USM Numérica

Librarían Pandas

Objetivos

1. Conocer los principales comandos de la librería pandas
2. Utilizar pandas para limpieza y manipulación de datos.

Sobre el autor

Sebastián Flores

ICM UTFSM

sebastian.flores@usm.cl

Sobre la presentación

Contenido creada en ipython notebook (jupyter)

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Software:

- python 2.7 o python 3.1
- pandas 0.16.1

Opcional:

- numpy 1.9.2
- matplotlib 1.3.1

Aprender haciendo

Consideraremos el siguiente archivo `data.csv` que contiene datos incompletos:

In [201]:
```
%%bash
cat data/data.csv
```

```
diametro;altura;volumen;tipo_de_arbol
11.2;75;19.9;Cherrie Tree
11.3;79;24.2;Cherry Tree
11.4;76;21.0;Cherry Tree
11.4;76;21.4;Apple Tree
13.7;71;25.7;Cherry Tree
13.8;64;24.9;Cherry Tree
14.0;78;34.5;Cherrie Tree
14.2;80;31.7;Cherry Tree
;74;36.3;Apple Tree
16.0;72;38.3;Cherry Tree
16.3;77;42.6;Cherry Tree
17.3;81;55.4;Apple Tree
17.5;;55.7;Cherry Tree
17.9;80;58.3;Cherry Tree
18.0;80;51.5;Cherry Tree
18.0;;51.0;
20.6;;;Cherry Tree
```

1.- ¿Porqué utilizar pandas?

Razón oficial: Porque en numpy no es posible mezclar tipos de datos, lo cual complica cargar, usar, limpiar y guardar datos mixtos.

Razón personal: Porque habían cosas que en R eran más fáciles pero no pythonísticas. La librería pandas es un excelente compromiso.

In [202]:

```
import numpy as np
df = np.loadtxt("data/data.csv", delimiter=";", dtype=str)
print( df )
```

```
[['diametro' 'altura' 'volumen' 'tipo_de_arbol']
 ['11.2' '75' '19.9' 'Cherrie Tree']
 ['11.3' '79' '24.2' 'Cherry Tree']
 ['11.4' '76' '21.0' 'Cherry Tree']
 ['11.4' '76' '21.4' 'Apple Tree']
 ['13.7' '71' '25.7' 'Cherry Tree']
 ['13.8' '64' '24.9' 'Cherry Tree']
 ['14.0' '78' '34.5' 'Cherrie Tree']
 ['14.2' '80' '31.7' 'Cherry Tree']
 ['' '74' '36.3' 'Apple Tree']
 ['16.0' '72' '38.3' 'Cherry Tree']
 ['16.3' '77' '42.6' 'Cherry Tree']
 ['17.3' '81' '55.4' 'Apple Tree']
 ['17.5' '' '55.7' 'Cherry Tree']
 ['17.9' '80' '58.3' 'Cherry Tree']
 ['18.0' '80' '51.5' 'Cherry Tree']
 ['18.0' '' '51.0' '']
 ['20.6' '' '' 'Cherry Tree']]
```

In [205]:

```
import pandas as pd
df = pd.read_csv("data/data.csv", sep=";")
print( df )
#df
```

```
    diametro  altura  volumen tipo_de_arbol
0       11.2      75     19.9  Cherrie Tree
1       11.3      79     24.2   Cherry Tree
2       11.4      76     21.0   Cherry Tree
3       11.4      76     21.4    Apple Tree
4       13.7      71     25.7   Cherry Tree
5       13.8      64     24.9   Cherry Tree
6       14.0      78     34.5  Cherrie Tree
7       14.2      80     31.7   Cherry Tree
8        NaN      74     36.3    Apple Tree
9       16.0      72     38.3   Cherry Tree
10      16.3      77     42.6   Cherry Tree
11      17.3      81     55.4    Apple Tree
12      17.5     NaN     55.7   Cherry Tree
13      17.9      80     58.3   Cherry Tree
14      18.0      80     51.5   Cherry Tree
15      18.0     NaN     51.0           NaN
16      20.6     NaN      NaN   Cherry Tree
```

In [207]:

```
inch2m = 0.0254
feet2m = 0.3048
df.diametro = df.diametro * inch2m
df.altura = df.altura * feet2m
df.volumen = df.volumen * (feet2m**3)
df.tipo_de_arbol = "Cherry Tree"
df
```

Out[207]:

	diametro	altura	volumen	tipo_de_arbol
0	0.007226	6.967728	0.015957	Cherry Tree
1	0.007290	7.339340	0.019405	Cherry Tree
2	0.007355	7.060631	0.016839	Cherry Tree
3	0.007355	7.060631	0.017159	Cherry Tree
4	0.008839	6.596116	0.020607	Cherry Tree
5	0.008903	5.945795	0.019966	Cherry Tree
6	0.009032	7.246437	0.027664	Cherry Tree
7	0.009161	7.432243	0.025418	Cherry Tree
8	NaN	6.874825	0.029107	Cherry Tree
9	0.010323	6.689019	0.030711	Cherry Tree
10	0.010516	7.153534	0.034159	Cherry Tree
11	0.011161	7.525146	0.044422	Cherry Tree
12	0.011290	NaN	0.044663	Cherry Tree
13	0.011548	7.432243	0.046747	Cherry Tree
14	0.011613	7.432243	0.041295	Cherry Tree
15	0.011613	NaN	0.040894	Cherry Tree
16	0.013290	NaN	NaN	Cherry Tree

In [208]:
```
print( df.columns )
```

```
Index([u'diametro', u'altura', u'volumen', u'tipo_de_arbol'], dtype='objec
t')
```

In [209]:
```
print( df.index )
```

```
Int64Index([0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16], dty
pe='int64')
```

In [210]:
```
print( df["altura"]*2 )
```

```
0     13.935456
1     14.678680
2     14.121262
3     14.121262
4     13.192232
5     11.891589
6     14.492874
7     14.864486
8     13.749650
9     13.378038
10    14.307068
11    15.050292
12          NaN
13    14.864486
14    14.864486
15          NaN
16          NaN
Name: altura, dtype: float64
```

In [211]:
```
print( df["diametro"]**2 * df["altura"] / df.volumen )
```

```
0     0.022799
1     0.020102
2     0.022682
3     0.022258
4     0.025006
5     0.023606
6     0.021370
7     0.024540
8          NaN
9     0.023209
10    0.023160
11    0.021103
12         NaN
13    0.021203
14    0.024272
15         NaN
16         NaN
dtype: float64
```

2. Lo básico de pandas

- Pandas imita los dataframes de R, pero en python. Todo lo que no tiene sentido es porque se parece demasiado a R.
- Pandas permite tener datos como en tablas de excel: datos en una columna pueden ser mixtos.
- La idea central es que la indexación es "a medida": las columnas y las filas (index) pueden ser enteros o floats, pero también pueden ser strings. Depende de lo que tenga sentido.
- Los elementos básicos de pandas son:
    - **Series**: Conjunto de valores con indexación variable.
    - **DataFrames**: Conjunto de Series.

