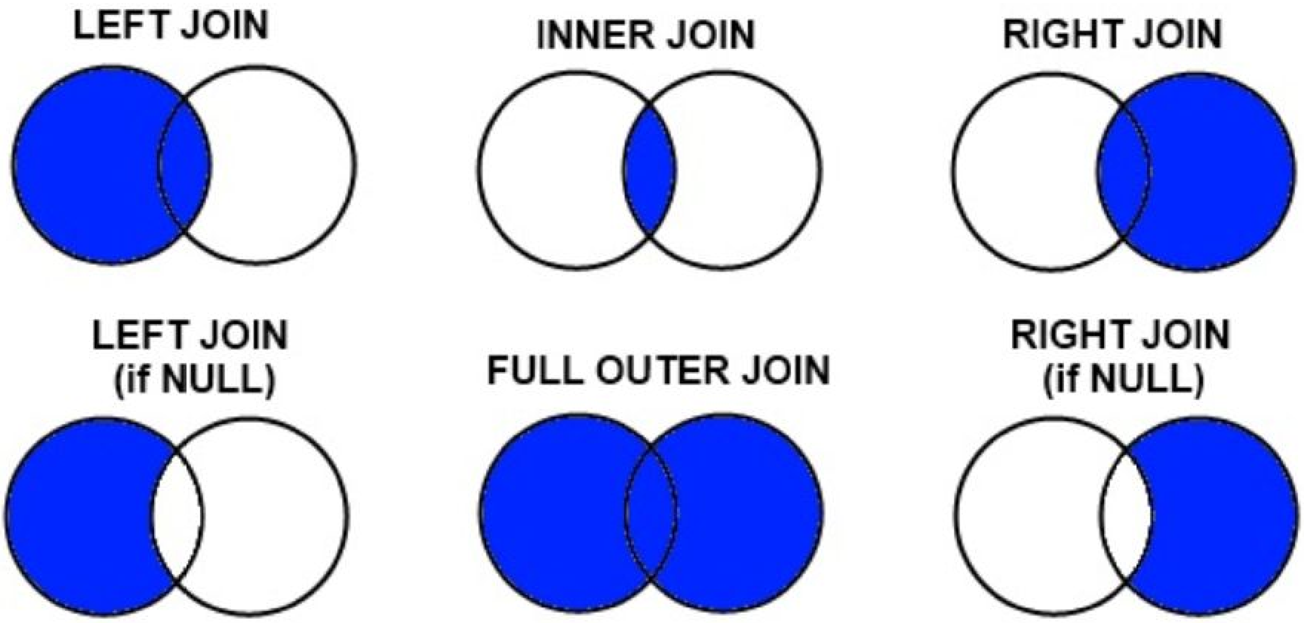
T5 - Data analysis techniques and methodologies



- Merging on Dataframes Columns

We can merge Dataframes N:1 and N:N
pandas.merge(<Dataframe_1>, ..., <Dataframe_n>) -> Looks for strictly coincidences index and labels
pandas.merge(<Dataframes>, on= <ColumnLabels>) -> Label exact coincidence values, not indexes.
pandas.merge(<dfs>, on = <CoLabels>, how= {‘inner’, ‘right’, ‘left’, ‘outer’ }) -> Order to merge:

> inner: for labels, after indexes df1, …, after indexes dfn. Default value for merge
> right: for Colabels, after labels dfn, …, after labels df1. NaN not permitted on right dfs labels
> left: for CoLabels, after labels df1, …, after labels dfn. NaN not permitted on left dfs labels
> outer: same as inned, but permits NaN for any non combination.

pandas.merge(…., suffixes=<suffix list for labels not in CoLabels>)

- Merging on DataFrames Indexes

Merge index to index -> **left_index = True, right_index = True**
Merge label with index -> left_on = < list of labels>, right_index = True
|-> right_on=< list of labels>, left_index = True

