

| Module | Description | Example | Script |
|--------|---|--|-------------|
| core | dictionary, adding a new entry | <code>co['po'] = 'CO'</code> | g05/demo.py |
| core | dictionary, creating | <code>co = {'name':'Colorado', 'capital':'Denver'}</code> | g05/demo.py |
| core | dictionary, creating via comprehension | <code>fips_cols = {col:str for col in fips_vars}</code> | g13/demo.py |
| core | dictionary, looking up a value | <code>name = ny['name']</code> | g05/demo.py |
| core | dictionary, making a list of | <code>list1 = [co,ny]</code> | g05/demo.py |
| core | dictionary, obtaining a list of keys | <code>names = super_dict.keys()</code> | g05/demo.py |
| core | f-string, grouping with commas | <code>print(f'Total population: {tot_pop:,}')</code> | g11/demo.py |
| core | f-string, using a formatting string | <code>print(f"PV of {payment} with T={year} and r={r} is \${p. . .</code> | g07/demo.py |
| core | file, closing | <code>fh.close()</code> | g02/demo.py |
| core | file, opening for reading | <code>fh = open('states.csv')</code> | g05/demo.py |
| core | file, opening for writing | <code>fh = open(filename,"w")</code> | g02/demo.py |
| core | file, output using print | <code>print("It was written during",year,file=fh)</code> | g02/demo.py |
| core | file, output using write | <code>fh.write("Where was this file was written?\n")</code> | g02/demo.py |
| core | file, print without adding spaces | <code>print('\nOuter:\n', join_o['_merge'].value_counts(), s. . .</code> | g14/demo.py |
| core | file, reading one line at a time | <code>for line in fh:</code> | g05/demo.py |
| core | for, looping through a list | <code>for n in a_list:</code> | g04/demo.py |
| core | for, looping through a list of tuples | <code>for number,name in div_info:</code> | g13/demo.py |
| core | function, calling | <code>d1_ssq = sumsq(d1)</code> | g06/demo.py |
| core | function, calling with an optional argument | <code>sample_function(100, 10, r=0.07)</code> | g07/demo.py |
| core | function, defining | <code>def sumsq(values):</code> | g06/demo.py |
| core | function, defining with optional argument | <code>def sample_function(payment,year,r=0.05):</code> | g07/demo.py |
| core | function, returning a result | <code>return values</code> | g06/demo.py |
| core | list, appending an element | <code>a_list.append("four")</code> | g03/demo.py |
| core | list, create via comprehension | <code>cubes = [n**3 for n in a_list]</code> | g04/demo.py |
| core | list, creating | <code>a_list = ["zero", "one", "two", "three"]</code> | g03/demo.py |
| core | list, determining length | <code>n = len(b_list)</code> | g03/demo.py |
| core | list, extending with another list | <code>a_list.extend(a_more)</code> | g03/demo.py |
| core | list, generating a sequence | <code>b_list = range(1,6)</code> | g04/demo.py |
| core | list, joining with spaces | <code>a_string = " ".join(a_list)</code> | g03/demo.py |
| core | list, selecting an element | <code>print(a_list[0])</code> | g03/demo.py |
| core | list, selecting elements 0 to 3 | <code>print(a_list[:4])</code> | g03/demo.py |
| core | list, selecting elements 1 to 2 | <code>print(a_list[1:3])</code> | g03/demo.py |

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| core | list, selecting elements 1 to the end | <code>print(a_list[1:])</code> | g03/demo.py |
| core | list, selecting last 3 elements | <code>print(a_list[-3:])</code> | g03/demo.py |
| core | list, selecting the last element | <code>print(a_list[-1])</code> | g03/demo.py |
| core | list, sorting | <code>c_sort = sorted(b_list)</code> | g03/demo.py |
| core | list, summing | <code>tot_inc = sum(incomes)</code> | g08/demo.py |
| core | math, raising a number to a power | <code>a_cubes.append(n**3)</code> | g04/demo.py |
| core | math, rounding a number | <code>rounded = round(ratio,2)</code> | g05/demo.py |
| core | sets, computing difference | <code>print(name_states - pop_states)</code> | g13/demo.py |