2.1 Series

Una serie es un conveniente conjunto de datos, como una columna de datos de excel, pero con indexación más genérica.

```
pd.Series(self, data=None, index=None, dtype=None, name=None, copy=False,
fastpath=False)
```

In [ ]:

```
import pandas as pd
s1 = pd.Series([False, 1, 2., "3", 4 + 0j])
print( s1 )
```

In [ ]:

```
# Casting a otros tipos
print( list(s1) )
print( set(s1) )
print( np.array(s1) )
```

In [225]:
```
# Ejemplo de operatoria
s0 = pd.Series(range(6), index=range(6))
s1 = pd.Series([1,2,3], index=[1,2,3])
s2 = pd.Series([4,5,6], index=[4,5,6])
s3 = pd.Series([10,10,10], index=[1,4,6])
```

In [217]:
```
print( s0 )
```

```
0    0
1    1
2    2
3    3
4    4
5    5
dtype: int64
```

In [219]:
```
print( s0 + s1 )
```

```
0   NaN
1     2
2     4
3     6
4   NaN
5   NaN
dtype: float64
```

In [220]:
```
print( s0 + s1 + s2 )
```

```
0   NaN
1   NaN
```

```
2   NaN
3   NaN
4   NaN
5   NaN
6   NaN
dtype: float64
```

In [222]:

```
print( s0.add(s1, fill_value=0) )
```

```
0    0
1    2
2    4
3    6
4    4
5    5
dtype: float64
```

2.2 DataFrames

Un Dataframe es una colección de Series con una indexación común. Como una planilla de excel.

```
pd.DataFrame(self, data=None, index=None,
             columns=None, dtype=None, copy=False)
```

In [223]:

```
# dict
df = pd.DataFrame({"col1":[1,2,3,4],
                   "col2":[1., 2., 3., 4.],
                   "col3":["uno", "dos", "tres", "cuatro"]})
df
```

Out[223]:

	col1	col2	col3
0	1	1	uno
1	2	2	dos
2	3	3	tres
3	4	4	cuatro

3.1 Obteniendo datos

1. **Archivo csv**
2. **Archivo json**
3. **Archivo de excel**: convertir a csv cuidadosamente (elegir un separador apropiado, no comentar strings).

In [228]:

```
# csv
df = pd.read_csv("data/data.csv", sep=";")
df
```

Out[228]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherrie Tree
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
6	14.0	78	34.5	Cherrie Tree
7	14.2	80	31.7	Cherry Tree
8	NaN	74	36.3	Apple Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
11	17.3	81	55.4	Apple Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
15	18.0	NaN	51.0	NaN
16	20.6	NaN	NaN	Cherry Tree

In [227]:
```
df = pd.read_json("data/data.json")
df
```

Out[227]:

	altura	diametro	tipo_de_arbol	volumen
1	79	11.3	Cherry Tree	24.2
10	77	16.3	Cherry Tree	42.6
12	NaN	17.5	Cherry Tree	55.7
13	80	17.9	Cherry Tree	58.3
14	80	18.0	Cherry Tree	51.5
16	NaN	20.6	Cherry Tree	NaN
2	76	11.4	Cherry Tree	21.0
4	71	13.7	Cherry Tree	25.7
5	64	13.8	Cherry Tree	24.9
7	80	14.2	Cherry Tree	31.7
9	72	16.0	Cherry Tree	38.3

4.- Inspeccionando datos

1. Accesando las columnas
2. shape
3. head, tail, describe
4. histogram
5. pd.scatter_matrix
6. count_values

In [229]:
```
df = pd.read_csv("data/data.csv", sep=";")
df.columns
```

Out[229]:
```
Index([u'diametro', u'altura', u'volumen', u'tipo_de_arbol'], dtype='objec
t')
```

In [232]:
```
df['altura']
```

Out[232]:
```
0     75
1     79
2     76
3     76
4     71
5     64
6     78
7     80
8     74
9     72
10    77
11    81
12   NaN
13    80
14    80
15   NaN
16   NaN
Name: altura, dtype: float64
```

In [233]:
```
df.shape
```

Out[233]:
```
(17, 4)
```

In [234]:
```
df.head()
```

Out[234]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherrie Tree
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree

In [235]:
```
df.tail()
```

Out[235]:

	diametro	altura	volumen	tipo_de_arbol
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
15	18.0	NaN	51.0	NaN
16	20.6	NaN	NaN	Cherry Tree

In [236]:
```
df.describe()
```

Out[236]:

	diametro	altura	volumen
count	16.000000	14.000000	16.000000
mean	15.162500	75.928571	37.025000
std	2.948418	4.615430	13.773816
min	11.200000	64.000000	19.900000
25%	13.125000	74.250000	24.725000
50%	15.100000	76.500000	35.400000
75%	17.600000	79.750000	51.125000
max	20.600000	81.000000	58.300000

