Practical No. 1

April 29, 2025

[ ]:
```
import pandas as pd
import numpy as np
```

[ ]:
```
data=pd.read_csv("Untitled Folder/vehicles.csv")
```

[ ]:
```
data
```

```
              id                                                url  \
0     7222695916  https://prescott.craigslist.org/cto/d/prescott…
1     7218891961  https://fayar.craigslist.org/ctd/d/bentonville…
2     7221797935  https://keys.craigslist.org/cto/d/summerland-k…
3     7222270760  https://worcester.craigslist.org/cto/d/west-br…
4     7210384030  https://greensboro.craigslist.org/cto/d/trinit…
…            …                                                 …
1996  7308972392  https://dothan.craigslist.org/ctd/d/alachua-20…
1997  7308971633  https://dothan.craigslist.org/ctd/d/alachua-20…
1998  7308831024  https://dothan.craigslist.org/ctd/d/dothan-201…
1999  7308801755  https://dothan.craigslist.org/ctd/d/alachua-20…
2000  7308801682  https://dothan.craigslist.org/ctd/d/alachua-20…

                      region                        region_url  price  \
0                   prescott    https://prescott.craigslist.org   6000
1               fayetteville       https://fayar.craigslist.org  11900
2               florida keys        https://keys.craigslist.org  21000
3     worcester / central MA   https://worcester.craigslist.org   1500
4                 greensboro  https://greensboro.craigslist.org   4900
…                        …                                 …    …
1996                dothan      https://dothan.craigslist.org  17860
1997                dothan      https://dothan.craigslist.org  54488
1998                dothan      https://dothan.craigslist.org  33990
1999                dothan      https://dothan.craigslist.org      3
2000                dothan      https://dothan.craigslist.org  18681

        year manufacturer                    model condition    cylinders  \
0        NaN          NaN                      NaN       NaN          NaN
1        NaN          NaN                      NaN       NaN          NaN
2        NaN          NaN                      NaN       NaN          NaN
3        NaN          NaN                      NaN       NaN          NaN
```

```
4        NaN          NaN                       NaN       NaN          NaN
…         …           …                         …         …            …
1996  2014.0         jeep   grand cherokee limited       NaN          NaN
1997  2020.0         ford         f-150 lariat 4wd       NaN          NaN
1998  2017.0          ram  1500 crew cab tradesman      good  8 cylinders
1999  2020.0         ford          fusion se sedan       NaN          NaN
2000  2019.0       nissan      altima 2.5 sr sedan       NaN          NaN

      … size    type paint_color  \
0     …  NaN     NaN         NaN
1     …  NaN     NaN         NaN
2     …  NaN     NaN         NaN
3     …  NaN     NaN         NaN
4     …  NaN     NaN         NaN
…   …  …     …          …
1996  …  NaN     NaN         NaN
1997  …  NaN     NaN         NaN
1998  …  NaN  pickup        blue
1999  …  NaN     NaN         NaN
2000  …  NaN     NaN         NaN

                                                image_url  \
0                                                     NaN
1                                                     NaN
2                                                     NaN
3                                                     NaN
4                                                     NaN
…                                                     …
1996  https://images.craigslist.org/00O0O_ijP2Qx9vMi…
1997  https://images.craigslist.org/00U0U_dTOexEOB2l…
1998  https://images.craigslist.org/00Y0Y_jRbwm0dSjS…
1999  https://images.craigslist.org/00E0E_b3RHuW4jYv…
2000  https://images.craigslist.org/00101_lBMiBbuKBr…

                                              description county state  \
0                                                     NaN    NaN    az
1                                                     NaN    NaN    ar
2                                                     NaN    NaN    fl
3                                                     NaN    NaN    ma
4                                                     NaN    NaN    nc
…                                                     …      …      …
1996  2014 JEEP GRAND CHEROKEE LIMITED ~ Hundreds of…    NaN    al
1997  2020 FORD F-150 LARIAT 4WD / F150 4X4 TRUCK ~ …    NaN    al
1998  Carvana is the safer way to buy a car During t…    NaN    al
1999  2020 FORD FUSION SE SEDAN ~ Hundreds of NEW & …    NaN    al
2000  2019 NISSAN ALTIMA 2.5 SR SEDAN ~ Hundreds of …    NaN    al

            lat       long             posting_date
```

```
0           NaN        NaN                        NaN
1           NaN        NaN                        NaN
2           NaN        NaN                        NaN
3           NaN        NaN                        NaN
4           NaN        NaN                        NaN
…           …          …                          …
1996  29.801374 -82.531052  2021-04-18T17:15:59-0500
1997  29.802119 -82.529850  2021-04-18T17:14:22-0500
1998  31.230000 -85.400000  2021-04-18T12:50:51-0500
1999  29.803337 -82.528074  2021-04-18T11:59:35-0500
2000  29.802566 -82.529678  2021-04-18T11:59:27-0500

[2001 rows x 26 columns]
```

