Lab Assignment 8: Data Management Using `pandas`, Part 1

DS 6001: Practice and Application of Data Science

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Instructions

Please answer the following questions as completely as possible using text, code, and the results of code as needed. Format your answers in a Jupyter notebook. To receive full credit, make sure you address every part of the problem, and make sure your document is formatted in a clean and professional way.

In this lab, you will be working with the 2017 Workplace Health in America survey which was conducted by the Centers for Disease Control and Prevention. According to the survey's guidence document:

> The Workplace Health in America (WHA) Survey gathered information from a cross-sectional, nationally representative sample of US worksites. The sample was drawn from the Dun & Bradstreet (D&B) database of all private and public employers in the United States with at least 10 employees. Like previous national surveys, the worksite served as the sampling unit rather than the companies or firms to which the worksites belonged. Worksites were selected using a stratified simple random sample (SRS) design, where the primary strata were ten multi-state regions defined by the Centers for Disease Control and Prevention (CDC), plus an additional stratum containing all hospital worksites.

The data contain over 300 features that report the industry and type of company where the respondents are employed, what kind of health insurance and other health programs are offered, and other characteristics of the workplaces including whether employees are allowed to work from home and the gender and age makeup of the workforce. The data are full of interesting information, but in order to make use of the data a great deal of data manipulation is required first.

Problem 0

Import the following libraries:

In [ ]:

```
import numpy as np
import pandas as pd
import sidetable
import sqlite3
import warnings
warnings.filterwarnings('ignore')
```

Problem 1

The raw data are stored in an ASCII file on the 2017 Workplace Health in America survey homepage. Load the raw data directly into Python without downloading the data onto your harddrive and display a dataframe with only the 14th, 28th, and 102nd rows of the data. [1 point]

https://www.cdc.gov/workplacehealthpromotion/survey/data.html

In [ ]:

```
pd.set_option('display.max_columns', None) # displaying all the columns
```

In [ ]:

```
# https://www.cdc.gov/workplacehealthpromotion/data-surveillance/docs/whpps_120717.
# This file is an ASCII “~” delimited file with all of the corresponding survey dat

csv_url = 'https://www.cdc.gov/workplacehealthpromotion/data-surveillance/docs/whpp
df_p1 = pd.read_csv(csv_url, sep='~')

# doing the 13th, 27th, and 101st idx's to display the 14th, 28th, and 102nd rows s
idxs_to_display = [13,27,101]

df_p1.iloc[idxs_to_display]
```

Out[ ]:

	OC1	OC3	HI1	HI2	HI3	HI4	HRA1	HRA1A	HRA1B	HRA1E	CP1	CP2	CP3	CP4	CP5
13	3	1.0	2.0	3.0	2.0	1.0	1.0	3.0	3.0	1.0	2.0	1.0	2.0	2.0	1.0
27	1	3.0	1.0	3.0	1.0	1.0	1.0	2.0	4.0	2.0	1.0	1.0	1.0	1.0	2.0
101	2	1.0	1.0	3.0	2.0	1.0	1.0	2.0	4.0	2.0	1.0	1.0	1.0	1.0	1.0

Problem 2

The data contain 301 columns. Create a new variable in Python's memory to store a working version of the data. In the working version, delete all of the columns except for the following:

- `Industry` : 7 Industry Categories with NAICS codes
- `Size` : 8 Employee Size Categories
- `OC3` Is your organization for profit, non-profit, government?

- `HI1` In general, do you offer full, partial or no payment of premiums for personal health insurance for full-time employees?
- `HI2` Over the past 12 months, were full-time employees asked to pay a larger proportion, smaller proportion or the same proportion of personal health insurance premiums?
- `HI3` : Does your organization offer personal health insurance for your part-time employees?
- `CP1` : Are there health education programs, which focus on skill development and lifestyle behavior change along with information dissemination and awareness building?
- `WL6` : Allow employees to work from home?
- Every column that begins `WD` , expressing the percentage of employees that have certain characteristics at the firm

[1 point]

confirming the 301 columns

In [ ]:
```
df_p1.shape
```

Out[ ]:
```
(2843, 301)
```

In [ ]:
```
# first, get all the wd_cols
wd_cols = df_p1.columns.where(df_p1.columns.str.contains('WD')).dropna().tolist()
#wd_cols

# create a list of the other columns requests
requested_cols = ['Industry','Size','OC3','HI1','HI2','HI3','CP1','WL6']
# add the wd_cols to the requested_cols

df_p2 = df_p1[requested_cols + wd_cols].copy()
```

In [ ]:
```
print(df_p2.shape)
df_p2.head()
```

```
(2843, 16)
```

Out[ ]:

	Industry	Size	OC3	HI1	HI2	HI3	CP1	WL6	WD1_1	WD1_2	WD2	WD3	WD4	WD5	W
0	7.0	7.0	3.0	2.0	1.0	2.0	1.0	1.0	25.0	20.0	85.0	60.0	40.0	15.0	
1	7.0	6.0	3.0	2.0	3.0	1.0	1.0	1.0	997.0	997.0	90.0	90.0	997.0	997.0	
2	7.0	8.0	3.0	1.0	3.0	1.0	1.0	1.0	35.0	4.0	997.0	997.0	40.0	15.0	99
3	7.0	4.0	2.0	1.0	2.0	1.0	2.0	2.0	50.0	15.0	50.0	85.0	75.0	0.0	
4	7.0	4.0	3.0	1.0	3.0	1.0	1.0	1.0	50.0	40.0	60.0	60.0	40.0	30.0	

Problem 3

The codebook for the WHA data contain short descriptions of the meaning of each of the columns in the data. Use these descriptions to decide on better and more intuitive names for the columns in the working version of the data, and rename the columns accordingly. [1 point]

https://www.cdc.gov/workplacehealthpromotion/data-surveillance/docs/2017-WHA-Datafile-Codebook-508.pdf

- **OC3**: Is your organization for profit, non-profit, government?
- Health Insurance **HI1**: In general, do you offer full, partial or no payment of premiums for personal

health insurance for full-time employees?

- Health Insurance **HI2**: Over the past 12 months, were full-time employees asked to pay a larger

proportion, smaller proportion or the same proportion of personal health insurance premiums?

- Health Insurance **HI3**: Does your organization offer personal health insurance for your part-time

employees?

- Promoting Health at Work **CP1**: Health education programs, which focus on skill development and

lifestyle behavior change along with information dissemination and awareness building?

- Work-Life Programming, Policies and Benefits **WL6**: Allow employees to work from home?
- **WD1_1**: Workforce Demographics WD1_1: What percentage of employees are under age 30?
- **WD1_2**: Workforce Demographics WD1_2: What percentage of employees are age 60 or older?
- **WD2**: Workforce Demographics WD2: What percentage of employees are female?
- **WD3**: Workforce Demographics WD3: What percentage of employees are hourly/non-exempt?
- **WD4**: Workforce Demographics WD4: What percentage of employees work something other than a typical daytime

shift?

- **WD5**: Workforce Demographics WD5: What percentage of employees regularly work remotely or off-site?
- **WD6**: Workforce Demographics WD6: What percentage of employees are under collective bargaining or unionized?
- **WD7**: Workforce Demographics WD7: What is the average annual percentage of turnover at this worksite

location?

In [ ]:

```
new_cols = ['industry','org_size','org_type','premium_coverage','premium_change','p
'under_30_perc','60_older_perc','female_perc','hourly_perc','off_shift_perc','remot

df_p2.columns = new_cols
print(df_p2.shape)
df_p2.head()
```

```
(2843, 16)
```

Out[ ]:

	industry	org_size	org_type	premium_coverage	premium_change	part_time_coverage	wellness
0	7.0	7.0	3.0	2.0	1.0	2.0	
1	7.0	6.0	3.0	2.0	3.0	1.0	
2	7.0	8.0	3.0	1.0	3.0	1.0	
3	7.0	4.0	2.0	1.0	2.0	1.0	
4	7.0	4.0	3.0	1.0	3.0	1.0	

Problem 4

Using the codebook and this dictionary of NAICS industrial codes, place descriptive labels on the categories of the industry column in the working data. [1 point]

https://www.naics.com/search-naics-codes-by-industry/

- 1 = Industry Category 1: NAICS Sectors: 11, 21, 22, 23, 31-33
  - 11 Agriculture, Forestry, Fishing and Hunting
  - 21 Mining
  - 22 Utilities
  - 23 Construction
  - 31-33 Manufacturing
- 2 = Industry Category 2: NAICS Sectors: 42, 44-45, 48-49
  - Wholesale Trade
  - Retail Trade
  - Transportation and Warehousing
- 3 = Industry Category 3: NAICS Sectors: 71, 72, 81
  - Arts, Entertainment, and Recreation

    - Accommodation and Food Services
    - Other Services (except Public Administration)
- 4 = Industry Category 4: NAICS Sectors: 51, 52, 53, 54, 55, 56
    - Information
    - Finance and Insurance
    - Real Estate Rental and Leasing
    - Professional, Scientific, and Technical Services
    - Management of Companies and Enterprises
    - Administrative and Support and Waste Management and Remediation Services
- 5 = Industry Category 5: NAICS Sectors: 61, 62 (excluding hospital worksites)
    - Educational Services
    - Health Care and Social Assistance
- 6 = Industry Category 6: NAICS Sectors: 92
    - Public Administration
- 7 = Industry Category 7: Hospital worksites (NAICS6 = 622110, 622210, 622310)

In [ ]:

```
industry_map = {1:'Agriculture, Infrastructure, and Mining',
               2:'Trade, Transportation, and Warehousing',
               3:'Entertainment and Recreation',
               4:'Professional, Managementment, and Administrative Services',
               5: 'Educational Services, Health Care, and Social Assistance',
               6: 'Public Administration',
               7:'Hospitals'}

df_p2.industry = df_p2.industry.map(industry_map)
df_p2.industry
```