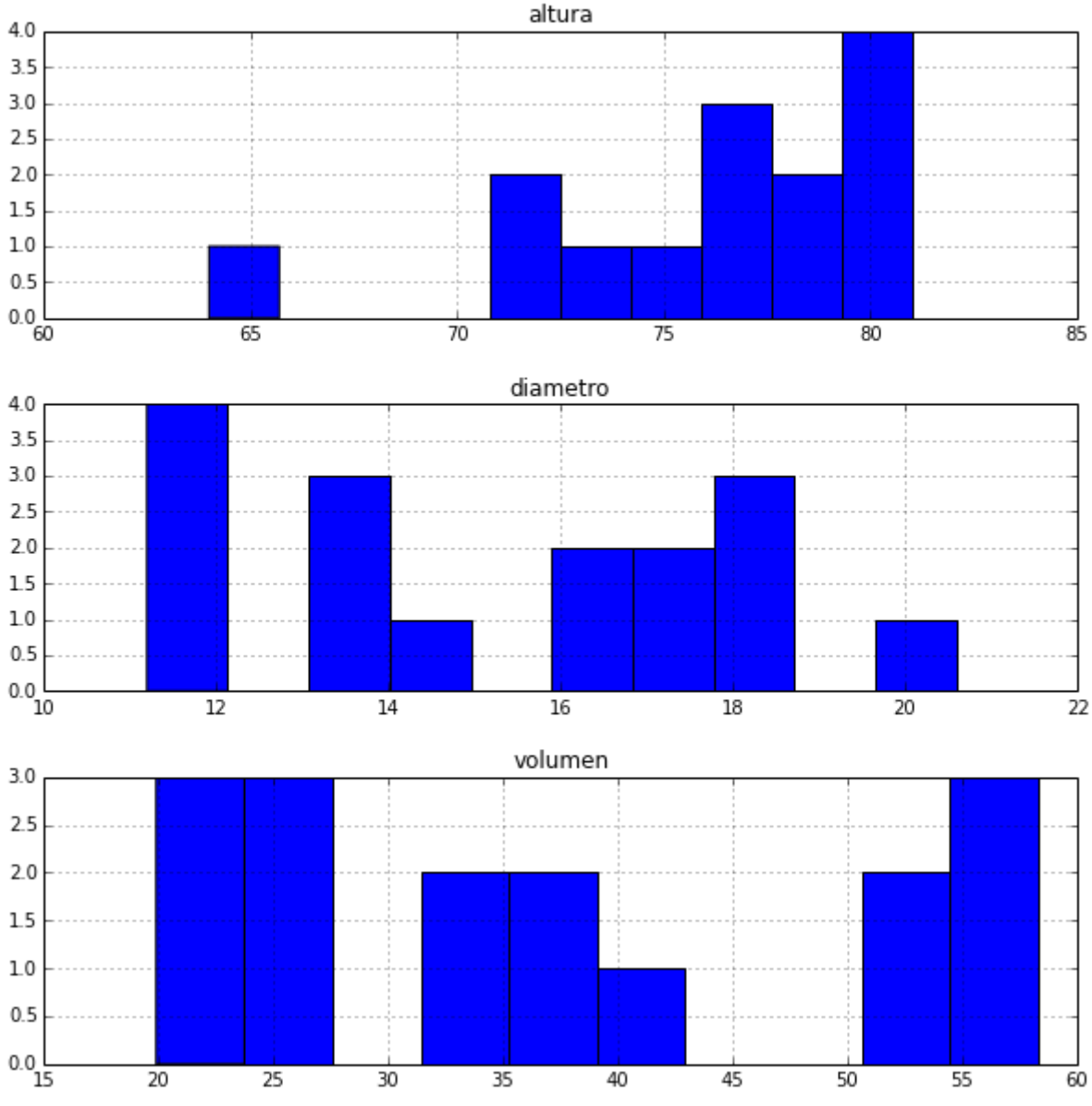
In [289]:
```
df.describe(include="all")
```

Out[289]:

	diametro	altura	volumen	tipo_de_arbol
count	16.000000	14.000000	16.000000	16
unique	NaN	NaN	NaN	3
top	NaN	NaN	NaN	Cherry Tree
freq	NaN	NaN	NaN	11
mean	15.162500	75.928571	37.025000	NaN
std	2.948418	4.615430	13.773816	NaN
min	11.200000	64.000000	19.900000	NaN
25%	13.125000	74.250000	24.725000	NaN
50%	15.100000	76.500000	35.400000	NaN
75%	17.600000	79.750000	51.125000	NaN
max	20.600000	81.000000	58.300000	NaN

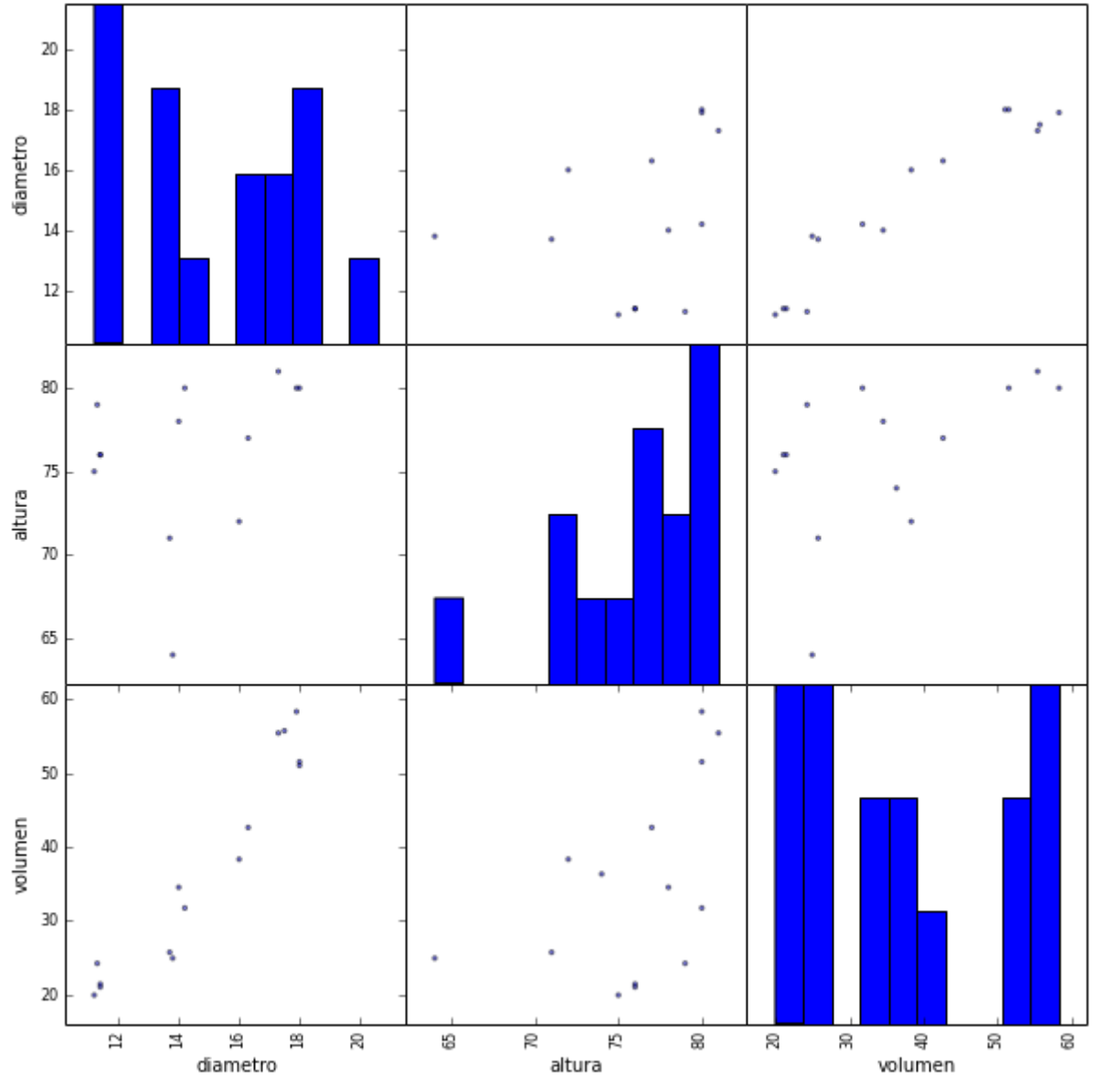
In [238]:

```
from matplotlib import pyplot as plt
df.hist(figsize=(10,10), layout=(3,1))
#df.hist(figsize=(8,8), layout=(3,1), by="tipo_de_arbol")
plt.show()
```


altura
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
60
65
70
75
80
85
diametro
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10
12
14
16
18
20
22
volumen
3.0
2.5
2.0
1.5
1.0
0.5
0.0
15
20
25
30
35
40
45
50
55
60