[ ]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2001 entries, 0 to 2000
Data columns (total 26 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   id            2001 non-null   int64
 1   url           2001 non-null   object
 2   region        2001 non-null   object
 3   region_url    2001 non-null   object
 4   price         2001 non-null   int64
 5   year          1952 non-null   float64
 6   manufacturer  1831 non-null   object
 7   model         1961 non-null   object
 8   condition     1122 non-null   object
 9   cylinders     1258 non-null   object
 10  fuel          1940 non-null   object
 11  odometer      1962 non-null   float64
 12  title_status  1871 non-null   object
 13  transmission  1973 non-null   object
 14  VIN           1268 non-null   object
 15  drive         1363 non-null   object
 16  size          493 non-null    object
 17  type          1380 non-null   object
 18  paint_color   1534 non-null   object
 19  image_url     1974 non-null   object
 20  description   1974 non-null   object
 21  county        0 non-null      float64
 22  state         2001 non-null   object
 23  lat           1962 non-null   float64
 24  long          1962 non-null   float64
 25  posting_date  1974 non-null   object
dtypes: float64(5), int64(2), object(19)
```

```
memory usage: 406.6+ KB
```

[ ]:
```
data.describe()
```

```
                 id         price         year      odometer  county  \
count  2.001000e+03  2.001000e+03  1952.000000  1.962000e+03     0.0
mean   7.308532e+09  5.625151e+05  2011.201332  2.038947e+05     NaN
std    1.150144e+07  2.219042e+07     9.704075  9.915782e+05     NaN
min    7.208550e+09  0.000000e+00  1903.000000  0.000000e+00     NaN
25%    7.305754e+09  5.500000e+03  2008.000000  2.967350e+04     NaN
50%    7.310397e+09  1.720000e+04  2013.000000  8.799700e+04     NaN
75%    7.313504e+09  2.998000e+04  2017.000000  1.572288e+05     NaN
max    7.316878e+09  9.876543e+08  2021.000000  9.999999e+06     NaN

               lat         long
count  1962.000000  1962.000000
mean     33.735365   -85.549365
std       2.167945     3.375666
min      26.021800  -122.693000
25%      32.922900   -86.817617
50%      33.455361   -86.737847
75%      33.736288   -85.480000
max      44.120200   -73.572300
```

[ ]:
```
data.head(5)
```

```
           id                                                url  \
0  7222695916  https://prescott.craigslist.org/cto/d/prescott…
1  7218891961  https://fayar.craigslist.org/ctd/d/bentonville…
2  7221797935  https://keys.craigslist.org/cto/d/summerland-k…
3  7222270760  https://worcester.craigslist.org/cto/d/west-br…
4  7210384030  https://greensboro.craigslist.org/cto/d/trinit…

                  region                          region_url  price  year  \
0               prescott    https://prescott.craigslist.org   6000   NaN
1           fayetteville       https://fayar.craigslist.org  11900   NaN
2           florida keys        https://keys.craigslist.org  21000   NaN
3  worcester / central MA   https://worcester.craigslist.org   1500   NaN
4             greensboro  https://greensboro.craigslist.org   4900   NaN

  manufacturer model condition cylinders  … size  type paint_color  \
0          NaN   NaN       NaN       NaN  …  NaN   NaN         NaN
1          NaN   NaN       NaN       NaN  …  NaN   NaN         NaN
2          NaN   NaN       NaN       NaN  …  NaN   NaN         NaN
3          NaN   NaN       NaN       NaN  …  NaN   NaN         NaN
4          NaN   NaN       NaN       NaN  …  NaN   NaN         NaN

  image_url description county state lat long posting_date
```

```
0       NaN         NaN    NaN    az NaN  NaN          NaN
1       NaN         NaN    NaN    ar NaN  NaN          NaN
2       NaN         NaN    NaN    fl NaN  NaN          NaN
3       NaN         NaN    NaN    ma NaN  NaN          NaN
4       NaN         NaN    NaN    nc NaN  NaN          NaN

