Descriptive Statistics

Estimated time needed: **30** minutes

In this lab, you'll go over some hands-on exercises using Python.

Objectives

- Import Libraries
- Read in Data
- Lab exercises and questions

Import Libraries

All Libraries required for this lab are listed below. The libraries pre-installed on Skills Network Labs are commented. If you run this notebook in a different environment, e.g. your desktop, you may need to uncomment and install certain libraries.

In [ ]:

```
#! mamba install pandas==1.3.3
#! mamba install numpy=1.21.2
#!  mamba install matplotlib=3.4.3-y
```

Import the libraries we need for the lab

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as pyplot
```

Read in the csv file from the URL using the request library

In [2]:

```
ratings_url = 'https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-ST0151EN-SkillsNetwork/labs/teachingratings.csv'
ratings_df=pd.read_csv(ratings_url)
```

Data Description

Variable	Description
minority	Does the instructor belong to a minority (non-Caucasian) group?
age	The professor's age
gender	Indicating whether the instructor was male or female.
credits	Is the course a single-credit elective?
beauty	Rating of the instructor's physical appearance by a panel of six students averaged across the six panelists and standardized to have a mean of zero.
eval	Course overall teaching evaluation score, on a scale of 1 (very unsatisfactory) to 5 (excellent).
division	Is the course an upper or lower division course?
native	Is the instructor a native English speaker?
tenure	Is the instructor on a tenure track?
students	Number of students that participated in the evaluation.
allstudents	Number of students enrolled in the course.
prof	Indicating instructor identifier.

Display information about the dataset

1. Structure of the dataframe
2. Describe the dataset
3. Number of rows and columns

print out the first five rows of the data

In [3]:

```
ratings_df.head()
```

Out[3]:

	minority	age	gender	credits	beauty	eval	division	native	tenure	students	allstud
0	yes	36	female	more	0.289916	4.3	upper	yes	yes	24	
1	yes	36	female	more	0.289916	3.7	upper	yes	yes	86	
2	yes	36	female	more	0.289916	3.6	upper	yes	yes	76	
3	yes	36	female	more	0.289916	4.4	upper	yes	yes	77	
4	no	59	male	more	-0.737732	4.5	upper	yes	yes	17	

get information about each variable

In [4]:

```
ratings_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 463 entries, 0 to 462
Data columns (total 19 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   minority         463 non-null    object
 1   age              463 non-null    int64
 2   gender           463 non-null    object
 3   credits          463 non-null    object
 4   beauty           463 non-null    float64
 5   eval             463 non-null    float64
 6   division         463 non-null    object
 7   native           463 non-null    object
 8   tenure           463 non-null    object
 9   students         463 non-null    int64
 10  allstudents      463 non-null    int64
 11  prof             463 non-null    int64
 12  PrimaryLast      463 non-null    int64
 13  vismin           463 non-null    int64
 14  female           463 non-null    int64
 15  single_credit    463 non-null    int64
 16  upper_division   463 non-null    int64
 17  English_speaker  463 non-null    int64
 18  tenured_prof     463 non-null    int64
dtypes: float64(2), int64(11), object(6)
memory usage: 68.9+ KB
```

get the number of rows and columns - prints as (number of rows, number of columns)

In [5]:

```
ratings_df.shape
```

Out[5]:

```
(463, 19)
```

Lab Exercises

Can you identify whether the teachers' Rating data is a time series or cross-sectional?

Print out the first ten rows of the data

1. Does it have a date or time variable? - No - it is not a time series dataset
2. Does it observe more than one teacher being rated? - Yes - it is cross-sectional dataset

> The dataset is a Cross-sectional

In [6]:

```
ratings_df.head(10)
```

Out[6]:

	minority	age	gender	credits	beauty	eval	division	native	tenure	students	allstud
0	yes	36	female	more	0.289916	4.3	upper	yes	yes	24	
1	yes	36	female	more	0.289916	3.7	upper	yes	yes	86	
2	yes	36	female	more	0.289916	3.6	upper	yes	yes	76	
3	yes	36	female	more	0.289916	4.4	upper	yes	yes	77	
4	no	59	male	more	-0.737732	4.5	upper	yes	yes	17	
5	no	59	male	more	-0.737732	4.0	upper	yes	yes	35	
6	no	59	male	more	-0.737732	2.1	upper	yes	yes	39	
7	no	51	male	more	-0.571984	3.7	upper	yes	yes	55	
8	no	51	male	more	-0.571984	3.2	upper	yes	yes	111	
9	no	40	female	more	-0.677963	4.3	upper	yes	yes	40	

Find the mean, median, minimum, and maximum values for students

Find Mean value for students

In [7]:

```
ratings_df['students'].mean()
```

Out[7]:

```
36.62419006479482
```

Find the Median value for students

In [8]:

```
ratings_df['students'].median()
```

Out[8]:

```
23.0
```

Find the Minimum value for students

In [9]:

```
ratings_df['students'].min()
```

Out[9]:

```
5
```

Find the Maximum value for students

In [10]:

```
ratings_df['students'].max()
```

Out[10]:

```
380
```

Produce a descriptive statistics table

In [11]:

```
ratings_df.describe()
```

Out[11]:

	age	beauty	eval	students	allstudents	prof	PrimaryLa
count	463.000000	4.630000e+02	463.000000	463.000000	463.000000	463.000000	463.0000
mean	48.365011	6.271140e-08	3.998272	36.624190	55.177106	45.434125	0.2030
std	9.802742	7.886477e-01	0.554866	45.018481	75.072800	27.508902	0.4026
min	29.000000	-1.450494e+00	2.100000	5.000000	8.000000	1.000000	0.0000
25%	42.000000	-6.562689e-01	3.600000	15.000000	19.000000	20.000000	0.0000
50%	48.000000	-6.801430e-02	4.000000	23.000000	29.000000	44.000000	0.0000
75%	57.000000	5.456024e-01	4.400000	40.000000	60.000000	70.500000	0.0000
max	73.000000	1.970023e+00	5.000000	380.000000	581.000000	94.000000	1.0000

Create a histogram of the beauty variable and briefly comment on the distribution of data

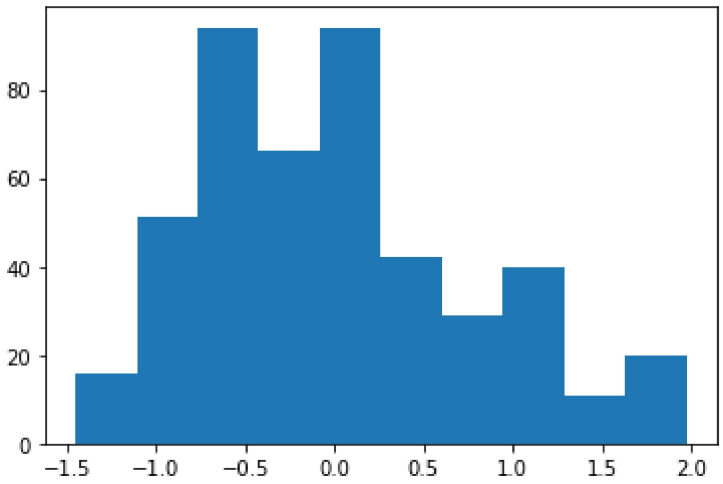
using the `matplotlib` library, create a histogram

In [12]:

```
pyplot.hist(ratings_df['beauty'])
```

Out[12]:

```
(array([16., 51., 94., 66., 94., 42., 29., 40., 11., 20.]),
 array([-1.45049405, -1.10844234, -0.76639063, -0.42433892, -0.08228722,
        0.25976449,  0.6018162 ,  0.94386791,  1.28591962,  1.62797133,
        1.97002304]),
 <BarContainer object of 10 artists>)
```



here are few conclusions from the histogram most of the data for beauty is around the -0.5 and 0 the distribution is skewed to the right therefore looking at the data we can say the mean is close to 0

Does average beauty score differ by gender? Produce the means and standard deviations for both male and female instructors.

Use a group by gender to view the mean scores of the beauty we can say that beauty scores differ by gender as the mean beauty score for women is higher than men

In [13]:

```
ratings_df.groupby('gender').agg({'beauty':['mean', 'std', 'var']}).reset_index()
```

Out[13]:

	gender	beauty		
		mean	std	var
0	female	0.116109	0.81781	0.668813
1	male	-0.084482	0.75713	0.573246

Calculate the percentage of males and females that are tenured professors. Will you say that tenure status differ by gender?

First groupby to get the total sum

In [14]:

```
tenure_count = ratings_df[ratings_df.tenure == 'yes'].groupby('gender').agg({'tenure':
'count'}).reset_index()
```

Find the percentage

In [15]:

```
tenure_count['percentage'] = 100 * tenure_count.tenure/tenure_count.tenure.sum()
tenure_count
```

Out[15]:

	gender	tenure	percentage
0	female	145	40.166205
1	male	216	59.833795

Practice Questions

Question 1: Calculate the percentage of visible minorities are tenure professors. Will you say that tenure status differed if teacher was a visible minority?

In [16]:

```
## insert code here
tenure_count = ratings_df.groupby('minority').agg({'tenure':'count'}).reset_index()
tenure_count['percentage'] = 100* tenure_count.tenure/tenure_count.tenure.sum()
tenure_count
```

Out[16]:

	minority	tenure	percentage
0	no	399	86.177106
1	yes	64	13.822894

Double-click **here** for the solution.

Question 2: Does average age differ by tenure? Produce the means and standard deviations for both tenured and untenured professors.

In [19]:

```
## insert code here
ratings_df.groupby('tenure').agg({'age':['mean','std']}).reset_index
```

Out[19]:

```
<bound method DataFrame.reset_index of              age
             mean        std
tenure
no       50.186275   6.946372
yes      47.850416  10.420056>
```

Double-click **here** for the solution.

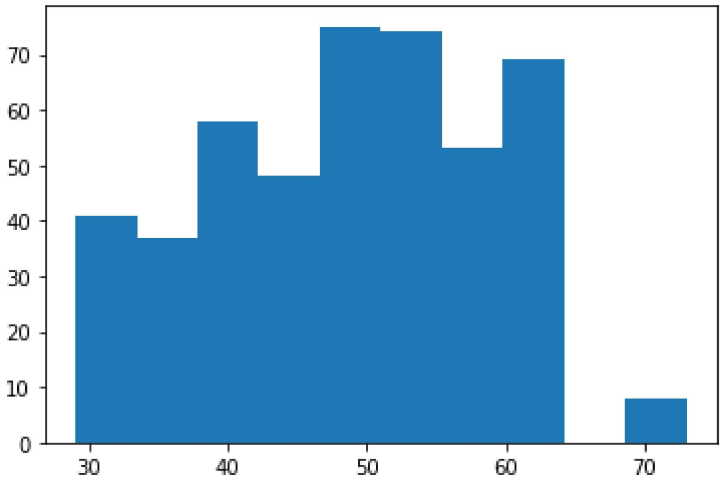
Question 3: Create a histogram for the age variable.

In [20]:

```
## insert code here
pyplot.hist(ratings_df['age'])
```

Out[20]:

```
(array([41., 37., 58., 48., 75., 74., 53., 69.,  0.,  8.]),
 array([29. , 33.4, 37.8, 42.2, 46.6, 51. , 55.4, 59.8, 64.2, 68.6, 73.
]),
 <BarContainer object of 10 artists>)
```



Double-click **here** for the solution.

Question 4: What is the Median evaluation score for tenured Professors?

In [21]:

```
## insert code here
ratings_df[ratings_df['tenure']=='yes']['eval'].median()
```

Out[21]:

```
4.0
```

Double-click **here** for the solution.

Authors

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Change Log

Date (YYYY-MM-DD)	Version	Changed By	Change Description
2020-08-14	0.1	Aije Egwaikhide	Created the initial version of the lab