In [239]:

```
from matplotlib import pyplot as plt
pd.scatter_matrix(df, figsize=(10,10), range_padding=0.2)
plt.show()
```


diametro
altura
volumen
12
14
16
18
20
65
70
75
80
20
30
40
50
60

In [240]:
```
df.tipo_de_arbol.value_counts()
```

Out[240]:
```
Cherry Tree     11
Apple Tree       3
Cherrie Tree     2
dtype: int64
```

5.- Manipulando DataFrames

1. Agregando columnas
2. Borrando columnas
3. Agregando filas
4. Borrando filas
5. Mask
6. Grouping
7. Imputación de datos
8. Apply
9. Merge (a la SQL)
10. Accesamiento

5.1 Agregando columnas

In [241]:
```
df = pd.read_csv("data/data.csv", sep=";")
df["radio"] = .5 * df.diametro
df
```

Out[241]:

	diametro	altura	volumen	tipo_de_arbol	radio
0	11.2	75	19.9	Cherrie Tree	5.60
1	11.3	79	24.2	Cherry Tree	5.65
2	11.4	76	21.0	Cherry Tree	5.70
3	11.4	76	21.4	Apple Tree	5.70
4	13.7	71	25.7	Cherry Tree	6.85
5	13.8	64	24.9	Cherry Tree	6.90
6	14.0	78	34.5	Cherrie Tree	7.00
7	14.2	80	31.7	Cherry Tree	7.10
8	NaN	74	36.3	Apple Tree	NaN
9	16.0	72	38.3	Cherry Tree	8.00
10	16.3	77	42.6	Cherry Tree	8.15
11	17.3	81	55.4	Apple Tree	8.65
12	17.5	NaN	55.7	Cherry Tree	8.75
13	17.9	80	58.3	Cherry Tree	8.95
14	18.0	80	51.5	Cherry Tree	9.00
15	18.0	NaN	51.0	NaN	9.00
16	20.6	NaN	NaN	Cherry Tree	10.30

In [242]:
```
df.area = np.pi * df.radio **2
df.columns
```

Out[242]:
```
Index([u'diametro', u'altura', u'volumen', u'tipo_de_arbol', u'radio'], dt
ype='object')
```

5.2 Renombrando columnas

In [243]:
```
df = pd.read_csv("data/data.csv", sep=";")
print( df.columns )
df.columns = ["RaDiO","AlTuRa","VoLuMeN","TiPo_De_ArBoL"]
```

```
Index([u'diametro', u'altura', u'volumen', u'tipo_de_arbol'], dtype='objec
t')
```

In [248]:
```
print( df.columns )
```

```
Index([u'radio', u'altura', u'volumen', u'tipo_de_arbol'], dtype='object')
```

In [247]:
```
df.columns = [col.lower() for col in df.columns]
print( df.columns )
```

```
Index([u'radio', u'altura', u'volumen', u'tipo_de_arbol'], dtype='object')
```

5.3 Borrando columnas

In [258]:
```
df = pd.read_csv("data/data.csv", sep=";")
print( df.columns )
```

```
Index([u'diametro', u'altura', u'volumen', u'tipo_de_arbol'], dtype='objec
t')
```

In [259]:
```
df = df[["tipo_de_arbol","volumen", "diametro"]]
df
```

Out[259]:

	tipo_de_arbol	volumen	diametro
0	Cherrie Tree	19.9	11.2
1	Cherry Tree	24.2	11.3
2	Cherry Tree	21.0	11.4
3	Apple Tree	21.4	11.4
4	Cherry Tree	25.7	13.7
5	Cherry Tree	24.9	13.8
6	Cherrie Tree	34.5	14.0
7	Cherry Tree	31.7	14.2
8	Apple Tree	36.3	NaN
9	Cherry Tree	38.3	16.0
10	Cherry Tree	42.6	16.3
11	Apple Tree	55.4	17.3
12	Cherry Tree	55.7	17.5
13	Cherry Tree	58.3	17.9
14	Cherry Tree	51.5	18.0
15	NaN	51.0	18.0
16	Cherry Tree	NaN	20.6

In [260]:
```
df = df.drop("tipo_de_arbol", axis=1)
```

```
df
```

Out[260]:

	volumen	diametro
0	19.9	11.2
1	24.2	11.3
2	21.0	11.4
3	21.4	11.4
4	25.7	13.7
5	24.9	13.8
6	34.5	14.0
7	31.7	14.2
8	36.3	NaN
9	38.3	16.0
10	42.6	16.3
11	55.4	17.3
12	55.7	17.5
13	58.3	17.9
14	51.5	18.0
15	51.0	18.0
16	NaN	20.6

In [261]:

```
df.drop("diametro", axis=1, inplace=True)
df
```

Out[261]:

	volumen
0	19.9
1	24.2
2	21.0
3	21.4
4	25.7
5	24.9
6	34.5
7	31.7
8	36.3
9	38.3

	volumen
10	42.6
11	55.4
12	55.7
13	58.3
14	51.5
15	51.0
16	NaN

5.4 Agregando filas (indices)

In [263]:
```
df = pd.read_csv("data/data.csv", sep=";")
print( df.index )
df
```

```
Int64Index([0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16], dty
pe='int64')
```

Out[263]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherrie Tree
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
6	14.0	78	34.5	Cherrie Tree
7	14.2	80	31.7	Cherry Tree
8	NaN	74	36.3	Apple Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
11	17.3	81	55.4	Apple Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
15	18.0	NaN	51.0	NaN
16	20.6	NaN	NaN	Cherry Tree

In [265]:
```
df = df.reindex( range(20) )
df
```

Out[265]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherrie Tree

	diametro	altura	volumen	tipo_de_arbol
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
6	14.0	78	34.5	Cherrie Tree
7	14.2	80	31.7	Cherry Tree
8	NaN	74	36.3	Apple Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
11	17.3	81	55.4	Apple Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
15	18.0	NaN	51.0	NaN
16	20.6	NaN	NaN	Cherry Tree
17	NaN	NaN	NaN	NaN
18	NaN	NaN	NaN	NaN
19	NaN	NaN	NaN	NaN

In [269]:

```
# Usando loc para acceder con notación de indices tradicional
df.loc[20, :] = [10, 20, 30, "CT"]
df
```

Out[269]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherrie Tree
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
6	14.0	78	34.5	Cherrie Tree
7	14.2	80	31.7	Cherry Tree
8	NaN	74	36.3	Apple Tree

	diametro	altura	volumen	tipo_de_arbol
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
11	17.3	81	55.4	Apple Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
15	18.0	NaN	51.0	NaN
16	20.6	NaN	NaN	Cherry Tree
17	NaN	NaN	NaN	NaN
18	NaN	NaN	NaN	NaN
19	NaN	NaN	NaN	NaN
20	10.0	20	30.0	CT