[5 rows x 26 columns]
```

[ ]:
```
data.tail()
```

```
             id                                                url  region  \
1996  7308972392  https://dothan.craigslist.org/ctd/d/alachua-20…  dothan
1997  7308971633  https://dothan.craigslist.org/ctd/d/alachua-20…  dothan
1998  7308831024  https://dothan.craigslist.org/ctd/d/dothan-201…  dothan
1999  7308801755  https://dothan.craigslist.org/ctd/d/alachua-20…  dothan
2000  7308801682  https://dothan.craigslist.org/ctd/d/alachua-20…  dothan

                        region_url  price    year manufacturer  \
1996  https://dothan.craigslist.org  17860  2014.0         jeep
1997  https://dothan.craigslist.org  54488  2020.0         ford
1998  https://dothan.craigslist.org  33990  2017.0          ram
1999  https://dothan.craigslist.org      3  2020.0         ford
2000  https://dothan.craigslist.org  18681  2019.0       nissan

                       model condition    cylinders  … size    type  \
1996   grand cherokee limited       NaN          NaN  …  NaN     NaN
1997         f-150 lariat 4wd       NaN          NaN  …  NaN     NaN
1998  1500 crew cab tradesman      good  8 cylinders  …  NaN  pickup
1999          fusion se sedan       NaN          NaN  …  NaN     NaN
2000      altima 2.5 sr sedan       NaN          NaN  …  NaN     NaN

     paint_color                                          image_url  \
1996         NaN  https://images.craigslist.org/00O0O_ijP2Qx9vMi…
1997         NaN  https://images.craigslist.org/00U0U_dTOexEOB2l…
1998        blue  https://images.craigslist.org/00Y0Y_jRbwm0dSjS…
1999         NaN  https://images.craigslist.org/00E0E_b3RHuW4jYv…
2000         NaN  https://images.craigslist.org/00101_lBMiBbuKBr…

                                          description county state  \
1996  2014 JEEP GRAND CHEROKEE LIMITED ~ Hundreds of…    NaN    al
1997  2020 FORD F-150 LARIAT 4WD / F150 4X4 TRUCK ~ …    NaN    al
1998  Carvana is the safer way to buy a car During t…    NaN    al
1999  2020 FORD FUSION SE SEDAN ~ Hundreds of NEW & …    NaN    al
2000  2019 NISSAN ALTIMA 2.5 SR SEDAN ~ Hundreds of …    NaN    al

           lat       long              posting_date
1996  29.801374 -82.531052  2021-04-18T17:15:59-0500
1997  29.802119 -82.529850  2021-04-18T17:14:22-0500
```

```
1998  31.230000 -85.400000  2021-04-18T12:50:51-0500
1999  29.803337 -82.528074  2021-04-18T11:59:35-0500
2000  29.802566 -82.529678  2021-04-18T11:59:27-0500

[5 rows x 26 columns]
```

[ ]:
```
data.isnull().sum()
```

```
id                0
url               0
region            0
region_url        0
price             0
year             49
manufacturer    170
model            40
condition       879
cylinders       743
fuel             61
odometer         39
title_status    130
transmission     28
VIN             733
drive           638
size           1508
type            621
paint_color     467
image_url        27
description      27
county         2001
state             0
lat              39
long             39
posting_date     27
dtype: int64
```

[ ]:
```
data['price'].dtype
```

```
dtype('int64')
```

[ ]:
```
data['price']=data['price'].astype('float')
```

[ ]:
```
data['price'].dtype
```

```
dtype('float64')
```

[ ]:
```
data['odometer'].replace(np.nan, data['odometer'].mean(), inplace=True)
```

[ ]:
```
data.isnull().sum()
```