● Joining Dataframes with same indexes

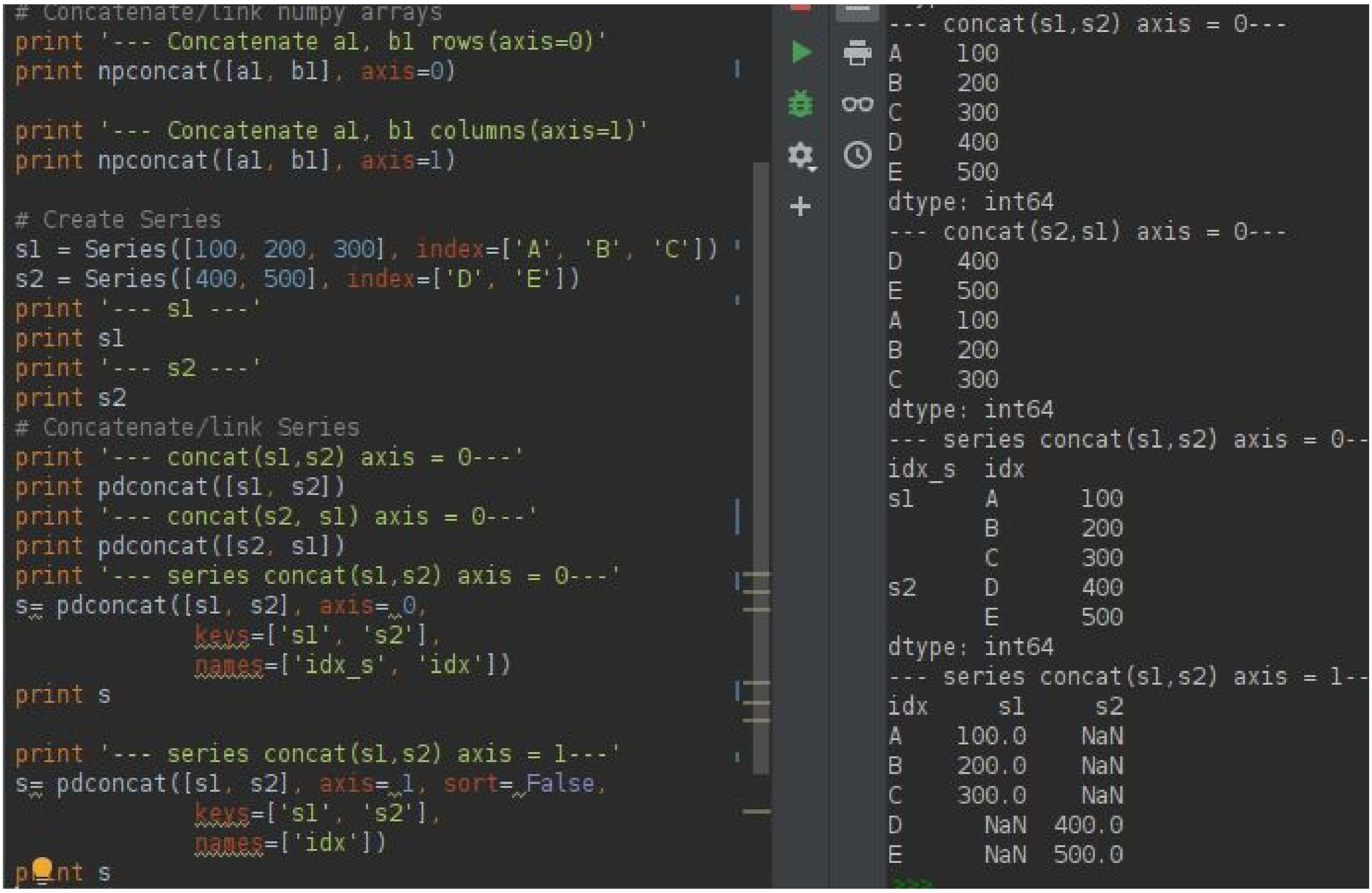
Joining dataframe to other dataframe: adding combinations and columns for items:

Example1: **df1.join(df2)**

df1	**data**	**df2**	**profit**	**df1.j(df2)**	**data**	**profit**
O	0	**O**	10	**L**	2	NaN
U	1	**O**	20	**O**	0	10.0
L	2	**U**	20	**O**	0	20.0
O	3			**O**	3	10.0
U	4			**O**	3	20.0
				U	1	20.0
				U	4	20.0

● Concatenation of Series

Concatenate/link them along specific access: **axis = 0** -> rows, **axis = 1** -> columns (generates Dataframe)
For new behaviour (not sort by default) on **axis = 1** -> **sort = False**
Label indexes by **names=**
Set subindexes by **keys=**

