

GroupBy_ed

May 20, 2022

Sometimes we want to select data based on groups and understand aggregated data on a group level. We have seen that even though Pandas allows us to iterate over every row in a dataframe, it is generally very slow to do so. Fortunately Pandas has a `groupby()` function to speed up such task. The idea behind the `groupby()` function is that it takes some dataframe, splits it into chunks based on some key values, applies computation on those chunks, then combines the results back together into another dataframe. In pandas this is referred to as the split-apply-combine pattern.

1 Splitting

```
[2]: # Let's look at an example. First, we'll bring in our pandas and numpy
      ↳ libraries
import pandas as pd
import numpy as np
```

```
[157]: # Let's look at some US census data
df = pd.read_csv('datasets/census.csv')
# And exclude state level summarizations, which have sum level value of 40
df = df[df['SUMLEV']==50]
df.head()
```

```
[157]:
```

	SUMLEV	REGION	DIVISION	STATE	COUNTY	STNAME	CTYNAME	\
1	50	3	6	1	1	Alabama	Autauga County	
2	50	3	6	1	3	Alabama	Baldwin County	
3	50	3	6	1	5	Alabama	Barbour County	
4	50	3	6	1	7	Alabama	Bibb County	
5	50	3	6	1	9	Alabama	Blount County	

	CENSUS2010POP	ESTIMATESBASE2010	POPESTIMATE2010	...	RDOMESTICMIG2011	\
1	54571	54571	54660	...	7.242091	
2	182265	182265	183193	...	14.832960	
3	27457	27457	27341	...	-4.728132	
4	22915	22919	22861	...	-5.527043	
5	57322	57322	57373	...	1.807375	

	RDOMESTICMIG2012	RDOMESTICMIG2013	RDOMESTICMIG2014	RDOMESTICMIG2015	\
1	-2.915927	-3.012349	2.265971	-2.530799	
2	17.647293	21.845705	19.243287	17.197872	

3	-2.500690	-7.056824	-3.904217	-10.543299
4	-5.068871	-6.201001	-0.177537	0.177258
5	-1.177622	-1.748766	-2.062535	-1.369970

	RNETMIG2011	RNETMIG2012	RNETMIG2013	RNETMIG2014	RNETMIG2015
1	7.606016	-2.626146	-2.722002	2.592270	-2.187333
2	15.844176	18.559627	22.727626	20.317142	18.293499
3	-4.874741	-2.758113	-7.167664	-3.978583	-10.543299
4	-5.088389	-4.363636	-5.403729	0.754533	1.107861
5	1.859511	-0.848580	-1.402476	-1.577232	-0.884411

[5 rows x 100 columns]

```
[3]: # In the first example for groupby() I want to use the census date. Let's get a
      # list of the unique states,
      # then we can iterate over all the states and for each state we reduce the data
      # frame and calculate the
      # average.

      # Let's run such task for 3 times and time it. For this we'll use the cell
      # magic function %%timeit
```

```
[3]: %%timeit -n 3

      # código del curso que es más lento

      for state in df['STNAME'].unique():
          # We'll just calculate the average using numpy for this particular state
          avg = np.average(df.where(df['STNAME']==state).dropna()['CENSUS2010POP'])
          # And we'll print it to the screen
          print('Counties in state ' + state +
                ' have an average population of ' + str(avg))
```

```
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Counties in state Alaska have an average population of 24490.724137931036
Counties in state Arizona have an average population of 426134.4666666667
Counties in state Arkansas have an average population of 38878.906666666667
Counties in state California have an average population of 642309.5862068966
Counties in state Colorado have an average population of 78581.1875
Counties in state Connecticut have an average population of 446762.125
Counties in state Delaware have an average population of 299311.3333333333
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Counties in state Illinois have an average population of 125790.50980392157
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```

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Counties in state North Dakota have an average population of 12690.396226415094

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 2.2 s ± 21.8 ms per loop (mean ± std. dev. of 7 runs, 3 loops each)

```
[ ]: # Se ve que tarda 2,27 segundos

# If you scroll down to the bottom of that output you can see it takes a fair
→bit of time to finish.
# Now let's try another approach using groupby()
```

```
[15]: %%timeit -n 3

# Ahora hago mi código, scando where() y drop()

for state in df['STNAME'].unique():
    # We'll just calculate the average using numpy for this particular state
    # df['col'].unique() devuelve valores únicos dentro de la Serie

    # Primero AGRUPAMOS por Estado y extraemos la serie con la columna que no
→interesa, que incluye info de
    # todas las ciudades de un estado en particular para cada iteración
    serie = df[df['STNAME']==state]['CENSUS2010POP']

    # En segundo lugar APLICAMOS un procesamiento (apply)
    avg = np.average(serie)

    # And we'll print it to the screen
```

```
print('Counties in state ' + state +  
      ' have an average population of ' + str(avg))
```

```
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Counties in state Connecticut have an average population of 446762.125