5.5 Renombrando filas (índices)

In [270]:
```
df = pd.read_csv("data/data.csv", sep=";")
print df.index
```

```
Int64Index([0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16], dty
pe='int64')
```

In [271]:
```
df.index = df.index + 10
print df.index
```

```
Int64Index([10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 2
5,
            26],
           dtype='int64')
```

In [272]:
```
df.index = ["i_%d"%idx for idx in df.index]
print df.index
```

```
Index([u'i_10', u'i_11', u'i_12', u'i_13', u'i_14', u'i_15', u'i_16', u'i_
17',
       u'i_18', u'i_19', u'i_20', u'i_21', u'i_22', u'i_23', u'i_24', u'i_
25',
       u'i_26'],
      dtype='object')
```

5.6 Borrando indices

In [273]:
```
print df.index
df
```

```
Index([u'i_10', u'i_11', u'i_12', u'i_13', u'i_14', u'i_15', u'i_16', u'i_
17',
       u'i_18', u'i_19', u'i_20', u'i_21', u'i_22', u'i_23', u'i_24', u'i_
25',
       u'i_26'],
      dtype='object')
```

Out[273]:

	diametro	altura	volumen	tipo_de_arbol
i_10	11.2	75	19.9	Cherrie Tree
i_11	11.3	79	24.2	Cherry Tree
i_12	11.4	76	21.0	Cherry Tree
i_13	11.4	76	21.4	Apple Tree
i_14	13.7	71	25.7	Cherry Tree
i_15	13.8	64	24.9	Cherry Tree
i_16	14.0	78	34.5	Cherrie Tree
i_17	14.2	80	31.7	Cherry Tree
i_18	NaN	74	36.3	Apple Tree
i_19	16.0	72	38.3	Cherry Tree
i_20	16.3	77	42.6	Cherry Tree
i_21	17.3	81	55.4	Apple Tree
i_22	17.5	NaN	55.7	Cherry Tree
i_23	17.9	80	58.3	Cherry Tree
i_24	18.0	80	51.5	Cherry Tree
i_25	18.0	NaN	51.0	NaN
i_26	20.6	NaN	NaN	Cherry Tree

In [274]:
```
df = df.drop(["i_11","i_13","i_19"], axis=0)
```

```
print( df.index )
df
```

```
Index([u'i_10', u'i_12', u'i_14', u'i_15', u'i_16', u'i_17', u'i_18', u'i_
20',
       u'i_21', u'i_22', u'i_23', u'i_24', u'i_25', u'i_26'],
      dtype='object')
```

Out[274]:

	diametro	altura	volumen	tipo_de_arbol
i_10	11.2	75	19.9	Cherrie Tree
i_12	11.4	76	21.0	Cherry Tree
i_14	13.7	71	25.7	Cherry Tree
i_15	13.8	64	24.9	Cherry Tree
i_16	14.0	78	34.5	Cherrie Tree
i_17	14.2	80	31.7	Cherry Tree
i_18	NaN	74	36.3	Apple Tree
i_20	16.3	77	42.6	Cherry Tree
i_21	17.3	81	55.4	Apple Tree
i_22	17.5	NaN	55.7	Cherry Tree
i_23	17.9	80	58.3	Cherry Tree
i_24	18.0	80	51.5	Cherry Tree
i_25	18.0	NaN	51.0	NaN
i_26	20.6	NaN	NaN	Cherry Tree

In [275]:
```
df.drop(["i_24","i_25","i_26"], axis=0, inplace=True)
df
```

Out[275]:

	diametro	altura	volumen	tipo_de_arbol
i_10	11.2	75	19.9	Cherrie Tree
i_12	11.4	76	21.0	Cherry Tree
i_14	13.7	71	25.7	Cherry Tree
i_15	13.8	64	24.9	Cherry Tree
i_16	14.0	78	34.5	Cherrie Tree
i_17	14.2	80	31.7	Cherry Tree
i_18	NaN	74	36.3	Apple Tree
i_20	16.3	77	42.6	Cherry Tree
i_21	17.3	81	55.4	Apple Tree
i_22	17.5	NaN	55.7	Cherry Tree
i_23	17.9	80	58.3	Cherry Tree

In [276]:
```
df = df[-5:]
df
```

Out[276]:

	diametro	altura	volumen	tipo_de_arbol
i_18	NaN	74	36.3	Apple Tree
i_20	16.3	77	42.6	Cherry Tree
i_21	17.3	81	55.4	Apple Tree
i_22	17.5	NaN	55.7	Cherry Tree
i_23	17.9	80	58.3	Cherry Tree

Observación

```
# seleccionar la columna col
# regresa una serie
df[col]

# seleccionar las columnas col1, col2, ..., coln
# regresa dataframe
df[[col1,col2,.., coln]]

# selecciona solo el indice inicio
# regresa un dataframe
df[inicio:(inicio+1)]

# selecciona los indices en notacion
#regresa un dataframe
df[inicio:fin:salto]

# seleccion mixta
# regresa un dataframe
df.loc[inicio:fin:salto, col1:col2]
```

5.7 Masking

In [277]:
```
df = pd.read_csv("data/data.csv", sep=";")
vol_mean = df.volumen.mean()
vol_std = df.volumen.std()
```

In [279]:
```
mask_1 = df.altura < 80
mask_2 =  df.volumen <= vol_mean + vol_std
df1 = df[ mask_1 & mask_2 ]
df1
```

Out[279]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherrie Tree
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
6	14.0	78	34.5	Cherrie Tree
8	NaN	74	36.3	Apple Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree

In [280]:
```
# Si se hace dinamicamente, utilizar suficientes parentesis
#df2 = df[ ((vol_mean - vol_std) <= df.volumen) & (df.volumen <= (vol_mean + vol_std) ) ]
df2 = df[ (df.volumen >=(vol_mean - vol_std)) & (df.volumen <= (vol_mean + vol_std) ) ]
df2
```

Out[280]:

	diametro	altura	volumen	tipo_de_arbol
1	11.3	79	24.2	Cherry Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree

	diametro	altura	volumen	tipo_de_arbol
6	14.0	78	34.5	Cherrie Tree
7	14.2	80	31.7	Cherry Tree
8	NaN	74	36.3	Apple Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree

In [281]:

```
# A veces para simplificar numpy ayuda
mask_1 = df.volumen >= (vol_mean - vol_std)
mask_2 = df.volumen <= (vol_mean + vol_std)
mask = np.logical_and(mask_1, mask_2)
df3 = df[np.logical_not(mask)]
df3
```

Out[281]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherrie Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
11	17.3	81	55.4	Apple Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
15	18.0	NaN	51.0	NaN
16	20.6	NaN	NaN	Cherry Tree