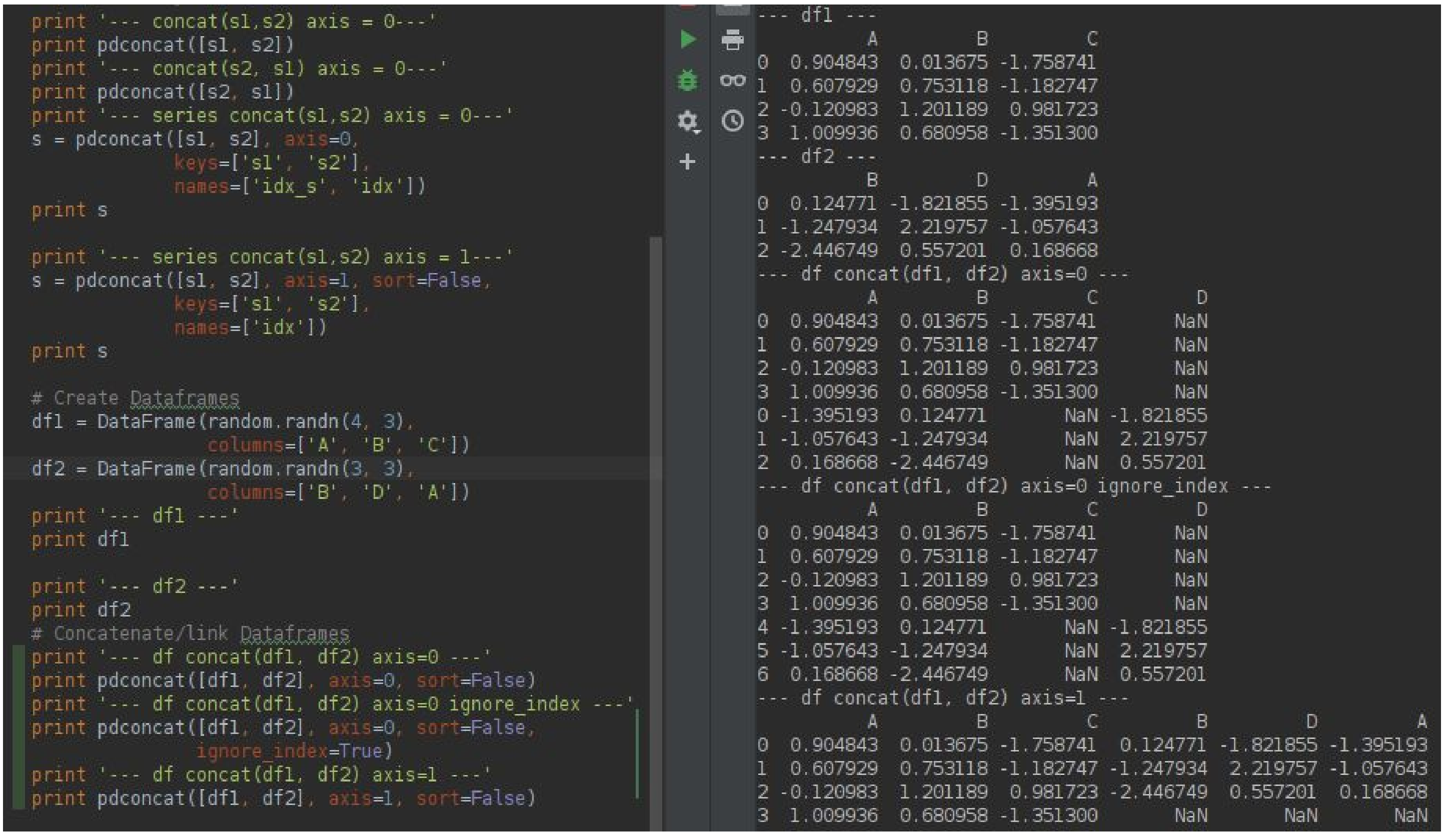


```
# Concatenate/link numpy arrays
print '--- Concatenate a1, b1 rows(axis=0)'
print npconcat([a1, b1], axis=0)

print '--- Concatenate a1, b1 columns(axis=1)'
print npconcat([a1, b1], axis=1)

# Create Series
s1 = Series([100, 200, 300], index=['A', 'B', 'C'])
s2 = Series([400, 500], index=['D', 'E'])
print '--- s1 ---'
print s1
print '--- s2 ---'
print s2
# Concatenate/link Series
print '--- concat(s1,s2) axis = 0---'
print pdconcat([s1, s2])
print '--- concat(s2, s1) axis = 0---'
print pdconcat([s2, s1])
print '--- series concat(s1,s2) axis = 0---'
s= pdconcat([s1, s2], axis= 0,
             keys=['s1', 's2'],
             names=['idx_s', 'idx'])
print s

print '--- series concat(s1,s2) axis = 1---'
s= pdconcat([s1, s2], axis= 1, sort= False,
             keys=['s1', 's2'],
             names=['idx'])
print s
```

```
--- concat(s1,s2) axis = 0---
A    100
B    200
C    300
D    400
E    500
dtype: int64
--- concat(s2,s1) axis = 0---
D    400
E    500
A    100
B    200
C    300
dtype: int64
--- series concat(s1,s2) axis = 0--
idx_s  idx
s1     A      100
       B      200
       C      300
s2     D      400
       E      500
dtype: int64
--- series concat(s1,s2) axis = 1--
idx     s1     s2
A    100.0    NaN
B    200.0    NaN
C    300.0    NaN
D      NaN  400.0
E      NaN  500.0
```