Out[ ]:

```
0                   Hospitals
1                   Hospitals
2                   Hospitals
3                   Hospitals
4                   Hospitals
                ...
2838    Public Administration
2839    Public Administration
2840    Public Administration
2841    Public Administration
2842    Public Administration
Name: industry, Length: 2843, dtype: object
```

In [ ]:

```
df_p2.head()
```

Out[ ]:

	industry	org_size	org_type	premium_coverage	premium_change	part_time_coverage	wellnes
0	Hospitals	7.0	3.0	2.0	1.0	2.0	
1	Hospitals	6.0	3.0	2.0	3.0	1.0	
2	Hospitals	8.0	3.0	1.0	3.0	1.0	
3	Hospitals	4.0	2.0	1.0	2.0	1.0	
4	Hospitals	4.0	3.0	1.0	3.0	1.0	

Problem 5

Using the codebook, recode the "size" column to have three categories: "Small" for workplaces with fewer than 100 employees, "Medium" for workplaces with at least 100 but fewer than 500 employees, and "Large" for companies with at least 500 employees. [Note: Python dataframes have an attribute `.size` that reports the space the dataframe takes up in memory. Don't confuse this attribute with the column named "Size" in the raw data.] [1 point]

Size: 8 Employee Size Categories

Cumulative Cumulative

Size Column From Cookbook

- 1 = Size Category 1: 10-24
- 2 = Size Category 2: 25-49
- 3 = Size Category 3: 50-99

- 4 = Size Category 4: 100-249
- 5 = Size Category 5: 250-499

- 6 = Size Category 6: 500-749
- 7 = Size Category 7: 750-999
- 8 = Size Category 8: 1,000+

In [ ]:

```
# set the org_size column to a category type
df_p2.org_size = df_p2.org_size.astype('category')
```

In [ ]:

```
df_p2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2843 entries, 0 to 2842
Data columns (total 16 columns):
 #   Column              Non-Null Count  Dtype   
---  ------              --------------  -----   
 0   industry            2842 non-null   object  
 1   org_size            2842 non-null   category
 2   org_type            2842 non-null   float64 
 3   premium_coverage    2842 non-null   float64 
 4   premium_change      2842 non-null   float64 
 5   part_time_coverage  2842 non-null   float64 
 6   wellness_program    2842 non-null   float64 
 7   work_from_home      2842 non-null   float64 
 8   under_30_perc       2842 non-null   float64 
 9   60_older_perc       2842 non-null   float64 
 10  female_perc         2842 non-null   float64 
 11  hourly_perc         2842 non-null   float64 
 12  off_shift_perc      2842 non-null   float64 
 13  remote_perc         2842 non-null   float64 
 14  union_perc          2842 non-null   float64 
 15  turnover_perc       2842 non-null   float64 
dtypes: category(1), float64(14), object(1)
memory usage: 336.4+ KB
```

In [ ]:

```
size_map = {1:'Small',
               2:'Small',
               3:'Small',
               4:'Medium',
               5: 'Medium',
               6: 'Large',
               7:'Large',
               8:'Large'}

df_p2['org_size'] = df_p2.org_size.map(size_map)
print(df_p2.shape)
df_p2.head()
```

```
(2843, 16)
```

Out[ ]:

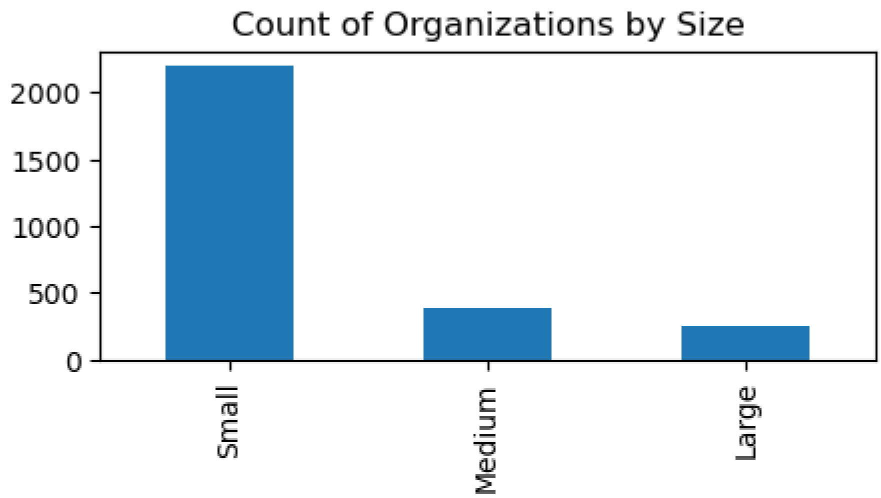
	industry	org_size	org_type	premium_coverage	premium_change	part_time_coverage	wellnes
0	Hospitals	Large	3.0	2.0	1.0	2.0	
1	Hospitals	Large	3.0	2.0	3.0	1.0	
2	Hospitals	Large	3.0	1.0	3.0	1.0	
3	Hospitals	Medium	2.0	1.0	2.0	1.0	
4	Hospitals	Medium	3.0	1.0	3.0	1.0	

In [ ]:

```
# plot a bar plot of the rows by org_size color on org_size
df_p2.org_size.value_counts().plot(kind='bar', title='Count of Organizations by Siz
```