| core | sets, creating | <code>name_states = set(name_data['State'])</code> | g13/demo.py |
| core | sets, of tuples | <code>tset1 = set([(1,2), (2,3), (1,3), (2,3)])</code> | g13/demo.py |
| core | string, concatenating | <code>name = s1+" "+s2+" "+s3</code> | g02/demo.py |
| core | string, converting to an int | <code>values.append(int(line))</code> | g06/demo.py |
| core | string, creating | <code>filename = "demo.txt"</code> | g02/demo.py |
| core | string, including a newline character | <code>fh.write(name+"!\n")</code> | g02/demo.py |
| core | string, splitting on a comma | <code>parts = line.split(',')</code> | g05/demo.py |
| core | string, splitting on whitespace | <code>b_list = b_string.split()</code> | g03/demo.py |
| core | string, stripping blank space | <code>clean = [item.strip() for item in parts]</code> | g05/demo.py |
| core | type, obtaining for a variable | <code>print('\nraw_states is a DataFrame object:', type(raw_ . .</code> | g09/demo.py |
| csv | setting up a DictReader object | <code>reader = csv.DictReader(fh)</code> | g08/demo.py |
| json | importing the module | <code>import json</code> | g05/demo.py |
| json | using to print an object nicely | <code>print(json.dumps(list1,indent=4))</code> | g05/demo.py |
| matplotlib | axes, adding a horizontal line | <code>ax21.axhline(medians['etr'], c='r', ls='-', lw=1)</code> | g12/demo.py |
| matplotlib | axes, adding a vertical line | <code>ax21.axvline(medians['inc'], c='r', ls='-', lw=1)</code> | g12/demo.py |
| matplotlib | axes, labeling the X axis | <code>ax2.set_xlabel('Millions')</code> | g11/demo.py |
| matplotlib | axes, labeling the Y axis | <code>ax1.set_ylabel("Millions")</code> | g11/demo.py |
| matplotlib | axes, turning off the label | <code>ax.set_ylabel(None)</code> | g13/demo.py |
| matplotlib | figure, adding a title | <code>fig2.suptitle('Pooled Data')</code> | g12/demo.py |
| matplotlib | figure, four panel grid | <code>fig3, axs = plt.subplots(2,2,sharex=True,sharey=True)</code> | g12/demo.py |
| matplotlib | figure, left and right panels | <code>fig2, (ax21,ax22) = plt.subplots(1,2)</code> | g12/demo.py |
| matplotlib | figure, saving | <code>fig2.savefig('figure.png')</code> | g11/demo.py |

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| matplotlib | figure, tuning the layout | <code>fig2.tight_layout()</code> | <code>g11/demo.py</code> |
| matplotlib | importing pyplot | <code>import matplotlib.pyplot as plt</code> | <code>g11/demo.py</code> |
| matplotlib | setting the default resolution | <code>plt.rcParams['figure.dpi'] = 300</code> | <code>g11/demo.py</code> |
| matplotlib | using subplots to set up a figure | <code>fig1, ax1 = plt.subplots()</code> | <code>g11/demo.py</code> |
| pandas | columns, dividing with explicit alignment | <code>normed2 = 100*states.div(pa_row,axis='columns')</code> | <code>g09/demo.py</code> |
| pandas | columns, listing names | <code>print('\nColumns:', list(raw_states.columns))</code> | <code>g09/demo.py</code> |
| pandas | columns, renaming | <code>county = county.rename(columns={'B01001_001E':'pop'})</code> | <code>g10/demo.py</code> |
| pandas | columns, retrieving one by name | <code>pop = states['pop']</code> | <code>g09/demo.py</code> |
| pandas | columns, retrieving several by name | <code>print(pop[some_states]/1e6)</code> | <code>g09/demo.py</code> |
| pandas | dataframe, boolean row selection | <code>print(trim[has_AM], "\n")</code> | <code>g12/demo.py</code> |
| pandas | dataframe, dropping duplicates | <code>flood = flood.drop_duplicates(subset='TAX_ID')</code> | <code>g14/demo.py</code> |
| pandas | dataframe, dropping missing data | <code>trim = demo.dropna(subset="Days")</code> | <code>g12/demo.py</code> |
| pandas | dataframe, finding duplicate records | <code>dups = parcels.duplicated(subset='TAX_ID', keep=False . . .</code> | <code>g14/demo.py</code> |
| pandas | dataframe, getting a block of rows via index | <code>sel = merged.loc[number]</code> | <code>g13/demo.py</code> |