- Concatenation of dataframes

pandas.concat([df1, df2, axis = 0/1, sort=False, ignore_index=True)
Same as pandas.Series, but for recreate continuous index use **ignore_index=True**.
Cell values not assigned were filled with NaN.

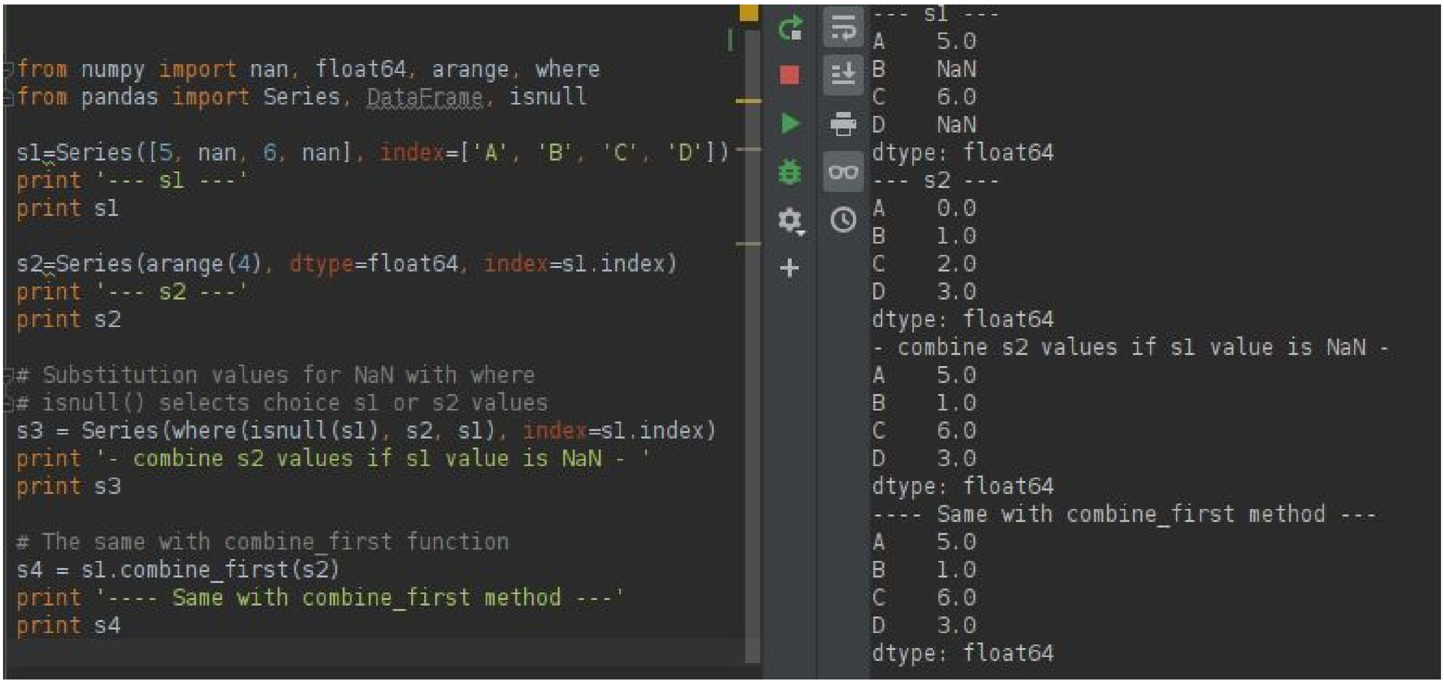


```
print '--- concat(s1,s2) axis = 0---'
print pdconcat([s1, s2])
print '--- concat(s2, s1) axis = 0---'
print pdconcat([s2, s1])
print '--- series concat(s1,s2) axis = 0---'
s = pdconcat([s1, s2], axis=0,
             keys=['s1', 's2'],
             names=['idx_s', 'idx'])
print s

print '--- series concat(s1,s2) axis = 1---'
s = pdconcat([s1, s2], axis=1, sort=False,
             keys=['s1', 's2'],
             names=['idx'])
print s

# Create Dataframes
df1 = DataFrame(random.randn(4, 3),
                columns=['A', 'B', 'C'])
df2 = DataFrame(random.randn(3, 3),
                columns=['B', 'D', 'A'])
print '--- df1 ---'
print df1

print '--- df2 ---'
print df2
# Concatenate/link Dataframes
print '--- df concat(df1, df2) axis=0 ---'
print pdconcat([df1, df2], axis=0, sort=False)
print '--- df concat(df1, df2) axis=0 ignore_index ---'
print pdconcat([df1, df2], axis=0, sort=False,
               ignore_index=True)
print '--- df concat(df1, df2) axis=1 ---'
print pdconcat([df1, df2], axis=1, sort=False)
```

```
--- df1 ---
          A         B         C
0  0.904843  0.013675 -1.758741
1  0.607929  0.753118 -1.182747
2 -0.120983  1.201189  0.981723
3  1.009936  0.680958 -1.351300
--- df2 ---
          B         D         A
0  0.124771 -1.821855 -1.395193
1 -1.247934  2.219757 -1.057643
2 -2.446749  0.557201  0.168668
--- df concat(df1, df2) axis=0 ---
          A         B         C         D
0  0.904843  0.013675 -1.758741       NaN
1  0.607929  0.753118 -1.182747       NaN
2 -0.120983  1.201189  0.981723       NaN
3  1.009936  0.680958 -1.351300       NaN
0 -1.395193  0.124771       NaN -1.821855
1 -1.057643 -1.247934       NaN  2.219757
2  0.168668 -2.446749       NaN  0.557201
--- df concat(df1, df2) axis=0 ignore_index ---
          A         B         C         D
0  0.904843  0.013675 -1.758741       NaN
1  0.607929  0.753118 -1.182747       NaN
2 -0.120983  1.201189  0.981723       NaN
3  1.009936  0.680958 -1.351300       NaN
4 -1.395193  0.124771       NaN -1.821855
5 -1.057643 -1.247934       NaN  2.219757
6  0.168668 -2.446749       NaN  0.557201
--- df concat(df1, df2) axis=1 ---
          A         B         C         B         D         A
0  0.904843  0.013675 -1.758741  0.124771 -1.821855 -1.395193
1  0.607929  0.753118 -1.182747 -1.247934  2.219757 -1.057643
2 -0.120983  1.201189  0.981723 -2.446749  0.557201  0.168668
3  1.009936  0.680958 -1.351300       NaN       NaN       NaN
```

