value < 0.000

We can reject H0 with a confidence higer tan 99.9

✗ H0.: There is no linear association between the *number of rentals* and the *temperature*.

✓ H1.:There is a linear association between the *number of rentals* and the *temperature*.

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Statistical Programming with Python

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Questions?

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Thank you !

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