Counties in state Delaware have an average population of 299311.3333333333

Counties in state District of Columbia have an average population of 601723.0

Counties in state Florida have an average population of 280616.5671641791

Counties in state Georgia have an average population of 60928.63522012578

Counties in state Hawaii have an average population of 272060.2

Counties in state Idaho have an average population of 35626.86363636364

Counties in state Illinois have an average population of 125790.50980392157

Counties in state Indiana have an average population of 70476.10869565218

Counties in state Iowa have an average population of 30771.262626262625

Counties in state Kansas have an average population of 27172.55238095238

Counties in state Kentucky have an average population of 36161.39166666667

Counties in state Louisiana have an average population of 70833.9375

Counties in state Maine have an average population of 83022.5625

Counties in state Maryland have an average population of 240564.66666666666

Counties in state Massachusetts have an average population of 467687.78571428574

Counties in state Michigan have an average population of 119080.0

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Counties in state Missouri have an average population of 52077.62608695652

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Counties in state Nevada have an average population of 158855.9411764706

Counties in state New Hampshire have an average population of 131647.0

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Counties in state New Mexico have an average population of 62399.36363636364

Counties in state New York have an average population of 312550.03225806454

Counties in state North Carolina have an average population of 95354.83

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55.2 ms ± 4.32 ms per loop (mean ± std. dev. of 7 runs, 3 loops each)

```

```

[5]: # Demoró 55 ms
      # Esta versión ya fue más rápida que la anterior!

```

```

[16]: %%timeit -n 3

      # Ahora vamos a probar con la función groupby()

```



```

# For this method, we start by telling pandas we're interested in grouping by
→state name, this is the "split"

for group, frame in df.groupby('STNAME'):
    # You'll notice there are two values we set here. groupby() returns a
    →tuple, where the first value is the
    # value of the key we were trying to group by, in this case a specific
    →state name, and the second one is
    # projected dataframe that was found for that group

    # Now we include our logic in the "apply" step, which is to calculate an
    →average of the census2010pop
    avg = np.average(frame['CENSUS2010POP'])
    # And print the results
    print('Counties in state ' + group +
          ' have an average population of ' + str(avg))
# And we don't have to worry about the combine step in this case, because all
→of our data transformation is
# actually printing out results.

```

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 22.2 ms ± 419 µs per loop (mean ± std. dev. of 7 runs, 3 loops each)

[7]: *# Demoró 22 ms, menos que mi código*

Wow, what a huge difference in speed. An improve by roughly by two factors!

[158]: *# Now, 99% of the time, you'll use group by on one or more columns. But you can*
→also provide a function to

group by and use that to segment your data.

This is a bit of a fabricated example but lets say that you have a big batch
→job with lots of processing and

you want to work on only a third or so of the states at a given time. We
→could create some function which

returns a number between zero and two based on the first character of the
→state name. Then we can tell group

by to use this function to split up our data frame. It's important to note
→that in order to do this you need

to set the index of the data frame to be the column that you want to group by
→first.

We'll create some new function called set_batch_number and if the first
→letter of the parameter is a capital

M we'll return a 0. If it's a capital Q we'll return a 1 and otherwise we'll
→return a 2. Then we'll pass

this function to the data frame

le elimino cualquier indice que tenga

`df= df.reset_index()`

le asigno el indice por el que quiero agrupar.

Para usar funciones con groupby() si o si hay que tener un índice, este lo
→usaremos para agrupar con la función

La función que le pasemos a groupby() se aplicará sobre el index!!!!!!

`df = df.set_index('STNAME')`


```
df.index
```

```
[158]: Index(['Alabama', 'Alabama', 'Alabama', 'Alabama', 'Alabama', 'Alabama',  
          'Alabama', 'Alabama', 'Alabama', 'Alabama',  
          ...  
          'Wyoming', 'Wyoming', 'Wyoming', 'Wyoming', 'Wyoming', 'Wyoming',  
          'Wyoming', 'Wyoming', 'Wyoming', 'Wyoming'],  
         dtype='object', name='STNAME', length=3142)
```

```
[53]: # Definimos la función para agrupar  
# Acá se usa el orden de los caracteres para ordenar:  
# El orden de caracteres en Python es A-Z y luego a-z  
# Las letras mayúsculas usando chr() tiene valores entre 65-91 y las minúsculas  
→(97,123)  
  
# Está función junto con groupby() ira fila por fila en el df y agrupará por  
→grupos de letras:  
# 0 = A-L  
# 1 = M-P  
# 2 = Q-Z  
  
# Acá item = al index de cada fila  
def set_batch_number(item):  
    # esta función mirá la primer letra dentro de index = item[0]  
    if item[0]<'M':  
        return 0  
    if item[0]<'Q':  
        return 1  
    return 2  
  
# The dataframe is supposed to be grouped by according to the batch number And  
→we will loop through each batch  
# group  
for group, frame in df.groupby(set_batch_number):  
    print('There are ' + str(len(frame)) + ' records in group ' + str(group) +  
→' for processing.')  
    # agrego una linea para ver qué letras están en cada grupo  
    print('El grupo', str(group), 'incluye a los estados que comienzan con las  
→letras', set([estado[0] for estado in frame.index.unique()]),'\\n')
```

There are 1177 records in group 0 for processing.

El grupo 0 incluye a los estados que comienzan con las letras {'D', 'I', 'F', 'L', 'K', 'C', 'A', 'G', 'H'}

There are 1134 records in group 1 for processing.

El grupo 1 incluye a los estados que comienzan con las letras {'O', 'N', 'M', 'P'}

There are 831 records in group 2 for processing.

El grupo 2 incluye a los estados que comienzan con las letras {'U', 'T', 'S', 'R', 'V', 'W'}

```
[52]: # Se puede ver que groupby() en conjunto con la función set_batch_number()
      ↳ realizaron los 3 grupos
      # Estos grupos se ordenaron por las letras de los estados.