- Combining Series and Dataframes

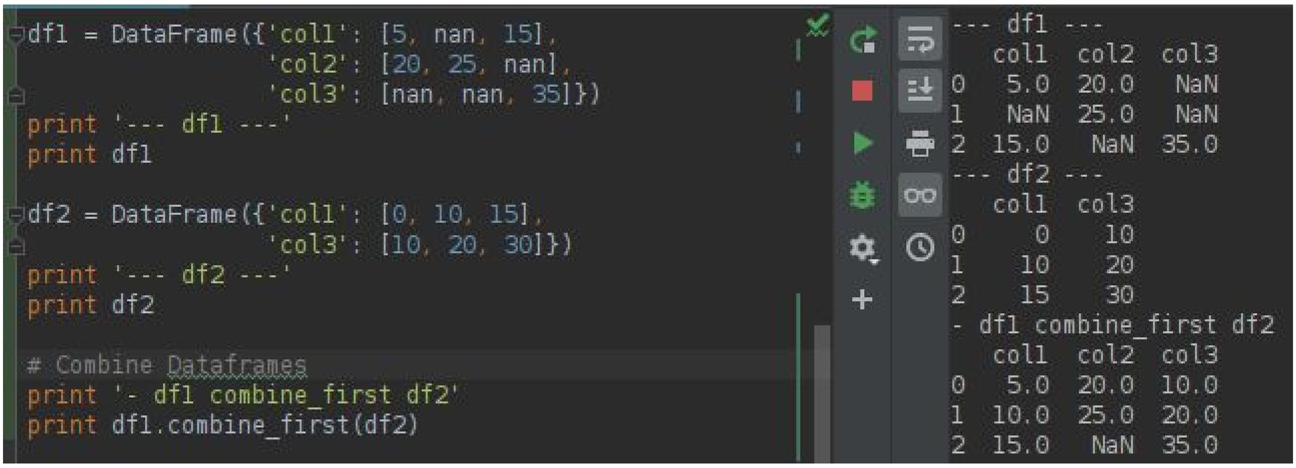
Example combining series if values are NaN:



```
from numpy import nan, float64, arange, where
from pandas import Series, DataFrame, isnull

s1=Series([5, nan, 6, nan], index=['A', 'B', 'C', 'D'])
print '--- s1 ---'
print s1

s2=Series(arange(4), dtype=float64, index=s1.index)
print '--- s2 ---'
print s2

# Substitution values for NaN with where
# isnull() selects choice s1 or s2 values
s3 = Series(where(isnull(s1), s2, s1), index=s1.index)
print '- combine s2 values if s1 value is NaN - '
print s3

# The same with combine_first function
s4 = s1.combine_first(s2)
print '---- Same with combine_first method ---'
print s4
```

```
--- s1 ---
A    5.0
B    NaN
C    6.0
D    NaN
dtype: float64
--- s2 ---
A    0.0
B    1.0
C    2.0
D    3.0
dtype: float64
- combine s2 values if s1 value is NaN -
A    5.0
B    1.0
C    6.0
D    3.0
dtype: float64
---- Same with combine_first method ---
A    5.0
B    1.0
C    6.0
D    3.0
dtype: float64
```