5.8.- Grouping

In [282]:
```
df = pd.read_csv("data/data.csv", sep=";")
df.columns
```

Out[282]:
```
Index([u'diametro', u'altura', u'volumen', u'tipo_de_arbol'], dtype='objec
t')
```

In [283]:
```
g = df.groupby("tipo_de_arbol")
print( g )
```

```
<pandas.core.groupby.DataFrameGroupBy object at 0x7fb0e37e1f90>
```

In [284]:
```
print( g.count() )
```

```
               diametro  altura  volumen
tipo_de_arbol
Apple Tree            2       3        3
Cherrie Tree          2       2        2
Cherry Tree          11       9       10
```

In [285]:
```
print( g.sum() ) # .mean(), .std()
```

```
               diametro  altura  volumen
tipo_de_arbol
Apple Tree         28.7     231    113.1
Cherrie Tree       25.2     153     54.4
Cherry Tree       170.7     679    373.9
```

In [286]:
```
# Ejemplo real
df[["tipo_de_arbol","diametro", "altura"]].groupby("tipo_de_arbol").mean()
```

Out[286]:

tipo_de_arbol	diametro	altura
Apple Tree	14.350000	77.000000
Cherrie Tree	12.600000	76.500000
Cherry Tree	15.518182	75.444444

5.9.- Imputación de datos

In [288]:
```
# Antes de imputar datos, siempre explorar
df.describe(include="all")
```

Out[288]:

	diametro	altura	volumen	tipo_de_arbol
count	16.000000	14.000000	16.000000	16
unique	NaN	NaN	NaN	3
top	NaN	NaN	NaN	Cherry Tree
freq	NaN	NaN	NaN	11
mean	15.162500	75.928571	37.025000	NaN
std	2.948418	4.615430	13.773816	NaN
min	11.200000	64.000000	19.900000	NaN
25%	13.125000	74.250000	24.725000	NaN
50%	15.100000	76.500000	35.400000	NaN
75%	17.600000	79.750000	51.125000	NaN
max	20.600000	81.000000	58.300000	NaN

In [290]:

```
# Imputación manual de datos (incorrecto)
df["tipo_de_arbol"][df.tipo_de_arbol=="Cherrie Tree"] = "Cherry Tree"
df
```

```
/usr/local/lib/python2.7/dist-packages/ipykernel/__main__.py:2: SettingWit
hCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy
  from ipykernel import kernelapp as app
```

Out[290]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherry Tree
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
6	14.0	78	34.5	Cherry Tree
7	14.2	80	31.7	Cherry Tree
8	NaN	74	36.3	Apple Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
11	17.3	81	55.4	Apple Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
15	18.0	NaN	51.0	NaN
16	20.6	NaN	NaN	Cherry Tree

In [291]:

```
# Imputación manual de datos
df = pd.read_csv("data/data.csv", sep=";")
index_mask = (df.tipo_de_arbol=="Cherrie Tree")
df.loc[index_mask, "tipo_de_arbol"] = "Cherry Tree" # .loc es esencial
df
```

Out[291]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherry Tree
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
6	14.0	78	34.5	Cherry Tree
7	14.2	80	31.7	Cherry Tree
8	NaN	74	36.3	Apple Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
11	17.3	81	55.4	Apple Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
15	18.0	NaN	51.0	NaN
16	20.6	NaN	NaN	Cherry Tree

In [292]:

```
# Imputación de datos: llenar NaNs con promedio
df = pd.read_csv("data/data.csv", sep=";")
df1 = df.fillna(df.mean())
df1
```

Out[292]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2000	75.000000	19.900	Cherrie Tree
1	11.3000	79.000000	24.200	Cherry Tree
2	11.4000	76.000000	21.000	Cherry Tree
3	11.4000	76.000000	21.400	Apple Tree
4	13.7000	71.000000	25.700	Cherry Tree
5	13.8000	64.000000	24.900	Cherry Tree
6	14.0000	78.000000	34.500	Cherrie Tree
7	14.2000	80.000000	31.700	Cherry Tree
8	15.1625	74.000000	36.300	Apple Tree
9	16.0000	72.000000	38.300	Cherry Tree
10	16.3000	77.000000	42.600	Cherry Tree
11	17.3000	81.000000	55.400	Apple Tree
12	17.5000	75.928571	55.700	Cherry Tree
13	17.9000	80.000000	58.300	Cherry Tree
14	18.0000	80.000000	51.500	Cherry Tree
15	18.0000	75.928571	51.000	NaN
16	20.6000	75.928571	37.025	Cherry Tree

In [293]:

```
# Imputación de datos: llenar NaNs con valor
df2 = df.fillna(0)
df2
```

Out[293]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherrie Tree
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
6	14.0	78	34.5	Cherrie Tree
7	14.2	80	31.7	Cherry Tree
8	0.0	74	36.3	Apple Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
11	17.3	81	55.4	Apple Tree
12	17.5	0	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
15	18.0	0	51.0	0
16	20.6	0	0.0	Cherry Tree

In [294]:

```
# Imputación de datos: desechar filas con NaN
df3 = df.dropna()
df3
```

Out[294]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherrie Tree
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
6	14.0	78	34.5	Cherrie Tree
7	14.2	80	31.7	Cherry Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
11	17.3	81	55.4	Apple Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree

5.10 Apply

In [295]:
```
df = pd.read_csv("data/data.csv", sep=";")
df1 = df.diametro.apply(lambda x: x*2)
df1
```

Out[295]:
```
0     22.4
1     22.6
2     22.8
3     22.8
4     27.4
5     27.6
6     28.0
7     28.4
8      NaN
9     32.0
10    32.6
11    34.6
12    35.0
13    35.8
14    36.0
15    36.0
16    41.2
Name: diametro, dtype: float64
```

In [296]:
```
# Aplicación incorrecta
df2 = df["tipo_de_arbol"].apply(str.upper) # Error
df2
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-296-1993c7531ea9> in <module>()
      1 # Aplicación incorrecta
----> 2 df2 = df["tipo_de_arbol"].apply(str.upper) # Error
      3 df2

/usr/local/lib/python2.7/dist-packages/pandas/core/series.pyc in apply(self, func, convert_dtype, args, **kwds)
   2051             values = lib.map_infer(values, lib.Timestamp)
   2052
-> 2053         mapped = lib.map_infer(values, f, convert=convert_dtype)
   2054         if len(mapped) and isinstance(mapped[0], Series):
   2055             from pandas.core.frame import DataFrame

pandas/src/inference.pyx in pandas.lib.map_infer (pandas/lib.c:58519)()

TypeError: descriptor 'upper' requires a 'str' object but received a 'float'
```

In [297]:
```
# Aplicación correcta
df2 = df["tipo_de_arbol"].apply(lambda s: str(s).upper() )
df2
```