Out[ ]:

```
<AxesSubplot: title={'center': 'Count of Organizations by Size'}>
```



Problem 6

Use the codebook to write accurate and descriptive labels for each category for each categorical column in the working data. Then apply all of these labels to the data at once. Code "Legitimate Skip", "Don't know", "Refused", and "Blank" as missing values. [2 points]

In [ ]:

```
# org_type: OC3 (1 = For profit, public, 2 = For profit, private, 3 = Non-profit, 4
# premium_coverage: HI1 (1 = Full insurance coverage offered, 2 = Partial insurance
# premium_change: HI2 (1 = Larger, 2 = Smaller, 3 = About the same, 96 = Legitimate
# part_time_coverage: HI3 (1 = Yes, 2 = No, 97 = Don't know, 98 = Refusal, 99 = Bla
# wellness_program: CP1 (1 = Yes, 2 = No, 97 = Don't know, 98 = Refusal  )
# work_from_home: WL6 (1 = Yes, 2 = No, 97 = Don't know, 98 = Refusal  )
# make a copy of df_p2 for problem 6
df_p6 = df_p2.copy()

# make a replace map
replace_map = {'org_type':{1:'profit-public', 2:'profit-private', 3:'non-profit', 4
              'premium_coverage':{1:'full', 2:'partial', 3:'none', 97:np.nan, 98:np
              'premium_change':{1:'larger', 2:'smaller', 3:'same', 96:np.nan, 97:np
              'part_time_coverage':{1:'yes', 2:'no', 97:np.nan, 98:np.nan, 99:np.na
              'wellness_program':{1:'yes', 2:'no', 97:np.nan, 98:np.nan, 99:np.nan}
              'work_from_home':{1:'yes', 2:'no', 97:np.nan, 98:np.nan, 99:np.nan}}

# use the replace map
df_p6 = df_p6.replace(replace_map)
```

In [ ]:

```
df_p6.head()
```

Out[ ]:

	industry	org_size	org_type	premium_coverage	premium_change	part_time_coverage	wellnes
0	Hospitals	Large	non-profit	partial	larger	no	
1	Hospitals	Large	non-profit	partial	same	yes	
2	Hospitals	Large	non-profit	full	same	yes	
3	Hospitals	Medium	profit-private	full	smaller	yes	
4	Hospitals	Medium	non-profit	full	same	yes	

Problem 7

The features that measure the percent of the workforce with a particular characteristic use the codes 997, 998, and 999 to represent "Don't know", "Refusal", and "Blank/Invalid" respectively. Replace these values with missing values for all of the percentage features at the same time. [1 point]

In [ ]:

```
df_p7 = df_p6.copy()
```

In [ ]:

```
perccols = [x for x in df_p7.columns if x.endswith("perc")]
df_p7[perccols] = df_p7[perccols].replace([997, 998, 999], np.nan)
```

In [ ]:

```
df_p7.head()
```

Out[ ]:

	industry	org_size	org_type	premium_coverage	premium_change	part_time_coverage	wellnes
0	Hospitals	Large	non-profit	partial	larger	no	
1	Hospitals	Large	non-profit	partial	same	yes	
2	Hospitals	Large	non-profit	full	same	yes	
3	Hospitals	Medium	profit-private	full	smaller	yes	
4	Hospitals	Medium	non-profit	full	same	yes	

Problem 8

Sort the working data by industry in ascending alphabetical order. Within industry categories, sort the rows by size in ascending alphabetical order. Within groups with the same industry and size, sort by percent of the workforce that is under 30 in descending numeric order. [1 point]

```
In [ ]: df_p7.sort_values(by=['industry', 'org_size','under_30_perc'], ascending = [True, T
        df_p7
```

Out[ ]:

	industry	org_size	org_type	premium_coverage	premium_change	part_time_coverage
1732	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	same	no
1476	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	same	no
1477	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	smaller	no
704	Agriculture, Infrastructure, and Mining	Large	profit-private	full	same	no
1241	Agriculture, Infrastructure, and Mining	Large	profit-private	full	same	no
...	...	...	...	...	...	...
2604	Trade, Transportation, and Warehousing	Small	non-profit	full	same	no
2626	Trade, Transportation, and Warehousing	Small	profit-private	partial	larger	yes
2629	Trade, Transportation, and Warehousing	Small	profit-public	full	larger	no
2631	Trade, Transportation, and Warehousing	Small	profit-private	partial	larger	yes
1662	NaN	NaN	NaN	NaN	NaN	NaN

2843 rows × 16 columns

Problem 9

There is one row in the working data that has a `NaN` value for industry. Delete this row. Use a logical expression, and not the row number. [1 point]

In [ ]:

```
print(df_p7.shape)
df_p9 = df_p7.dropna(subset = ['industry'])
print(df_p9.shape)
df_p9.head()
```

```
(2843, 16)
(2842, 16)
```