Example combining Dataframes, same method **combine_first**:

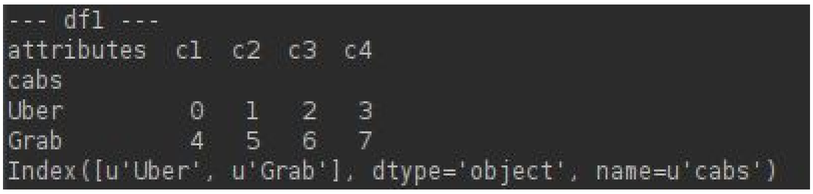


```
df1 = DataFrame({'col1': [5, nan, 15],
                 'col2': [20, 25, nan],
                 'col3': [nan, nan, 35]})
print '--- df1 ---'
print df1

df2 = DataFrame({'col1': [0, 10, 15],
                 'col3': [10, 20, 30]})
print '--- df2 ---'
print df2

# Combine Dataframes
print '- df1 combine_first df2'
print df1.combine_first(df2)
```

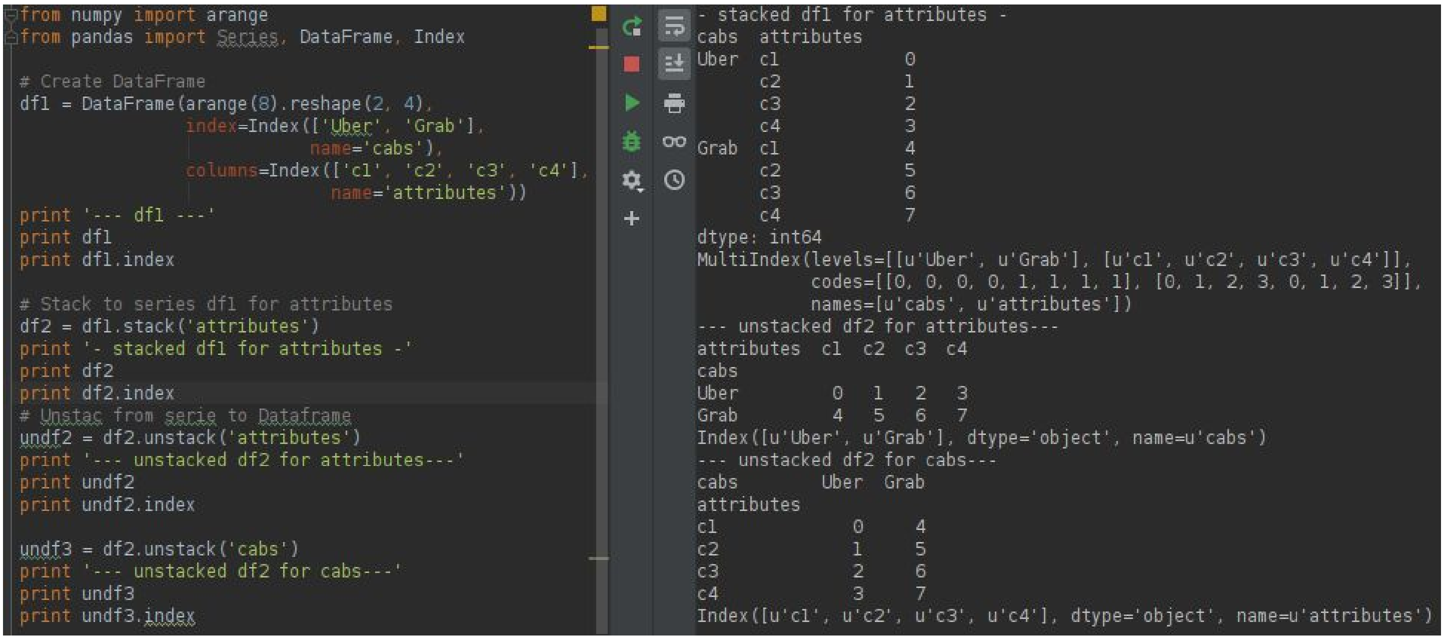
```
--- df1 ---
   col1  col2  col3
0   5.0  20.0   NaN
1   NaN  25.0   NaN
2  15.0   NaN  35.0
--- df2 ---
   col1  col3
0     0    10
1    10    20
2    15    30
- df1 combine_first df2
   col1  col2  col3
0   5.0  20.0  10.0
1  10.0  25.0  20.0
2  15.0   NaN  35.0
```