Out[297]:
```
0     CHERRIE TREE
1      CHERRY TREE
```

```
2      CHERRY TREE
3       APPLE TREE
4      CHERRY TREE
5      CHERRY TREE
6     CHERRIE TREE
7      CHERRY TREE
8       APPLE TREE
9      CHERRY TREE
10     CHERRY TREE
11      APPLE TREE
12     CHERRY TREE
13     CHERRY TREE
14     CHERRY TREE
15              NAN
16     CHERRY TREE
Name: tipo_de_arbol, dtype: object
```

In [298]:

```
# Error (o no?)
df3 = df.apply(lambda x: x*2)
df3
```

Out[298]:

	diametro	altura	volumen	tipo_de_arbol
0	22.4	150	39.8	Cherrie TreeCherrie Tree
1	22.6	158	48.4	Cherry TreeCherry Tree
2	22.8	152	42.0	Cherry TreeCherry Tree
3	22.8	152	42.8	Apple TreeApple Tree
4	27.4	142	51.4	Cherry TreeCherry Tree
5	27.6	128	49.8	Cherry TreeCherry Tree
6	28.0	156	69.0	Cherrie TreeCherrie Tree
7	28.4	160	63.4	Cherry TreeCherry Tree
8	NaN	148	72.6	Apple TreeApple Tree
9	32.0	144	76.6	Cherry TreeCherry Tree
10	32.6	154	85.2	Cherry TreeCherry Tree
11	34.6	162	110.8	Apple TreeApple Tree
12	35.0	NaN	111.4	Cherry TreeCherry Tree
13	35.8	160	116.6	Cherry TreeCherry Tree
14	36.0	160	103.0	Cherry TreeCherry Tree
15	36.0	NaN	102.0	NaN
16	41.2	NaN	NaN	Cherry TreeCherry Tree

Atajo

Para usar las operaciones de string en una columna de strings, es posible utilizar la siguiente notación para ahorrar espacio.

In [299]:
```
df.tipo_de_arbol.str.upper()
```

Out[299]:
```
0      CHERRIE TREE
1       CHERRY TREE
2       CHERRY TREE
3        APPLE TREE
4       CHERRY TREE
5       CHERRY TREE
6      CHERRIE TREE
7       CHERRY TREE
8        APPLE TREE
9       CHERRY TREE
10      CHERRY TREE
11       APPLE TREE
12      CHERRY TREE
13      CHERRY TREE
14      CHERRY TREE
15              NaN
16      CHERRY TREE
Name: tipo_de_arbol, dtype: object
```

In [300]:
```
df.tipo_de_arbol.str.len()
```

Out[300]:
```
0      12
1      11
2      11
3      10
4      11
5      11
6      12
7      11
8      10
9      11
10     11
11     10
12     11
13     11
14     11
15    NaN
16     11
Name: tipo_de_arbol, dtype: float64
```

In [301]:
```
df.tipo_de_arbol.str[3:-3]
```

Out[301]:
```
0     rrie T
1      rry T
2      rry T
3       le T
4      rry T
5      rry T
6     rrie T
7      rry T
8       le T
9      rry T
10     rry T
11      le T
12     rry T
13     rry T
14     rry T
15       NaN
16     rry T
Name: tipo_de_arbol, dtype: object
```

5.11 Merge

In [302]:
```
df1 = pd.read_csv("data/data.csv", sep=";")
df1
```

Out[302]:

	diametro	altura	volumen	tipo_de_arbol
0	11.2	75	19.9	Cherrie Tree
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
3	11.4	76	21.4	Apple Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
6	14.0	78	34.5	Cherrie Tree
7	14.2	80	31.7	Cherry Tree
8	NaN	74	36.3	Apple Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
11	17.3	81	55.4	Apple Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
15	18.0	NaN	51.0	NaN
16	20.6	NaN	NaN	Cherry Tree

In [304]:

```
df2 = pd.DataFrame(data={"tipo_de_arbol":["Cherry Tree", "Apple Tree", "Pear Tree"],
                         "fruto":["guinda","manzana", "pera"],
                         "precio_pesos_por_kg":[500, 2000, np.nan]})
df2
```

Out[304]:

	fruto	precio_pesos_por_kg	tipo_de_arbol
0	guinda	500	Cherry Tree
1	manzana	2000	Apple Tree
2	pera	NaN	Pear Tree

In [305]:

```
df3 = df1.merge(df2, how="left", on="tipo_de_arbol")
df3
```

Out[305]:

	diametro	altura	volumen	tipo_de_arbol	fruto	precio_pesos_por_kg
0	11.2	75	19.9	Cherrie Tree	NaN	NaN
1	11.3	79	24.2	Cherry Tree	guinda	500
2	11.4	76	21.0	Cherry Tree	guinda	500
3	11.4	76	21.4	Apple Tree	manzana	2000
4	13.7	71	25.7	Cherry Tree	guinda	500
5	13.8	64	24.9	Cherry Tree	guinda	500
6	14.0	78	34.5	Cherrie Tree	NaN	NaN
7	14.2	80	31.7	Cherry Tree	guinda	500
8	NaN	74	36.3	Apple Tree	manzana	2000
9	16.0	72	38.3	Cherry Tree	guinda	500
10	16.3	77	42.6	Cherry Tree	guinda	500
11	17.3	81	55.4	Apple Tree	manzana	2000
12	17.5	NaN	55.7	Cherry Tree	guinda	500
13	17.9	80	58.3	Cherry Tree	guinda	500
14	18.0	80	51.5	Cherry Tree	guinda	500
15	18.0	NaN	51.0	NaN	NaN	NaN
16	20.6	NaN	NaN	Cherry Tree	guinda	500

In [306]:

```
df3 = df1.merge(df2, how="right", on="tipo_de_arbol")
df3
```

Out[306]:

	diametro	altura	volumen	tipo_de_arbol	fruto	precio_pesos_por_kg
0	11.3	79	24.2	Cherry Tree	guinda	500
1	11.4	76	21.0	Cherry Tree	guinda	500
2	13.7	71	25.7	Cherry Tree	guinda	500
3	13.8	64	24.9	Cherry Tree	guinda	500
4	14.2	80	31.7	Cherry Tree	guinda	500
5	16.0	72	38.3	Cherry Tree	guinda	500
6	16.3	77	42.6	Cherry Tree	guinda	500
7	17.5	NaN	55.7	Cherry Tree	guinda	500
8	17.9	80	58.3	Cherry Tree	guinda	500
9	18.0	80	51.5	Cherry Tree	guinda	500
10	20.6	NaN	NaN	Cherry Tree	guinda	500
11	11.4	76	21.4	Apple Tree	manzana	2000
12	NaN	74	36.3	Apple Tree	manzana	2000
13	17.3	81	55.4	Apple Tree	manzana	2000
14	NaN	NaN	NaN	Pear Tree	pera	NaN