[9]: # Notice that this time I didn't pass in a column name to groupby(). Instead, I
     ↳ set the index of the dataframe
     # to be STNAME, and if no column identifier is passed groupby() will
     ↳ automatically use the index.

[3]: # Otro ejemplo para agrupar usando dos índices

     # Let's take one more look at an example of how we might group data. In this
     ↳ example, I want to use a dataset
     # of housing from airbnb. In this dataset there are two columns of interest,
     ↳ one is the cancellation_policy
     # and the other is the review_scores_value.
import pandas as pd
df=pd.read_csv("datasets/listings.csv")
df.head()
```

```
[3]:      id      listing_url      scrape_id \
0  12147973  https://www.airbnb.com/rooms/12147973  20160906204935
1   3075044  https://www.airbnb.com/rooms/3075044  20160906204935
2     6976    https://www.airbnb.com/rooms/6976  20160906204935
3  1436513  https://www.airbnb.com/rooms/1436513  20160906204935
4   7651065  https://www.airbnb.com/rooms/7651065  20160906204935

      last_scraped      name \
0  2016-09-07      Sunny Bungalow in the City
1  2016-09-07      Charming room in pet friendly apt
2  2016-09-07      Mexican Folk Art Haven in Boston
3  2016-09-07  Spacious Sunny Bedroom Suite in Historic Home
4  2016-09-07      Come Home to Boston

      summary \
0  Cozy, sunny, family home. Master bedroom high...
1  Charming and quiet room in a second floor 1910...
2  Come stay with a friendly, middle-aged guy in ...
3  Come experience the comforts of home away from...
4  My comfy, clean and relaxing home is one block...
```

	space \
0	The house has an open and cozy feel at the sam...
1	Small but cozy and quite room with a full size...
2	Come stay with a friendly, middle-aged guy in ...
3	Most places you find in Boston are small howev...
4	Clean, attractive, private room, one block fro...

	description	experiences_offered \
0	Cozy, sunny, family home. Master bedroom high...	none
1	Charming and quiet room in a second floor 1910...	none
2	Come stay with a friendly, middle-aged guy in ...	none
3	Come experience the comforts of home away from...	none
4	My comfy, clean and relaxing home is one block...	none

	neighborhood_overview	... review_scores_value \
0	Roslindale is quiet, convenient and friendly. ...	NaN
1	The room is in Roslindale, a diverse and prima...	9.0
2	The LOCATION: Roslindale is a safe and diverse...	10.0
3	Roslindale is a lovely little neighborhood loc...	10.0
4	I love the proximity to downtown, the neighbor...	10.0

	requires_license	license	jurisdiction_names	instant_bookable \
0	f	NaN	NaN	f
1	f	NaN	NaN	t
2	f	NaN	NaN	f
3	f	NaN	NaN	f
4	f	NaN	NaN	f

	cancellation_policy	require_guest_profile_picture \
0	moderate	f
1	moderate	f
2	moderate	t
3	moderate	f
4	flexible	f

	require_guest_phone_verification	calculated_host_listings_count \
0	f	1
1	f	1
2	f	1
3	f	1
4	f	1

	reviews_per_month
0	NaN
1	1.30
2	0.47
3	1.00

[5 rows x 95 columns]

```
[8]: # Seteamos dos índices

# So, how would I group by both of these columns? A first approach might be to
→promote them to a multiindex
# and just call groupby()
df=df.set_index(["cancellation_policy","review_scores_value"])
```