Out[ ]:

	industry	org_size	org_type	premium_coverage	premium_change	part_time_coverage
1732	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	same	no
1476	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	same	no
1477	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	smaller	no
704	Agriculture, Infrastructure, and Mining	Large	profit-private	full	same	no
1241	Agriculture, Infrastructure, and Mining	Large	profit-private	full	same	no

Problem 10

Create a new feature named `gender_balance` that has three categories: "Mostly men" for workplaces with between 0% and 35% female employees, "Balanced" for workplaces with more than 35% and at most 65% female employees, and "Mostly women" for workplaces with more than 65% female employees. [1 point]

In [ ]:

```
# pd.cut() does what we are looking for - creates categories from break points in a
#  list of the breakpoints (inclusive for the upper bound but not the lower bound),

df_p10 = df_p9.copy()
df_p10['gender_balance'] = pd.cut(df_p10.female_perc, bins=[-1,35,65,100], labels=(
```

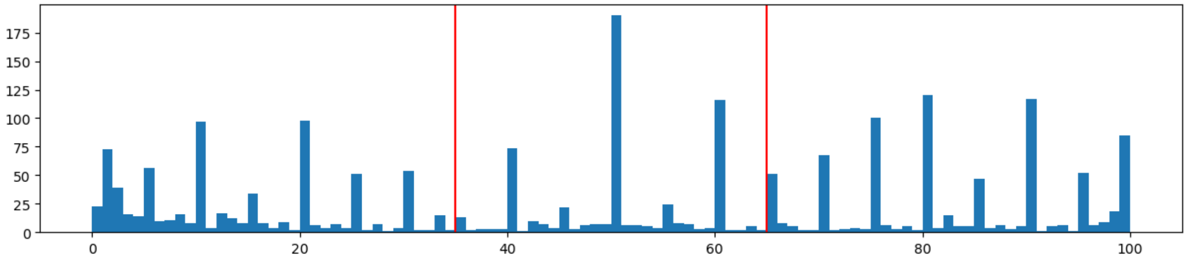
In [ ]:

```
import matplotlib.pyplot as plt
plt.figure(figsize=(15,3))
# plot a bar plot of female_perc
plt.hist(x=df_p9['female_perc'], bins=100)
```

```
# plot a verticle line at x = 35
plt.axvline(x=35, color='r')
plt.axvline(x=65, color='r')
```

Out[ ]:

```
<matplotlib.lines.Line2D at 0x209928826b0>
```

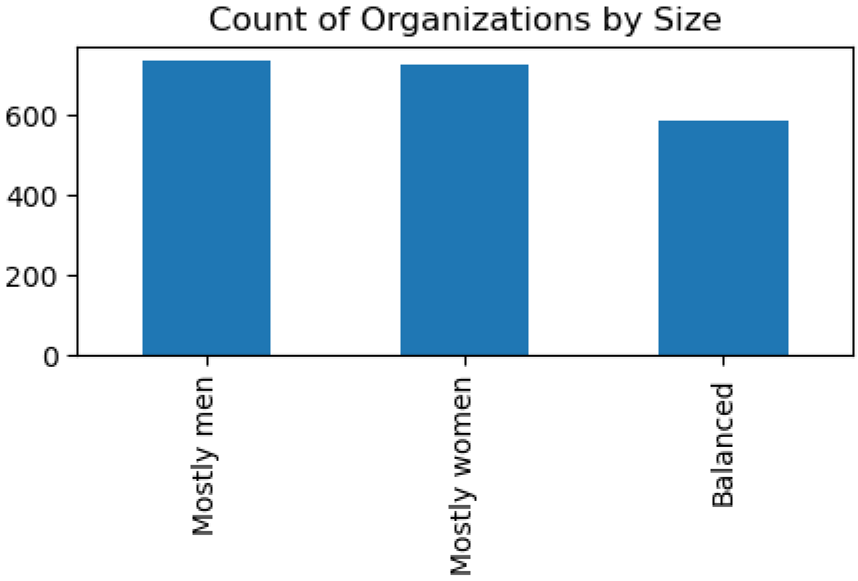


In [ ]:

```
df_p10.gender_balance.value_counts().plot(kind='bar', title='Count of Organizations
```

Out[ ]:

```
<AxesSubplot: title={'center': 'Count of Organizations by Size'}>
```



Problem 11

Change the data type of all categorical features in the working data from "object" to "category". [1 point]

In [ ]:

```
df_p11 = df_p10.copy()
print(df_p11.columns)
# first get all the columns that do not end with perc
categorical_cols = [col_name for col_name in df_p11.columns if not col_name.endswit
print(categorical_cols)
```

```
Index(['industry', 'org_size', 'org_type', 'premium_coverage',
       'premium_change', 'part_time_coverage', 'wellness_program',
       'work_from_home', 'under_30_perc', '60_older_perc', 'female_perc',
       'hourly_perc', 'off_shift_perc', 'remote_perc', 'union_perc',
       'turnover_perc', 'gender_balance'],
      dtype='object')
['industry', 'org_size', 'org_type', 'premium_coverage', 'premium_change', 'part_t
ime_coverage', 'wellness_program', 'work_from_home', 'gender_balance']
```