In [307]:
```
df3 = df1.merge(df2, how="inner", on="tipo_de_arbol")
df3
```

Out[307]:

	diametro	altura	volumen	tipo_de_arbol	fruto	precio_pesos_por_kg
0	11.3	79	24.2	Cherry Tree	guinda	500
1	11.4	76	21.0	Cherry Tree	guinda	500
2	13.7	71	25.7	Cherry Tree	guinda	500
3	13.8	64	24.9	Cherry Tree	guinda	500
4	14.2	80	31.7	Cherry Tree	guinda	500
5	16.0	72	38.3	Cherry Tree	guinda	500
6	16.3	77	42.6	Cherry Tree	guinda	500
7	17.5	NaN	55.7	Cherry Tree	guinda	500
8	17.9	80	58.3	Cherry Tree	guinda	500
9	18.0	80	51.5	Cherry Tree	guinda	500
10	20.6	NaN	NaN	Cherry Tree	guinda	500
11	11.4	76	21.4	Apple Tree	manzana	2000
12	NaN	74	36.3	Apple Tree	manzana	2000
13	17.3	81	55.4	Apple Tree	manzana	2000

In [308]:

```
df3 = df1.merge(df2, how="outer", on="tipo_de_arbol")
df3
```

Out[308]:

	diametro	altura	volumen	tipo_de_arbol	fruto	precio_pesos_por_kg
0	11.2	75	19.9	Cherrie Tree	NaN	NaN
1	14.0	78	34.5	Cherrie Tree	NaN	NaN
2	11.3	79	24.2	Cherry Tree	guinda	500
3	11.4	76	21.0	Cherry Tree	guinda	500
4	13.7	71	25.7	Cherry Tree	guinda	500
5	13.8	64	24.9	Cherry Tree	guinda	500
6	14.2	80	31.7	Cherry Tree	guinda	500
7	16.0	72	38.3	Cherry Tree	guinda	500
8	16.3	77	42.6	Cherry Tree	guinda	500
9	17.5	NaN	55.7	Cherry Tree	guinda	500
10	17.9	80	58.3	Cherry Tree	guinda	500
11	18.0	80	51.5	Cherry Tree	guinda	500
12	20.6	NaN	NaN	Cherry Tree	guinda	500
13	11.4	76	21.4	Apple Tree	manzana	2000
14	NaN	74	36.3	Apple Tree	manzana	2000
15	17.3	81	55.4	Apple Tree	manzana	2000
16	18.0	NaN	51.0	NaN	NaN	NaN
17	NaN	NaN	NaN	Pear Tree	pera	NaN

Guardando datos

1. **csv**
2. **json**
3. **excel**

   Lo más importante es tener cuidado de cómo se guardan los nombres de las columnas (header), y el indice (index).

   Depende de la utilización, pero mi recomendación es guardar el header explícitamente y guardar el index como una columna.

In [311]:

```
# guardar un csv
df = pd.read_csv("data/data.csv", sep=";")
df = df[df.tipo_de_arbol=="Cherry Tree"]
df.to_csv("data/output.csv", sep="|", index=True) # header=True by default
df
```

Out[311]:

	diametro	altura	volumen	tipo_de_arbol
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
7	14.2	80	31.7	Cherry Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
16	20.6	NaN	NaN	Cherry Tree

In [312]:

```
# Leer el csv anterior
df2 = pd.read_csv("data/output.csv", sep="|", index_col=0) # get index from first column
df2
```

Out[312]:

	diametro	altura	volumen	tipo_de_arbol
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
7	14.2	80	31.7	Cherry Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
16	20.6	NaN	NaN	Cherry Tree

In [313]:

```
%%bash
cat data/output.csv
```

```
|diametro|altura|volumen|tipo_de_arbol
1|11.3|79.0|24.2|Cherry Tree
2|11.4|76.0|21.0|Cherry Tree
4|13.7|71.0|25.7|Cherry Tree
5|13.8|64.0|24.9|Cherry Tree
7|14.2|80.0|31.7|Cherry Tree
9|16.0|72.0|38.3|Cherry Tree
10|16.3|77.0|42.6|Cherry Tree
12|17.5||55.7|Cherry Tree
13|17.9|80.0|58.3|Cherry Tree
14|18.0|80.0|51.5|Cherry Tree
16|20.6|||Cherry Tree
```

In [314]:

```
# guardar un json
df = pd.read_csv("data/data.csv", sep=";")
df = df[df.tipo_de_arbol=="Cherry Tree"]
df.to_json("data/output.json")
df
```

Out[314]:

	diametro	altura	volumen	tipo_de_arbol
1	11.3	79	24.2	Cherry Tree
2	11.4	76	21.0	Cherry Tree
4	13.7	71	25.7	Cherry Tree
5	13.8	64	24.9	Cherry Tree
7	14.2	80	31.7	Cherry Tree
9	16.0	72	38.3	Cherry Tree
10	16.3	77	42.6	Cherry Tree
12	17.5	NaN	55.7	Cherry Tree
13	17.9	80	58.3	Cherry Tree
14	18.0	80	51.5	Cherry Tree
16	20.6	NaN	NaN	Cherry Tree

In [315]:

```
# Leyendo el json anterior
df2 = pd.read_json("data/output.json")
df2
```

Out[315]:

	altura	diametro	tipo_de_arbol	volumen
1	79	11.3	Cherry Tree	24.2
10	77	16.3	Cherry Tree	42.6
12	NaN	17.5	Cherry Tree	55.7
13	80	17.9	Cherry Tree	58.3
14	80	18.0	Cherry Tree	51.5
16	NaN	20.6	Cherry Tree	NaN
2	76	11.4	Cherry Tree	21.0
4	71	13.7	Cherry Tree	25.7
5	64	13.8	Cherry Tree	24.9
7	80	14.2	Cherry Tree	31.7
9	72	16.0	Cherry Tree	38.3

In [316]:

```
%%bash
cat data/output.json
```


```
{"diametro":{"1":11.3,"2":11.4,"4":13.7,"5":13.8,"7":14.2,"9":16.0,"10":1
6.3,"12":17.5,"13":17.9,"14":18.0,"16":20.6},"altura":{"1":79.0,"2":76.
0,"4":71.0,"5":64.0,"7":80.0,"9":72.0,"10":77.0,"12":null,"13":80.0,"14":8
0.0,"16":null},"volumen":{"1":24.2,"2":21.0,"4":25.7,"5":24.9,"7":31.
7,"9":38.3,"10":42.6,"12":55.7,"13":58.3,"14":51.5,"16":null},"tipo_de_arb
ol":{"1":"Cherry Tree","2":"Cherry Tree","4":"Cherry Tree","5":"Cherry Tre
e","7":"Cherry Tree","9":"Cherry Tree","10":"Cherry Tree","12":"Cherry Tre
e","13":"Cherry Tree","14":"Cherry Tree","16":"Cherry Tree"}}
```

Desafío para la casa

Descargar algún archivo de interés:

- Abrir el archivo.
- Explorar los datos
- Visualizar los datos
- Completar los datos incompletos
- Guardar el archivo

¡Gracias por la atención!