```
[142]: df.head()
```

```
[142]:
```

		id \	
cancellation_policy	review_scores_value		
moderate	NaN	12147973	
	9.0	3075044	
	10.0	6976	
	10.0	1436513	
flexible	10.0	7651065	

		listing_url
cancellation_policy	review_scores_value	
moderate	NaN	https://www.airbnb.com/rooms/12147973
	9.0	https://www.airbnb.com/rooms/3075044
	10.0	https://www.airbnb.com/rooms/6976
	10.0	https://www.airbnb.com/rooms/1436513
flexible	10.0	https://www.airbnb.com/rooms/7651065

		scrape_id	last_scraped \
cancellation_policy	review_scores_value		
moderate	NaN	20160906204935	2016-09-07
	9.0	20160906204935	2016-09-07
	10.0	20160906204935	2016-09-07
	10.0	20160906204935	2016-09-07
flexible	10.0	20160906204935	2016-09-07

		name \
cancellation_policy	review_scores_value	
moderate	NaN	Sunny Bungalow in
		the City
friendly apt	9.0	Charming room in pet
	10.0	Mexican Folk Art Haven in
Boston		
	10.0	Spacious Sunny Bedroom Suite in
Historic Home		

flexible	10.0	Come Home to
Boston		

summary \		
cancellation_policy	review_scores_value	
moderate	NaN	Cozy, sunny, family home. Master
bedroom high...		
	9.0	Charming and quiet room in a second
floor 1910...		
	10.0	Come stay with a friendly, middle-aged
guy in ...		
	10.0	Come experience the comforts of home
away from...		
flexible	10.0	My comfy, clean and relaxing home is
one block...		

space \		
cancellation_policy	review_scores_value	
moderate	NaN	The house has an open and cozy feel at
the sam...		
	9.0	Small but cozy and quite room with a
full size...		
	10.0	Come stay with a friendly, middle-aged
guy in ...		
	10.0	Most places you find in Boston are
small howev...		
flexible	10.0	Clean, attractive, private room, one
block fro...		

description \		
cancellation_policy	review_scores_value	
moderate	NaN	Cozy, sunny, family home. Master
bedroom high...		
	9.0	Charming and quiet room in a second
floor 1910...		
	10.0	Come stay with a friendly, middle-aged
guy in ...		
	10.0	Come experience the comforts of home
away from...		
flexible	10.0	My comfy, clean and relaxing home is
one block...		

experiences_offered \		
cancellation_policy	review_scores_value	
moderate	NaN	none
	9.0	none
	10.0	none

	10.0		none
flexible	10.0		none

neighborhood_overview \			
cancellation_policy	review_scores_value		
moderate	NaN		Roslindale is quiet, convenient and
friendly. ...			
	9.0		The room is in Roslindale, a diverse
and prima...			
	10.0		The LOCATION: Roslindale is a safe and
diverse...			
	10.0		Roslindale is a lovely little
neighborhood loc...			
flexible	10.0		I love the proximity to downtown, the
neighbor...			

		... review_scores_communication \	
cancellation_policy	review_scores_value	...	
moderate	NaN	...	NaN
	9.0	...	10.0
	10.0	...	10.0
	10.0	...	10.0
flexible	10.0	...	10.0

		review_scores_location \	
cancellation_policy	review_scores_value		
moderate	NaN		NaN
	9.0		9.0
	10.0		9.0
	10.0		10.0
flexible	10.0		9.0

		requires_license	license \	
cancellation_policy	review_scores_value			
moderate	NaN	f		NaN
	9.0	f		NaN
	10.0	f		NaN
	10.0	f		NaN
flexible	10.0	f		NaN

		jurisdiction_names	instant_bookable \	
cancellation_policy	review_scores_value			
moderate	NaN	NaN		f
	9.0	NaN		t
	10.0	NaN		f
	10.0	NaN		f
flexible	10.0	NaN		f

		require_guest_profile_picture \
cancellation_policy	review_scores_value	
moderate	NaN	f
	9.0	f
	10.0	t
	10.0	f
flexible	10.0	f

		require_guest_phone_verification \
cancellation_policy	review_scores_value	
moderate	NaN	f
	9.0	f
	10.0	f
	10.0	f
flexible	10.0	f

		calculated_host_listings_count \
cancellation_policy	review_scores_value	
moderate	NaN	1
	9.0	1
	10.0	1
	10.0	1
flexible	10.0	1

		reviews_per_month
cancellation_policy	review_scores_value	
moderate	NaN	NaN
	9.0	1.30
	10.0	0.47
	10.0	1.00
flexible	10.0	2.25

[5 rows x 93 columns]

[144]: *# Ahora agrupamos usando los dos índices anteriores*

```
# When we have a multiindex we need to pass in the levels we are interested in
→ grouping by
for group, frame in df.groupby(level=(0,1)):
    print(group)
```

```
('flexible', 2.0)
('flexible', 4.0)
('flexible', 5.0)
('flexible', 6.0)
('flexible', 7.0)
```

```

('flexible', 8.0)
('flexible', 9.0)
('flexible', 10.0)
('moderate', 2.0)
('moderate', 4.0)
('moderate', 6.0)
('moderate', 7.0)
('moderate', 8.0)
('moderate', 9.0)
('moderate', 10.0)
('strict', 2.0)
('strict', 3.0)
('strict', 4.0)
('strict', 5.0)
('strict', 6.0)
('strict', 7.0)
('strict', 8.0)
('strict', 9.0)
('strict', 10.0)
('super_strict_30', 6.0)
('super_strict_30', 7.0)
('super_strict_30', 8.0)
('super_strict_30', 9.0)
('super_strict_30', 10.0)

```

[137]: *# Como level también se puede poner el nombre de los índices seleccionados*
→previamente