In [ ]:

```
# change the categorical_cols to categorical dtype
df_p11[categorical_cols] = df_p11[categorical_cols].astype('category')
df_p11.dtypes
```

Out[ ]:

```
industry              category
org_size              category
org_type              category
premium_coverage      category
premium_change        category
part_time_coverage    category
wellness_program      category
work_from_home        category
under_30_perc          float64
60_older_perc          float64
female_perc            float64
hourly_perc            float64
off_shift_perc         float64
remote_perc            float64
union_perc             float64
turnover_perc          float64
gender_balance        category
dtype: object
```

In [ ]:

```
print(df_p11.shape)
df_p11.head()
```

```
(2842, 17)
```

Out[ ]:

	industry	org_size	org_type	premium_coverage	premium_change	part_time_coverage
1732	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	same	no
1476	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	same	no
1477	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	smaller	no
704	Agriculture, Infrastructure, and Mining	Large	profit-private	full	same	no
1241	Agriculture, Infrastructure, and Mining	Large	profit-private	full	same	no

In [ ]:

```
df_p11.describe()
```

Out[ ]:

	under_30_perc	60_older_perc	female_perc	hourly_perc	off_shift_perc	remote_perc	unior
count	1874.000000	1901.000000	2047.000000	1907.000000	1986.000000	2058.000000	2151.0
mean	27.006403	12.237770	49.864680	62.243838	25.760826	13.651118	9.4
std	22.757196	13.900218	31.311489	32.979147	32.278475	26.838083	24.9
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0
25%	10.000000	2.000000	20.000000	35.000000	0.000000	0.000000	0.0
50%	20.000000	10.000000	50.000000	75.000000	10.000000	0.000000	0.0
75%	40.000000	17.000000	80.000000	90.000000	50.000000	10.000000	0.0
max	100.000000	100.000000	100.000000	100.000000	100.000000	100.000000	100.0

Problem 12

Filter the data to only those rows that represent small workplaces that allow employees to work from home. Then report how many of these workplaces offer full insurance, partial insurance, and no insurance. Use a function that reports the percent, cumulative count, and cumulative percent in addition to the counts. [1 point]

I **could** just use the `.query` method, but I will use the .apply method that was described in this week's textbook reading. Here is the .query example I would have used:

```
df_p12 = df_p11.query('org_size == "Small" & work_from_home == "yes"')
```

In [ ]:

```
# I want org_size == small, and work_from_home == yes
# COULD JUST DO THE QUERY
#df_p12 = df_p11.query('org_size == "Small" & work_from_home == "yes"')
# create a mapping of the conditions
# this is if I wanted to create a dataframe with ONLY the rows that meet the condit
#df_p12_mapping = df_p11.apply(lambda x: x['org_size'] in ["Small"] and x['work_fro
# print the count of true in df_p12_mapping
#print(df_p12_mapping.value_counts())
# use the mapping to only get the rows where the mapping is true
#df_p12 = df_p11[df_p12_mapping]

df_p12 = df_p11.copy()
df_p12['small_work_from_home'] = df_p12.apply(lambda x: x['org_size'] in ["Small"]
print(df_p12.shape)
df_p12.head()
```

```
(2842, 18)
```

Out[ ]:

	industry	org_size	org_type	premium_coverage	premium_change	part_time_coverage
1732	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	same	no
1476	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	same	no
1477	Agriculture, Infrastructure, and Mining	Large	profit-private	partial	smaller	no
704	Agriculture, Infrastructure, and Mining	Large	profit-private	full	same	no
1241	Agriculture, Infrastructure, and Mining	Large	profit-private	full	same	no

In [ ]:

```
# make df_p12['premium_coverage'] a category
df_p12['premium_coverage'] = df_p12['premium_coverage'].astype('category')
# make df_p12['premium_coverage'] ordered
df_p12['premium_coverage'].cat.reorder_categories(['none', 'partial', 'full'], inpl

df_p12.stb.freq(['small_work_from_home','premium_coverage']).sort_values(by=['small
```

Out[ ]:

	small_work_from_home	premium_coverage	count	percent	cumulative_count	cumulative_per
4	False	none	275	9.952950	2697	97.61
0	False	partial	971	35.142961	971	35.142
1	False	full	817	29.569309	1788	64.712
5	True	none	66	2.388708	2763	100.00
3	True	partial	310	11.219689	2422	87.658
2	True	full	324	11.726384	2112	76.438

Method 2 for completing problem 12

I **also** did this in a much more manual and complicated way my manually creating my own functions. I left the code here as a reference.

Now, for the "report how many of these workplaces offer full insurance, partial insurance, and no insurance. Use a function that reports the percent, cumulative count, and cumulative percent in addition to the counts."