```
id                0
url               0
region            0
region_url        0
price             0
year             49
manufacturer    170
model            40
condition       879
cylinders       743
fuel             61
odometer          0
title_status    130
transmission     28
VIN             733
drive           638
size           1508
type            621
paint_color     467
image_url        27
description      27
county         2001
state             0
lat              39
long             39
posting_date     27
dtype: int64
```

[ ]:
```

```

[ ]:
```

```

[ ]:
```
data=pd.read_csv("Untitled Folder/vehicles.csv")
```

[ ]:
```
data
```

[ ]:
```
data.info()
```

[ ]:
```
data.describe()
```

[ ]:
```
data.head(5)
```

[ ]:
```
data.tail()
```

[ ]:
```
data.isnull().sum()
```

[ ]:
```
data['price'].dtype
```

[ ]:
```
data['price']=data['price'].astype('float')
```

[ ]:
```
data['price'].dtype
```

[ ]:
```
data['odometer'].replace(np.nan, data['odometer'].mean(), inplace=True)
```

[ ]:
```
data.isnull().sum()
```

[ ]:
```

```

[ ]:
```

```

Practical No. 2

April 29, 2025

[8]:
```
import numpy as np
import pandas as pd
```

[10]:
```
data=pd.read_csv("AcademicPerformance.csv")
```

[16]:
```
data
```

[16]:

	gender	NationalITy	PlaceofBirth	StageID	GradeID	SectionID
0	M	KW	KuwaIT	lowerlevel	G-04	A
1	M	KW	KuwaIT	lowerlevel	G-04	NaN
2	M	KW	KuwaIT	lowerlevel	G-04	A
3	NaN	KW	KuwaIT	lowerlevel	G-04	A
4	M	KW	KuwaIT	lowerlevel	G-04	A
..	…	…	…	…	…	…
475	F	Jordan	Jordan	MiddleSchool	G-08	A
476	F	Jordan	Jordan	MiddleSchool	G-08	A
477	F	Jordan	Jordan	MiddleSchool	G-08	A
478	F	Jordan	Jordan	MiddleSchool	G-08	A
479	F	Jordan	Jordan	MiddleSchool	G-08	A

	Topic	Semester	Relation	raisedhands	VisITedResources
0	IT	F	Father	15.0	16.0
1	IT	F	Father	20.0	20.0
2	IT	NaN	Father	10.0	7.0
3	IT	F	Father	30.0	25.0
4	IT	F	Father	40.0	50.0
..	…	…	…	…	…
475	Chemistry	S	Father	5.0	4.0
476	Geology	F	Father	50.0	77.0
477	Geology	S	Father	55.0	74.0
478	History	F	Father	30.0	17.0
479	History	S	Father	35.0	14.0

	AnnouncementsView	Discussion	ParentAnsweringSurvey
0	2.0	20	Yes
1	3.0	25	Yes
2	0.0	30	15

```
3                    5.0          35                    No
4                   12.0          50                    No
..                   …          …                     …
475                  5.0           8                    No
476                 14.0          28                    No
477                 25.0          29                    No
478                 14.0          57                    No
479                 23.0          62                    No

    ParentschoolSatisfaction StudentAbsenceDays Class
0                       Good            Under-7     M
1                       Good            Under-7     M
2                        Bad            Above-7     L
3                        Bad            Above-7     L
4                        Bad            Above-7     M
..                       …                 …   …
475                      Bad            Above-7     L
476                      Bad            Under-7     M
477                      Bad            Under-7     M
478                      Bad            Above-7     L
479                      Bad            Above-7     L

[480 rows x 17 columns]
```

[15]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 480 entries, 0 to 479
Data columns (total 17 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   gender                    470 non-null    object
 1   NationalITy               480 non-null    object
 2   PlaceofBirth              480 non-null    object
 3   StageID                   480 non-null    object
 4   GradeID                   480 non-null    object
 5   SectionID                 474 non-null    object
 6   Topic                     480 non-null    object
 7   Semester                  471 non-null    object
 8   Relation                  480 non-null    object
 9   raisedhands               470 non-null    float64
 10  VisITedResources          475 non-null    float64
 11  AnnouncementsView         476 non-null    float64
 12  Discussion                480 non-null    int64
 13  ParentAnsweringSurvey     480 non-null    object
 14  ParentschoolSatisfaction  480 non-null    object
 15  StudentAbsenceDays        480 non-null    object
```

```
 16  Class                     480 non-null    object
dtypes: float64(3), int64(1), object(13)
memory usage: 63.9+ KB
```