```

for group, frame in df.
    ↳groupby(level=("cancellation_policy", "review_scores_value")):
        print('Grupo:', group)
        print('Nro. de opiniones:', len(frame), '\n')

```

Grupo: ('flexible', 2.0)

Nro. de opiniones: 1

Grupo: ('flexible', 4.0)

Nro. de opiniones: 5

Grupo: ('flexible', 5.0)

Nro. de opiniones: 1

Grupo: ('flexible', 6.0)

Nro. de opiniones: 18

Grupo: ('flexible', 7.0)

Nro. de opiniones: 12

Grupo: ('flexible', 8.0)
Nro. de opiniones: 67

Grupo: ('flexible', 9.0)
Nro. de opiniones: 200

Grupo: ('flexible', 10.0)
Nro. de opiniones: 332

Grupo: ('moderate', 2.0)
Nro. de opiniones: 1

Grupo: ('moderate', 4.0)
Nro. de opiniones: 1

Grupo: ('moderate', 6.0)
Nro. de opiniones: 10

Grupo: ('moderate', 7.0)
Nro. de opiniones: 7

Grupo: ('moderate', 8.0)
Nro. de opiniones: 82

Grupo: ('moderate', 9.0)
Nro. de opiniones: 304

Grupo: ('moderate', 10.0)
Nro. de opiniones: 379

Grupo: ('strict', 2.0)
Nro. de opiniones: 5

Grupo: ('strict', 3.0)
Nro. de opiniones: 2

Grupo: ('strict', 4.0)
Nro. de opiniones: 6

Grupo: ('strict', 5.0)
Nro. de opiniones: 1

Grupo: ('strict', 6.0)
Nro. de opiniones: 19

Grupo: ('strict', 7.0)
Nro. de opiniones: 30

Grupo: ('strict', 8.0)
Nro. de opiniones: 157

Grupo: ('strict', 9.0)
Nro. de opiniones: 598

Grupo: ('strict', 10.0)
Nro. de opiniones: 459

Grupo: ('super_strict_30', 6.0)
Nro. de opiniones: 2

Grupo: ('super_strict_30', 7.0)
Nro. de opiniones: 2

Grupo: ('super_strict_30', 8.0)
Nro. de opiniones: 28

Grupo: ('super_strict_30', 9.0)
Nro. de opiniones: 28

Grupo: ('super_strict_30', 10.0)
Nro. de opiniones: 7

[]: *# Ahora vamos a agrupar con dos columnas pero con criterio sobre la 2da columna*
Esto es más avanzado

Agrupar usando dos columnas pero aplicar algún criterio de selección en
→ alguna de las columnas

Ahora vamos a usar una función para elegir 2 columnas, pero en la segunda
→ queremos elegir por calificación

En la columna de review_scores_value" queremos agrupar por valor=10 por un
→ lado y todas las demás por otro

This seems to work ok. But what if we wanted to group by the cancelation
→ policy and review scores, but

separate out all the 10's from those under ten? In this case, we could use a
→ function to manage the

grouping

[9]: *# Si miramos el index, vemos que están expresados como tuplas*
Recordemos que groupby() funciona sobre los índices, en este caso tuplas
Por ende cuando creamos la función debemos hacerlo considerando que el index
→ son tuplas

index en cada fila = (cancellation_policy, review_scores_value)

```
# Miremos los valores en los índices de las primeras 5 filas. Están expresados
→ como tuplas
df.index[0:5]
```

```
[9]: MultiIndex([('moderate', nan),
                ('moderate', 9.0),
                ('moderate', 10.0),
                ('moderate', 10.0),
                ('flexible', 10.0)],
              names=['cancellation_policy', 'review_scores_value'])
```

```
[10]: # Creamos función para agrupar considerando los índices como tuplas

# en esta función el item sería el index, y el index está expresado en tuplas,
→ por ende index[0] es el primer índice
# e item[1] es el segundo índice
def grouping_fun(item):
    # Check the "review_scores_value" portion of the index. item is in the
    → format of
    # (cancellation_policy, review_scores_value)

    # Queremos seleccionar las calificaciones = 10
    # Hay que definir todos los grupos, incluso los que no interesan
    if item[1] == 10.0:
        return (item[0], "10.0") # acá la función no modifica los índices
    else:
        return (item[0], "not 10")

for group, frame in df.groupby(by=grouping_fun):
    print('Nombre del grupo:', group)
    print('Cantidad filas:', len(frame), '\n')
```

```
Nombre del grupo: ('flexible', '10.0')
Cantidad filas: 332
```

```
Nombre del grupo: ('flexible', 'not 10')
Cantidad filas: 667
```

```
Nombre del grupo: ('moderate', '10.0')
Cantidad filas: 379
```

```
Nombre del grupo: ('moderate', 'not 10')
Cantidad filas: 540
```

```
Nombre del grupo: ('strict', '10.0')
Cantidad filas: 459
```

```
Nombre del grupo: ('strict', 'not 10')
Cantidad filas: 1123
```

```
Nombre del grupo: ('super_strict_30', '10.0')
Cantidad filas: 7
```

```
Nombre del grupo: ('super_strict_30', 'not 10')
Cantidad filas: 78
```

2 Applying - 2da parte del proceso GROUP-APPLY-COMBINE

```
[14]: # To this point we have applied very simple processing to our data after
      ↪splitting, really just outputting
      # some print statements to demonstrate how the splitting works. The pandas
      ↪developers have three broad
      # categories of data processing to happen during the apply step, Aggregation of
      ↪group data, Transformation of
      # group data, and Filtration of group data
```

2.1 Aggregation

```
[26]: # The most straight forward apply step is the aggregation of data, and uses the
      ↪method agg() on the groupby
      # object. Thus far we have only iterated through the groupby object, unpacking
      ↪it into a label (the group
      # name) and a dataframe. But with agg we can pass in a dictionary of the
      ↪columns we are interested in
      # aggregating along with the function we are looking to apply to aggregate.