| pandas | dataframe, inner 1:1 merge | <code>join_i = parcels.merge(flood,</code> | <code>g14/demo.py</code> |
| pandas | dataframe, inner join | <code>merged = name_data.merge(pop_data,left_on="State",right. . .</code> | <code>g13/demo.py</code> |
| pandas | dataframe, left 1:1 merge | <code>join_l = parcels.merge(flood,</code> | <code>g14/demo.py</code> |
| pandas | dataframe, making a copy | <code>trim = trim.copy()</code> | <code>g12/demo.py</code> |
| pandas | dataframe, outer 1:1 merge | <code>join_o = parcels.merge(flood,</code> | <code>g14/demo.py</code> |
| pandas | dataframe, right 1:1 merge | <code>join_r = parcels.merge(flood,</code> | <code>g14/demo.py</code> |
| pandas | dataframe, selecting rows by list indexing | <code>print(low_to_high[-5:])</code> | <code>g09/demo.py</code> |
| pandas | dataframe, selecting rows via boolean | <code>dup_rec = flood[dups]</code> | <code>g14/demo.py</code> |
| pandas | dataframe, selecting rows via query | <code>trimmed = county.query("state == '04' or state == '36' ")</code> | <code>g10/demo.py</code> |
| pandas | dataframe, sorting by a column | <code>county = county.sort_values('pop')</code> | <code>g10/demo.py</code> |
| pandas | dataframe, summing a boolean | <code>print('\nduplicate parcels:', dups.sum())</code> | <code>g14/demo.py</code> |
| pandas | dataframe, using xs to select a subset | <code>print(county.xs('04',level='state'))</code> | <code>g10/demo.py</code> |
| pandas | dataframe, writing to a CSV file | <code>merged.to_csv('demo-merged.csv')</code> | <code>g13/demo.py</code> |
| pandas | datetime, building via to_datetime() | <code>date = pd.to_datetime(recs['ts'])</code> | <code>g14/demo.py</code> |
| pandas | datetime, extracting day attribute | <code>recs['day'] = date.dt.day</code> | <code>g14/demo.py</code> |
| pandas | datetime, extracting hour attribute | <code>recs['hour'] = date.dt.hour</code> | <code>g14/demo.py</code> |
| pandas | general, displaying all rows | <code>pd.set_option('display.max_rows', None)</code> | <code>g09/demo.py</code> |
| pandas | general, importing the module | <code>import pandas as pd</code> | <code>g09/demo.py</code> |
| pandas | general, using qcut to create deciles | <code>dec = pd.qcut(county['pop'], 10, labels=range(1,11))</code> | <code>g10/demo.py</code> |

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|--------|--|---|--------------------------|
| pandas | groupby, cumulative sum within group | <code>cumulative_inc = group_by_state['pop'].cumsum()</code> | <code>g10/demo.py</code> |
| pandas | groupby, descriptive statistics | <code>inc_stats = group_by_state['pop'].describe()</code> | <code>g10/demo.py</code> |
| pandas | groupby, iterating over groups | <code>for t,g in group_by_state:</code> | <code>g10/demo.py</code> |
| pandas | groupby, median of each group | <code>pop_med = group_by_state['pop'].median()</code> | <code>g10/demo.py</code> |
| pandas | groupby, quantile of each group | <code>pop_25th = group_by_state['pop'].quantile(0.25)</code> | <code>g10/demo.py</code> |
| pandas | groupby, return group number | <code>groups = group_by_state.ngroup()</code> | <code>g10/demo.py</code> |
| pandas | groupby, return number within group | <code>seqnum = group_by_state.cumcount()</code> | <code>g10/demo.py</code> |
| pandas | groupby, return rank within group | <code>rank_age = group_by_state['pop'].rank()</code> | <code>g10/demo.py</code> |
| pandas | groupby, select first records | <code>first2 = group_by_state.head(2)</code> | <code>g10/demo.py</code> |
| pandas | groupby, select largest values | <code>largest = group_by_state['pop'].nlargest(2)</code> | <code>g10/demo.py</code> |
| pandas | groupby, select last records | <code>last2 = group_by_state.tail(2)</code> | <code>g10/demo.py</code> |
| pandas | groupby, size of each group | <code>num_rows = group_by_state.size()</code> | <code>g10/demo.py</code> |