[12]:
```
data.isnull()
```

[12]:
```
     gender  NationalITy  PlaceofBirth  StageID  GradeID  SectionID  Topic  \
0     False        False         False    False    False      False  False
1     False        False         False    False    False       True  False
2     False        False         False    False    False      False  False
3      True        False         False    False    False      False  False
4     False        False         False    False    False      False  False
..      …            …             …        …        …          …    …
475   False        False         False    False    False      False  False
476   False        False         False    False    False      False  False
477   False        False         False    False    False      False  False
478   False        False         False    False    False      False  False
479   False        False         False    False    False      False  False

     Semester  Relation  raisedhands  VisITedResources  AnnouncementsView  \
0       False     False        False             False              False
1       False     False        False             False              False
2        True     False        False             False              False
3       False     False        False             False              False
4       False     False        False             False              False
..        …         …            …                 …                  …
475     False     False        False             False              False
476     False     False        False             False              False
477     False     False        False             False              False
478     False     False        False             False              False
479     False     False        False             False              False

     Discussion  ParentAnsweringSurvey  ParentschoolSatisfaction  \
0         False                  False                     False
1         False                  False                     False
2         False                  False                     False
3         False                  False                     False
4         False                  False                     False
..          …                      …                         …
475       False                  False                     False
476       False                  False                     False
477       False                  False                     False
478       False                  False                     False
479       False                  False                     False

     StudentAbsenceDays  Class
0                 False  False
```

```
1                False  False
2                False  False
3                False  False
4                False  False
..                 …    …
475              False  False
476              False  False
477              False  False
478              False  False
479              False  False

[480 rows x 17 columns]
```

[14]:
```
data.isnull().sum()
```

[14]:
```
gender                     10
NationalITy                 0
PlaceofBirth                0
StageID                     0
GradeID                     0
SectionID                   6
Topic                       0
Semester                    9
Relation                    0
raisedhands                10
VisITedResources            5
AnnouncementsView           4
Discussion                  0
ParentAnsweringSurvey       0
ParentschoolSatisfaction    0
StudentAbsenceDays          0
Class                       0
dtype: int64
```

[22]:
```
data.fillna(0)
```

[22]:
```
    gender NationalITy PlaceofBirth       StageID GradeID SectionID  \
0        M          KW       KuwaIT    lowerlevel    G-04         A
1        M          KW       KuwaIT    lowerlevel    G-04         0
2        M          KW       KuwaIT    lowerlevel    G-04         A
3        0          KW       KuwaIT    lowerlevel    G-04         A
4        M          KW       KuwaIT    lowerlevel    G-04         A
..     …          …           …           …     …       …
475      F      Jordan       Jordan  MiddleSchool    G-08         A
476      F      Jordan       Jordan  MiddleSchool    G-08         A
477      F      Jordan       Jordan  MiddleSchool    G-08         A
478      F      Jordan       Jordan  MiddleSchool    G-08         A
```

```
479      F      Jordan       Jordan  MiddleSchool    G-08         A

         Topic Semester Relation  raisedhands  VisITedResources  \
0           IT        F   Father         15.0              16.0
1           IT        F   Father         20.0              20.0
2           IT        0   Father         10.0               7.0
3           IT        F   Father         30.0              25.0
4           IT        F   Father         40.0              50.0
..         …      …       …           …                 …
475  Chemistry        S   Father          5.0               4.0
476    Geology        F   Father         50.0              77.0
477    Geology        S   Father         55.0              74.0
478    History        F   Father         30.0              17.0
479    History        S   Father         35.0              14.0

     AnnouncementsView  Discussion ParentAnsweringSurvey  \
0                  2.0          20                   Yes
1                  3.0          25                   Yes
2                  0.0          30                    15
3                  5.0          35                    No
4                 12.0          50                    No
..                 …           …                    …
475                5.0           8                    No
476               14.0          28                    No
477               25.0          29                    No
478               14.0          57                    No
479               23.0          62                    No

    ParentschoolSatisfaction StudentAbsenceDays Class
0                       Good            Under-7     M
1                       Good            Under-7     M
2                        Bad            Above-7     L
3                        Bad            Above-7     L
4                        Bad            Above-7     M
..                       …                 …   …
475                      Bad            Above-7     L
476                      Bad            Under-7     M
477                      Bad            Under-7     M
478                      Bad            Above-7     L
479                      Bad            Above-7     L

[480 rows x 17 columns]
```