      # Let's reset the index for our airbnb data
      df=df.reset_index()

      # Now lets group by the cancellation policy and find the average
      ↪review_scores_value by group
      df.groupby("cancellation_policy").agg({"review_scores_value":np.average})

      # DA ERROR porque hay valores NaN
```

```

      ↪
      -----
      ValueError                                Traceback (most recent call
      ↪last)
```

```

<ipython-input-26-afc50f1047d2> in <module>
    5
    6 # Let's reset the index for our airbnb data
----> 7 df=df.reset_index()
    8
    9 # Now lets group by the cancellation policy and find the average
↳review_scores_value by group

/opt/conda/lib/python3.7/site-packages/pandas/core/frame.py in
↳reset_index(self, level, drop, inplace, col_level, col_fill)
    4687             # to ndarray and maybe infer different dtype
    4688             level_values = _maybe_casted_values(lev, lab)
-> 4689             new_obj.insert(0, name, level_values)
    4690
    4691             new_obj.index = new_index

/opt/conda/lib/python3.7/site-packages/pandas/core/frame.py in
↳insert(self, loc, column, value, allow_duplicates)
    3569         self._ensure_valid_index(value)
    3570         value = self._sanitize_column(column, value, broadcast=False)
-> 3571         self._data.insert(loc, column, value,
↳allow_duplicates=allow_duplicates)
    3572
    3573     def assign(self, **kwargs):

/opt/conda/lib/python3.7/site-packages/pandas/core/internals/managers.py
↳in insert(self, loc, item, value, allow_duplicates)
    1170         if not allow_duplicates and item in self.items:
    1171             # Should this be a different kind of error??
-> 1172             raise ValueError("cannot insert {}, already exists".
↳format(item))
    1173
    1174         if not isinstance(loc, int):

ValueError: cannot insert level_0, already exists

```

[27]: *# Hrm. That didn't seem to work at all. Just a bunch of not a numbers. The*
↳issue is actually in the function
that we sent to aggregate. np.average does not ignore nans! However, there is
↳a function we can use for this

```
df.groupby("cancellation_policy").agg({"review_scores_value":np.nanmean})
```

```
[27]:
      review_scores_value
cancellation_policy
flexible                9.237421
moderate                9.307398
strict                 9.081441
super_strict_30        8.537313
```

```
[17]: # We can just extend this dictionary to aggregate by multiple functions or
      ↪multiple columns.
df.groupby("cancellation_policy").agg({"review_scores_value":(np.nanmean,np.
      ↪nanstd),
                                     "reviews_per_month":np.nanmean})
```

```
[17]:
      review_scores_value      reviews_per_month
      nanmean      nanstd      nanmean
cancellation_policy
flexible          9.237421  1.096271      1.829210
moderate          9.307398  0.859859      2.391922
strict            9.081441  1.040531      1.873467
super_strict_30   8.537313  0.840785      0.340143
```

```
[18]: # Take a moment to make sure you understand the previous cell, since it's
      ↪somewhat complex. First we're doing
# a group by on the dataframe object by the column "cancellation_policy". This
      ↪creates a new GroupBy object.
# Then we are invoking the agg() function on that object. The agg function is
      ↪going to apply one or more
# functions we specify to the group dataframes and return a single row per
      ↪dataframe/group. When we called
# this function we sent it two dictionary entries, each with the key indicating
      ↪which column we wanted
# functions applied to. For the first column we actually supplied a tuple of
      ↪two functions. Note that these
# are not function invocations, like np.nanmean(), or function names, like
      ↪"nanmean" they are references to
# functions which will return single values. The groupby object will recognize
      ↪the tuple and call each
# function in order on the same column. The results will be in a heirarchical
      ↪index, but since they are
# columns they don't show as an index per se. Then we indicated another column
      ↪and a single function we wanted
# to run.
```

2.2 Transformation

```
[19]: # Transformation is different from aggregation. Where agg() returns a single
      ↪ value per column, so one row per
      # group, transform() returns an object that is the same size as the group.
      ↪ Essentially, it broadcasts the
      # function you supply over the grouped dataframe, returning a new dataframe.
      ↪ This makes combining data later
      # easy.

[28]: # For instance, suppose we want to include the average rating values in a given
      ↪ group by cancellation policy,
      # but preserve the dataframe shape so that we could generate a difference
      ↪ between an individual observation
      # and the sum.