- Stacking/unstacking to/from series

Example:
- how to stack Dataframe to Serie.
- unstack from several Serie indexes.



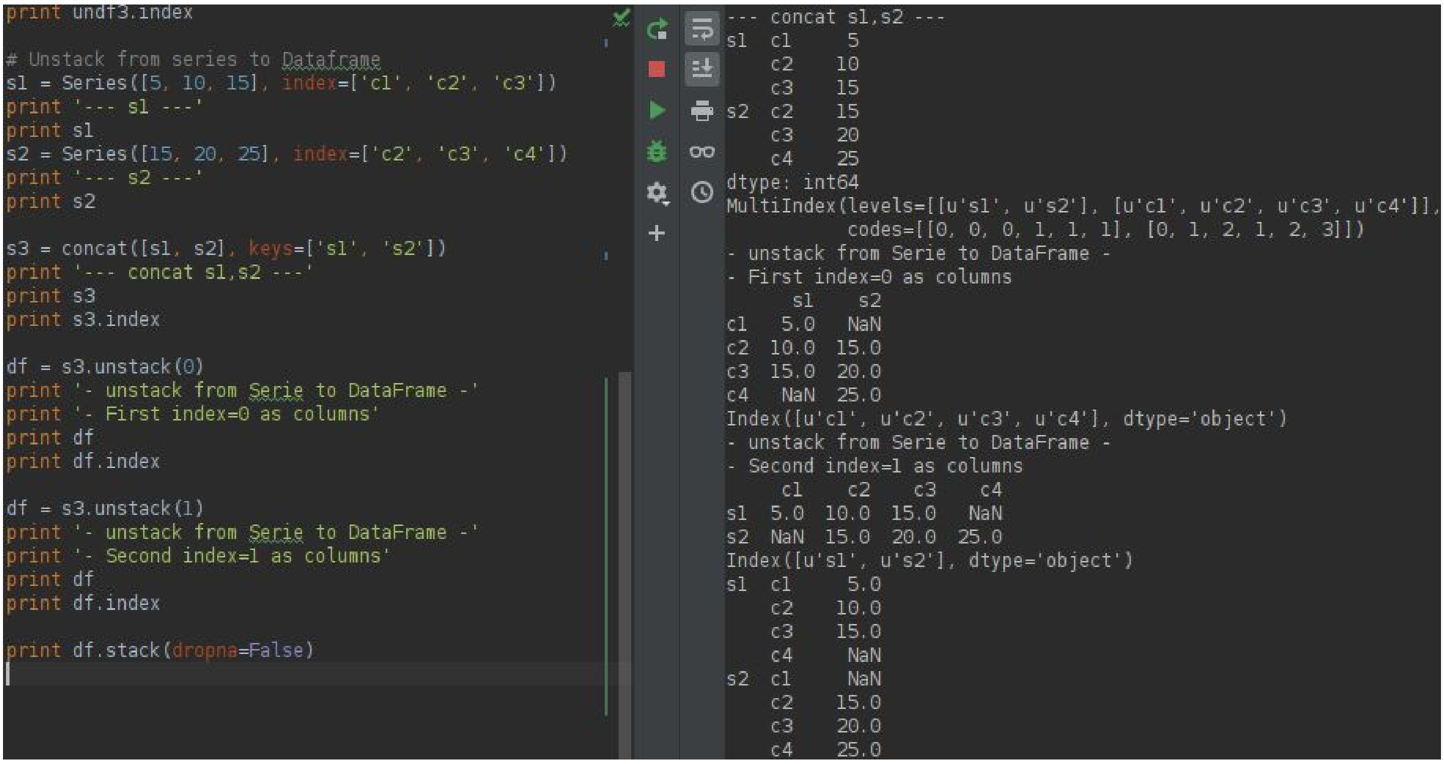
```
--- df1 ---
attributes  c1  c2  c3  c4
cabs
Uber         0   1   2   3
Grab         4   5   6   7
Index([u'Uber', u'Grab'], dtype='object', name=u'cabs')
```



```
from numpy import arange
from pandas import Series, DataFrame, Index

# Create DataFrame
df1 = DataFrame(arange(8).reshape(2, 4),
                index=Index(['Uber', 'Grab'],
                            name='cabs'),
                columns=Index(['c1', 'c2', 'c3', 'c4'],
                              name='attributes'))
print '--- df1 ---'
print df1
print df1.index

# Stack to series df1 for attributes
df2 = df1.stack('attributes')
print '- stacked df1 for attributes -'
print df2
print df2.index
# Unstac from serie to Dataframe
undf2 = df2.unstack('attributes')
print '--- unstacked df2 for attributes---'
print undf2
print undf2.index

undf3 = df2.unstack('cabs')
print '--- unstacked df2 for cabs---'
print undf3
print undf3.index
```

```
- stacked df1 for attributes -
cabs  attributes
Uber  c1            0
      c2            1
      c3            2
      c4            3
Grab  c1            4
      c2            5
      c3            6
      c4            7
dtype: int64
MultiIndex(levels=[[u'Uber', u'Grab'], [u'c1', u'c2', u'c3', u'c4']],
           codes=[[0, 0, 0, 0, 1, 1, 1, 1], [0, 1, 2, 3, 0, 1, 2, 3]],
           names=[u'cabs', u'attributes'])
--- unstacked df2 for attributes---
attributes  c1  c2  c3  c4
cabs
Uber         0   1   2   3
Grab         4   5   6   7
Index([u'Uber', u'Grab'], dtype='object', name=u'cabs')
--- unstacked df2 for cabs---
cabs        Uber  Grab
attributes
c1             0     4
c2             1     5
c3             2     6
c4             3     7
Index([u'c1', u'c2', u'c3', u'c4'], dtype='object', name=u'attributes')
```