| pandas | groupby, sum of each group | <code>state = county.groupby('state')['pop'].sum()</code> | <code>g10/demo.py</code> |
| pandas | index, creating with 3 levels | <code>county = county.set_index(['state','county', 'NAME'])</code> | <code>g10/demo.py</code> |
| pandas | index, listing names | <code>print('\nIndex (rows):', list(raw_states.index))</code> | <code>g09/demo.py</code> |
| pandas | index, renaming values | <code>div_pop = div_pop.rename(index=div_names)</code> | <code>g11/demo.py</code> |
| pandas | index, retrieving a row by name | <code>pa_row = states.loc['Pennsylvania']</code> | <code>g09/demo.py</code> |
| pandas | index, retrieving first rows by location | <code>print(low_to_high.iloc[0:10])</code> | <code>g09/demo.py</code> |
| pandas | index, retrieving last rows by location | <code>print(low_to_high.iloc[-5:])</code> | <code>g09/demo.py</code> |
| pandas | index, setting to a column | <code>states = raw_states.set_index('name')</code> | <code>g09/demo.py</code> |
| pandas | plotting, bar plot | <code>reg_pop.plot.bar(title='Population',ax=ax1)</code> | <code>g11/demo.py</code> |
| pandas | plotting, histogram | <code>hh_data['etr'].plot.hist(ax=ax1,bins=20,title='Distribu. . .</code> | <code>g12/demo.py</code> |
| pandas | plotting, horizontal bar plot | <code>div_pop.plot.barh(title='Population',ax=ax2)</code> | <code>g11/demo.py</code> |
| pandas | plotting, scatter colored by 3rd var | <code>tidy_data.plot.scatter(ax=ax4,x='Income',y='ETR',c='typ. . .</code> | <code>g12/demo.py</code> |
| pandas | plotting, scatter plot | <code>hh_data.plot.scatter(ax=ax21,x='inc',y='etr',title='ETR. . .</code> | <code>g12/demo.py</code> |
| pandas | plotting, turning off legend | <code>sel.plot.barh(x='Name',y='percent',ax=ax,legend=None)</code> | <code>g13/demo.py</code> |
| pandas | reading, csv data | <code>raw_states = pd.read_csv('state-data.csv')</code> | <code>g09/demo.py</code> |
| pandas | reading, setting index column | <code>state_data = pd.read_csv('state-data.csv',index_col='na. . .</code> | <code>g11/demo.py</code> |
| pandas | reading, using dtype dictionary | <code>county = pd.read_csv('county_pop.csv',dtype=fips)</code> | <code>g10/demo.py</code> |
| pandas | series, RE at start | <code>is_LD = trim['Number'].str.contains(r"1 2")</code> | <code>g12/demo.py</code> |
| pandas | series, automatic alignment by index | <code>merged['percent'] = 100*merged['pop']/div_pop</code> | <code>g13/demo.py</code> |
| pandas | series, contains RE or RE | <code>is_TT = trim['Days'].str.contains(r"Tu Th")</code> | <code>g12/demo.py</code> |

| Module | Description | Example | Script |
|--------|---------------------------------|--|-------------|
| pandas | series, contains a plain string | has_AM = trim['Time'].str.contains("AM") | g12/demo.py |
| pandas | series, contains an RE | has_AMPM = trim['Time'].str.contains("AM.*PM") | g12/demo.py |
| pandas | series, converting to a list | print(name_data['State'].to_list()) | g13/demo.py |
| pandas | series, retrieving an element | print("\nFlorida's population:", pop['Florida']/1e6) | g09/demo.py |
| pandas | series, sort in decending order | div_pop = div_pop.sort_values(ascending=False) | g11/demo.py |
| pandas | series, sorting by value | low_to_high = normed['med_pers_inc'].sort_values() | g09/demo.py |
| pandas | series, splitting via RE | trim['Split'] = trim["Time"].str.split(r": - ") | g12/demo.py |
| pandas | series, splitting with expand | exp = trim["Time"].str.split(r": - ", expand=True) | g12/demo.py |
| pandas | series, summing | reg_pop = by_reg['pop'].sum()/1e6 | g11/demo.py |
| pandas | series, using isin() | fixed = flood['TAX_ID'].isin(dup_rec['TAX_ID']) | g14/demo.py |
| pandas | series, using value_counts() | print('\nOuter:\n', join_o['_merge'].value_counts(), s. . . | g14/demo.py |
| scipy | calling newton's method | cr = opt.newton(find_cube_root,xinit,maxiter=20,args=[y. . . | g07/demo.py |
| scipy | importing the module | import scipy.optimize as opt | g07/demo.py |