      # Seleccionamos las columnas de interés
      # Una columna será la que usaremos para generar los grupos y en las otra/s se
      ↪ aplicará la transformación
      cols=['cancellation_policy', 'review_scores_value']

      # Now lets transform it, I'll store this in its own dataframe
      transform_df=df[cols].groupby('cancellation_policy').transform(np.nanmean)
      transform_df.head()

      # Se puede ver que se calculó la media para cada grupo, y ese valor se puso en
      ↪ la celda de cada fila, por ende los valores
      # se repiten en las celdas que pertenecen al mismo grupo

[28]:      review_scores_value
0              9.307398
1              9.307398
2              9.307398
3              9.307398
4              9.237421

[19]: # Si miramos la df antes de transformarla pero si agrupada, podemos ver los
      ↪ grupos
      df[cols].groupby('cancellation_policy').head()

      # se puede ver que los primeros 4 valores de arriba = 9.307398
      # son los mismos porque pertenec al grupo "moderate" (ver abajo)
      # O sea, que transform generó una media global para cada grupo, y luego ese
      ↪ valor global lo agregó a cada fila que
      # pertenece al grupo "moderate"

[19]:      cancellation_policy  review_scores_value
0              moderate              NaN
```

1	moderate	9.0
2	moderate	10.0
3	moderate	10.0
4	flexible	10.0
5	flexible	10.0
6	strict	9.0
7	moderate	10.0
9	strict	9.0
10	flexible	10.0
11	flexible	9.0
12	flexible	10.0
15	strict	10.0
18	strict	NaN
19	strict	10.0
399	super_strict_30	NaN
400	super_strict_30	NaN
420	super_strict_30	8.0
422	super_strict_30	8.0
512	super_strict_30	NaN

```
[29]: # So we can see that the index here is actually the same as the original
      → dataframe. So lets just join this
      # in.

      #Le cambiamos el nombre a la columna transformada de la transform_df
      transform_df.rename({'review_scores_value': 'mean_review_scores'},
      → axis='columns', inplace=True)

      # ahora que la columna transformada tiene su propio nombre, podemos hacer merge
      → de la df original(95cols)
      # y la transform_df (1 col)

      df=df.merge(transform_df, left_index=True, right_index=True)
      df.head()

      # el resultado es un dataframe de 96 columnas que incluye la nueva columna
      → transformada
```

```
[29]:      id      listing_url      scrape_id \
0  12147973  https://www.airbnb.com/rooms/12147973  20160906204935
1   3075044  https://www.airbnb.com/rooms/3075044  20160906204935
2    6976    https://www.airbnb.com/rooms/6976  20160906204935
3  1436513  https://www.airbnb.com/rooms/1436513  20160906204935
4   7651065  https://www.airbnb.com/rooms/7651065  20160906204935

      last_scraped      name \
```


0	2016-09-07	Sunny Bungalow in the City
1	2016-09-07	Charming room in pet friendly apt
2	2016-09-07	Mexican Folk Art Haven in Boston
3	2016-09-07	Spacious Sunny Bedroom Suite in Historic Home
4	2016-09-07	Come Home to Boston

	summary	\
0	Cozy, sunny, family home. Master bedroom high...	
1	Charming and quiet room in a second floor 1910...	
2	Come stay with a friendly, middle-aged guy in ...	
3	Come experience the comforts of home away from...	
4	My comfy, clean and relaxing home is one block...	

	space	\
0	The house has an open and cozy feel at the sam...	
1	Small but cozy and quite room with a full size...	
2	Come stay with a friendly, middle-aged guy in ...	
3	Most places you find in Boston are small howev...	
4	Clean, attractive, private room, one block fro...	

	description	experiences_offered	\
0	Cozy, sunny, family home. Master bedroom high...	none	
1	Charming and quiet room in a second floor 1910...	none	
2	Come stay with a friendly, middle-aged guy in ...	none	
3	Come experience the comforts of home away from...	none	
4	My comfy, clean and relaxing home is one block...	none	

	neighborhood_overview	... requires_license	\
0	Roslindale is quiet, convenient and friendly. ...	f	
1	The room is in Roslindale, a diverse and prima...	f	
2	The LOCATION: Roslindale is a safe and diverse...	f	
3	Roslindale is a lovely little neighborhood loc...	f	
4	I love the proximity to downtown, the neighbor...	f	

	license	jurisdiction_names	instant_bookable	cancellation_policy	\
0	NaN	NaN	f	moderate	
1	NaN	NaN	t	moderate	
2	NaN	NaN	f	moderate	
3	NaN	NaN	f	moderate	
4	NaN	NaN	f	flexible	

	require_guest_profile_picture	require_guest_phone_verification	\
0	f	f	
1	f	f	
2	t	f	
3	f	f	
4	f	f	

	calculated_host_listings_count	reviews_per_month	mean_review_scores
0	1	NaN	9.307398
1	1	1.30	9.307398
2	1	0.47	9.307398
3	1	1.00	9.307398
4	1	2.25	9.237421

[5 rows x 96 columns]

```
[24]: # Great, we can see that our new column is in place, the mean_review_scores. So
      ↪now we could create, for
      # instance, the difference between a given row and it's group (the cancellation
      ↪policy) means.