In [ ]:
```
df_12a = df_p12.groupby(['small_work_from_home','premium_coverage']).agg({'industry
df_12a.columns = df_12a.columns.droplevel(0)
df_12a.columns = ['count_full','count_none','count_partial']
df_12a
```

Out[ ]:

	count_full	count_none	count_partial
small_work_from_home			
False	817	275	971
True	324	66	310

Here i create a non-standard aggregation function for the percentage of the count

In [ ]:
```
#df_p12.groupby(['small_work_from_home','premium_coverage']).agg({'industry':['coun
# create a non standard aggregation function for percentage of the count that is fu
def perc_of_count(x):
    return (np.round(100 * x / float(x.sum()),2))
df_12b = df_p12.groupby(['small_work_from_home','premium_coverage']).agg({'industry

df_12b.columns = df_12b.columns.droplevel(0)
df_12b.columns = ['percentage_full','percentage_none','percentage_partial']
df_12b
```

Out[ ]:

	percentage_full	percentage_none	percentage_partial
small_work_from_home			
False	39.60	13.33	47.07
True	46.29	9.43	44.29

Here is the cummulative sum

In [ ]:

```
df_12c = df_p12.groupby(['small_work_from_home','premium_coverage']).agg({'industry
df_12c.columns = df_12c.columns.droplevel(0)
df_12c.columns = ['cum_count_full','cum_count_none','cum_count_partial']
df_12c
```

Out[ ]:

	cum_count_full	cum_count_none	cum_count_partial
small_work_from_home			
False	817	1092	2063
True	2387	2453	2763

Now, I need the cummulative percent

In [ ]:

```
def cum_perc_of_count(x):
    return (np.round(100 * x.cumsum()/ float(x.sum()),2))
```

In [ ]:

```
# calculate the cummulative percentage
df_12d = df_p12.groupby(['small_work_from_home','premium_coverage']).agg({'industry

df_12d.columns = df_12d.columns.droplevel(0)
df_12d.columns = ['cum_percentage_full','cum_percentage_none','cum_percentage_parti
df_12d
```

Out[ ]:

	cum_percentage_full	cum_percentage_none	cum_percentage_partial
small_work_from_home			
False	39.60	52.93	100.0
True	46.29	55.71	100.0

Merge all the columns together:

In [ ]:

```
# join df_12a, df_12b, df_12c, df_12d on small_work_from_home
df_12e = df_12a.join(df_12b).join(df_12c).join(df_12d)
df_12e
```

Out[ ]:

	count_full	count_none	count_partial	percentage_full	percentage_none	p
small_work_from_home						
False	817	275	971	39.60	13.33	
True	324	66	310	46.29	9.43	

Problem 13

Anything that can be done in SQL can be done with `pandas`. The next several questions ask you to write `pandas` code to match a given SQL query. But to check that the SQL query and `pandas` code yield the same result, create a new database wsing the `sqlite3` package and input the cleaned WHA data as a table in this database. (See module 6 for a discussion of SQlite in Python.) [1 point]

In [ ]:

```
# initialize a new database using Sqlite3
db_lab8 = sqlite3.connect('lab8.db')

# add clean df_p12 to the database
df_p12.to_sql('lab8', db_lab8, if_exists='replace', index=False)
```

Out[ ]:

```
2842
```

Problem 14

Write `pandas` code that replicates the output of the following SQL code:

```
SELECT size, type, premiums AS insurance, percent_female FROM whpps
WHERE industry = 'Hospitals' AND premium_change='Smaller'
ORDER BY percent_female DESC;
```

For each of these queries, your feature names might be different from the ones listed in the query, depending on the names you chose in problem 3. [2 points]

In [ ]:

```
t_sql = """
SELECT org_size, org_type, premium_coverage AS insurance, female_perc FROM lab8
WHERE industry = 'Hospitals' AND premium_change='smaller'
ORDER BY female_perc DESC;
"""
cur = db_lab8.cursor()
cur.execute(t_sql)
rows = cur.fetchall()
#for row in rows:
#    print(row)

df_rows = pd.DataFrame(rows, columns=['org_size','org_type','insurance','female_per
df_rows
```

Out[ ]:

	org_size	org_type	insurance	female_perc
0	Medium	non-profit	full	89.0
1	Large	non-profit	partial	80.0
2	Large	non-profit	partial	80.0
3	Small	non-profit	full	75.0
4	Medium	non-profit	partial	65.0
5	Medium	profit-private	full	50.0
6	Large	non-profit	partial	NaN
7	Medium	non-profit	full	NaN
8	Medium	None	partial	NaN
9	Medium	non-profit	partial	NaN
10	Medium	non-profit	full	NaN

This is the **easy** way with the `.query()` syntax:

In [ ]:

```
df_p12.query("industry == 'Hospitals' and premium_change == 'smaller'")[['org_size'
```

Out[ ]:

	org_size	org_type	insurance	female_perc
320	Medium	non-profit	full	89.0
187	Large	non-profit	partial	80.0
214	Large	non-profit	partial	80.0
229	Small	non-profit	full	75.0
191	Medium	non-profit	partial	65.0
3	Medium	profit-private	full	50.0
97	Large	non-profit	partial	NaN
75	Medium	non-profit	full	NaN
11	Medium	NaN	partial	NaN
48	Medium	non-profit	partial	NaN
51	Medium	non-profit	full	NaN

And here is with the `.apply()` syntax:

In [ ]:

```
df_p12[df_p12.apply(lambda x: x['industry'] in ["Hospitals"] and x['premium_change'
```