Other example from series to DataFrame with dropna utility to fill NaN values instead drop.



```
print undf3.index

# Unstack from series to Dataframe
s1 = Series([5, 10, 15], index=['c1', 'c2', 'c3'])
print '--- s1 ---'
print s1
s2 = Series([15, 20, 25], index=['c2', 'c3', 'c4'])
print '--- s2 ---'
print s2

s3 = concat([s1, s2], keys=['s1', 's2'])
print '--- concat s1,s2 ---'
print s3
print s3.index

df = s3.unstack(0)
print '- unstack from Serie to DataFrame -'
print '- First index=0 as columns'
print df
print df.index

df = s3.unstack(1)
print '- unstack from Serie to DataFrame -'
print '- Second index=1 as columns'
print df
print df.index

print df.stack(dropna=False)
```

```
--- concat s1,s2 ---
s1  c1     5
    c2    10
    c3    15
s2  c2    15
    c3    20
    c4    25
dtype: int64
MultiIndex(levels=[[u's1', u's2'], [u'c1', u'c2', u'c3', u'c4']],
           codes=[[0, 0, 0, 1, 1, 1], [0, 1, 2, 1, 2, 3]])
- unstack from Serie to DataFrame -
- First index=0 as columns
      s1    s2
c1   5.0   NaN
c2  10.0  15.0
c3  15.0  20.0
c4   NaN  25.0
Index([u'c1', u'c2', u'c3', u'c4'], dtype='object')
- unstack from Serie to DataFrame -
- Second index=1 as columns
     c1    c2    c3    c4
s1  5.0  10.0  15.0   NaN
s2  NaN  15.0  20.0  25.0
Index([u's1', u's2'], dtype='object')
s1  c1     5.0
    c2    10.0
    c3    15.0
    c4     NaN
s2  c1     NaN
    c2    15.0
    c3    20.0
    c4    25.0
```