      # Ahora podemos calcular la diferencia entre el valor de una celda y su media
      ↪(np.absolute devuelve el valor absoluto)
      # Para eso creamos una nueva columna en el df y le asignamos la diferencia
df['mean_diff']=np.absolute(df['review_scores_value']-df['mean_review_scores'])
df['mean_diff'].head()
```

```
[24]: 0      NaN
      1      0.307398
      2      0.692602
      3      0.692602
      4      0.762579
      Name: mean_diff, dtype: float64
```

```
[25]: # Vemos que le agregamos una columna más, por ende un total de 97
      print(len(df.columns))
```

97

2.3 Filtering

```
[23]: # The GroupBy object has build in support for filtering groups as well. It's
      ↪often that you'll want to group
      # by some feature, then make some transformation to the groups, then drop
      ↪certain groups as part of your
      # cleaning routines. The filter() function takes in a function which it applies
      ↪to each group dataframe and
      # returns either a True or a False, depending upon whether that group should be
      ↪included in the results.

[30]: # For instance, if we only want those groups which have a mean rating above 9
      ↪included in our results
a= df.groupby('cancellation_policy').filter(lambda x: np.
      ↪nanmean(x['review_scores_value'])>9.2)
```

[34]: *# Se puede ver que la filtración eliminó los grupos que tenían una media <= 9.2.
→ Eliminó los grupos y sus filas.*

```
print('df original tenía los siguientes grupos:', df['cancellation_policy'].  
      →unique())  
print('matriz filtrada tirnr los siguientes grupos:',a['cancellation_policy'].  
      →unique())
```

df original tenía los siguientes grupos: ['moderate' 'flexible' 'strict'
'super_strict_30']

matriz filtrada tirnr los siguientes grupos: ['moderate' 'flexible']

[36]: *# Quedaron los grupos con media >9.2 y sus filas. Es posible que algunos de sus
→elementos tengan review_scores_value
menores a 9.2 e incluso NaN pero el promedio general es mayor a 9.2*

```
a[['review_scores_value', 'cancellation_policy', 'mean_review_scores']].head(10)
```

[36]:

	review_scores_value	cancellation_policy	mean_review_scores
0	NaN	moderate	9.307398
1	9.0	moderate	9.307398
2	10.0	moderate	9.307398
3	10.0	moderate	9.307398
4	10.0	flexible	9.237421
5	10.0	flexible	9.237421
7	10.0	moderate	9.307398
8	10.0	moderate	9.307398
10	10.0	flexible	9.237421
11	9.0	flexible	9.237421

[25]: *# Notice that the results are still indexed, but that any of the results which
→were in a group with a mean
review score of less than or equal to 9.2 were not copied over.*

2.4 Applying

[26]: *# By far the most common operation I invoke on groupby objects is the apply()
→function. This allows you to
apply an arbitrary function to each group, and stitch the results back for
→each apply() into a single
dataframe where the index is preserved.*

```
# Lets look at an example using our airbnb data, I'm going to get a clean copy  
→of the dataframe
```

```
df=pd.read_csv("datasets/listings.csv")
```

```
# And lets just include some of the columns we were interested in previously
```

```
df=df[['cancellation_policy','review_scores_value']]
df.head()
```

```
[26]:  cancellation_policy  review_scores_value
0          moderate          NaN
1          moderate          9.0
2          moderate         10.0
3          moderate         10.0
4          flexible         10.0
```

```
[27]: # In previous work we wanted to find the average review score of a listing and
      ↳ its deviation from the group
      # mean. This was a two step process, first we used transform() on the groupby
      ↳ object and then we had to
      # broadcast to create a new column. With apply() we could wrap this logic in
      ↳ one place
def calc_mean_review_scores(group):
    # group is a dataframe just of whatever we have grouped by, e.g.
    ↳ cancellation policy, so we can treat
    # this as the complete dataframe
    avg=np.nanmean(group["review_scores_value"])
    # now broadcast our formula and create a new column
    group["review_scores_mean"]=np.abs(avg-group["review_scores_value"])
    return group

# Now just apply this to the groups
df.groupby('cancellation_policy').apply(calc_mean_review_scores).head()
```

```
[27]:  cancellation_policy  review_scores_value  review_scores_mean
0          moderate          NaN          NaN
1          moderate          9.0          0.307398
2          moderate         10.0          0.692602
3          moderate         10.0          0.692602
4          flexible         10.0          0.762579
```

```
[28]: # Using apply can be slower than using some of the specialized functions,
      ↳ especially agg(). But, if your
      # dataframes are not huge, it's a solid general purpose approach
```

Groupby is a powerful and commonly used tool for data cleaning and data analysis. Once you have grouped the data by some category you have a dataframe of just those values and you can conduct aggregated analysis on the segments that you are interested. The groupby() function follows a split-apply-combine approach - first the data is split into subgroups, then you can apply some transformation, filtering, or aggregation, then the results are combined automatically by pandas for us.