Out[ ]:

	org_size	org_type	insurance	female_perc
320	Medium	non-profit	full	89.0
187	Large	non-profit	partial	80.0
214	Large	non-profit	partial	80.0
229	Small	non-profit	full	75.0
191	Medium	non-profit	partial	65.0
3	Medium	profit-private	full	50.0
97	Large	non-profit	partial	NaN
75	Medium	non-profit	full	NaN
11	Medium	NaN	partial	NaN
48	Medium	non-profit	partial	NaN
51	Medium	non-profit	full	NaN

Problem 15

Write `pandas` code that replicates the output of the following SQL code:

```
SELECT industry,
    AVG(percent_female) as percent_female,
    AVG(percent_under30) as percent_under30,
    AVG(percent_over60) as percent_over60
FROM whpps
GROUP BY industry
ORDER BY percent_female DESC;
```

[2 points]

In [ ]:

```
t_sql = """
SELECT industry,
    AVG(female_perc) as percent_female,
    AVG(under_30_perc) as percent_under30,
    AVG([60_older_perc]) as percent_over60
FROM lab8
GROUP BY industry
ORDER BY percent_female DESC;
"""
cur = db_lab8.cursor()
cur.execute(t_sql)
rows = cur.fetchall()
#for row in rows:
#    print(row)

df_rows = pd.DataFrame(rows, columns=['industry','percent_female','percent_under30'
df_rows
```

Out[ ]:

	industry	percent_female	percent_under30	percent_over60
0	Educational Services, Health Care, and Social ...	80.657143	25.745665	11.349570
1	Hospitals	76.427027	27.213793	16.489655
2	Entertainment and Recreation	53.804416	38.566343	11.544872
3	Professional, Managementment, and Administrati...	50.632184	23.821752	12.465465
4	Public Administration	39.056738	21.015625	15.015385
5	Trade, Transportation, and Warehousing	32.657258	29.108696	12.584034
6	Agriculture, Infrastructure, and Mining	20.328605	22.257143	10.690355

In [ ]:

```
df_ans = pd.DataFrame(df_p12.groupby(['industry']).agg({'female_perc':['mean'], 'un
level_one = df_ans.columns.get_level_values(0).astype(str)
level_two = df_ans.columns.get_level_values(1).astype(str)
df_ans.columns = level_one + level_two
df_ans.sort_values('female_percmean', ascending=False)
```

Out[ ]:

	female_percmean	under_30_percmean	60_older_percmean
industry			
Educational Services, Health Care, and Social Assistance	80.657143	25.745665	11.349570
Hospitals	76.427027	27.213793	16.489655
Entertainment and Recreation	53.804416	38.566343	11.544872
Professional, Managementment, and Administrative Services	50.632184	23.821752	12.465465
Public Administration	39.056738	21.015625	15.015385
Trade, Transportation, and Warehousing	32.657258	29.108696	12.584034
Agriculture, Infrastructure, and Mining	20.328605	22.257143	10.690355

Problem 16

Write `pandas` code that replicates the output of the following SQL code:

```
SELECT gender_balance, premiums, COUNT(*)
FROM whpps
GROUP BY gender_balance, premiums
HAVING gender_balance is NOT NULL and premiums is NOT NULL;
```

[2 points]

In [ ]:

```
t_sql = """
SELECT gender_balance, premium_coverage, COUNT(*)
FROM lab8
GROUP BY gender_balance, premium_coverage
HAVING gender_balance is NOT NULL and premium_coverage is NOT NULL;
"""
cur = db_lab8.cursor()
cur.execute(t_sql)
rows = cur.fetchall()
#for row in rows:
#    print(row)

df_rows = pd.DataFrame(rows, columns=['gender_balance','premium_coverage','count'])
df_rows
```

Out[ ]:

	gender_balance	premium_coverage	count
0	Balanced	full	226
1	Balanced	none	77
2	Balanced	partial	271
3	Mostly men	full	301
4	Mostly men	none	91
5	Mostly men	partial	332
6	Mostly women	full	267
7	Mostly women	none	107
8	Mostly women	partial	333

In [ ]:

```
df_ans_16 = pd.DataFrame(df_p12.groupby(['gender_balance','premium_coverage']).agg(
level_one = df_ans.columns.get_level_values(0).astype(str)
# drop an index level
df_ans_16.columns = df_ans_16.columns.droplevel(0)
# drop all except the first column
df_ans_16 = df_ans_16.iloc[:,0:1]
df_ans_16.columns = ['count']
# repeat the index columns to make a dataframe
df_ans_16 = df_ans_16.reset_index()
df_ans_16
```

Out[ ]:

	gender_balance	premium_coverage	count
0	Mostly men	full	301
1	Mostly men	none	91
2	Mostly men	partial	332
3	Balanced	full	226
4	Balanced	none	77
5	Balanced	partial	271
6	Mostly women	full	267
7	Mostly women	none	107
8	Mostly women	partial	333

Finally, close the connection

In [ ]:

```
# close the connection to the sqlite database
db_lab8.close()
```