[19]:
```
data.isnull().sum()
```

[19]:
```
gender                    10
NationalITy                0
```

```
PlaceofBirth                0
StageID                     0
GradeID                     0
SectionID                   6
Topic                       0
Semester                    9
Relation                    0
raisedhands                10
VisITedResources            5
AnnouncementsView           4
Discussion                  0
ParentAnsweringSurvey       0
ParentschoolSatisfaction    0
StudentAbsenceDays          0
Class                       0
dtype: int64
```

[ ]:

Practical No. 3

April 29, 2025

[ ]:
```
import pandas as pd
```

[4]:
```
data = pd.read_csv("loan_data.csv")
data
```

[4]:

	Loan_ID	Gender	Age	Married	Dependents	Education	Self_Employed	\
0	LP001002	Male	35.0	No	0	Graduate	No	
1	LP001003	Male	NaN	Yes	1	Graduate	No	
2	LP001005	Male	25.0	Yes	0	Graduate	Yes	
3	LP001006	Male	26.0	Yes	0	Not Graduate	No	
4	LP001008	Male	30.0	No	0	Graduate	No	
..	…	…	…	…	…	…	…	
609	LP002978	Female	25.0	No	0	Graduate	No	
610	LP002979	Male	50.0	Yes	3+	Graduate	No	
611	LP002983	Male	38.0	Yes	1	Graduate	No	
612	LP002984	Male	45.0	Yes	2	Graduate	No	
613	LP002990	Female	26.0	No	0	Graduate	Yes	

	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	\
0	5849	0.0	NaN	360.0	
1	4583	1508.0	128.0	360.0	
2	3000	0.0	66.0	360.0	
3	2583	2358.0	120.0	360.0	
4	6000	0.0	141.0	360.0	
..	…	…	…	…	
609	2900	0.0	71.0	360.0	
610	4106	0.0	40.0	180.0	
611	8072	240.0	253.0	360.0	
612	7583	0.0	187.0	360.0	
613	4583	0.0	133.0	360.0	

	Credit_History	Property_Area	Loan_Status
0	1.0	Urban	Y
1	1.0	Rural	N
2	1.0	Urban	Y
3	1.0	Urban	Y
4	1.0	Urban	Y

```
..              …           …         …
609             1.0         Rural           Y
610             1.0         Rural           Y
611             1.0         Urban           Y
612             1.0         Urban           Y
613             0.0     Semiurban           N

[614 rows x 14 columns]
```

[5]:
```
data.head()
```

[5]:
```
    Loan_ID Gender   Age Married Dependents     Education Self_Employed  \
0  LP001002   Male  35.0      No          0      Graduate            No
1  LP001003   Male   NaN     Yes          1      Graduate            No
2  LP001005   Male  25.0     Yes          0      Graduate           Yes
3  LP001006   Male  26.0     Yes          0  Not Graduate            No
4  LP001008   Male  30.0      No          0      Graduate            No

   ApplicantIncome  CoapplicantIncome  LoanAmount  Loan_Amount_Term  \
0             5849                0.0         NaN             360.0
1             4583             1508.0       128.0             360.0
2             3000                0.0        66.0             360.0
3             2583             2358.0       120.0             360.0
4             6000                0.0       141.0             360.0

   Credit_History Property_Area Loan_Status
0             1.0         Urban           Y
1             1.0         Rural           N
2             1.0         Urban           Y
3             1.0         Urban           Y
4             1.0         Urban           Y
```

[6]:
```
data.tail()
```

[6]:
```
      Loan_ID  Gender   Age Married Dependents Education Self_Employed  \
609  LP002978  Female  25.0      No          0  Graduate            No
610  LP002979    Male  50.0     Yes         3+  Graduate            No
611  LP002983    Male  38.0     Yes          1  Graduate            No
612  LP002984    Male  45.0     Yes          2  Graduate            No
613  LP002990  Female  26.0      No          0  Graduate           Yes

     ApplicantIncome  CoapplicantIncome  LoanAmount  Loan_Amount_Term  \
609             2900                0.0        71.0             360.0
610             4106                0.0        40.0             180.0
611             8072              240.0       253.0             360.0
612             7583                0.0       187.0             360.0
613             4583                0.0       133.0             360.0
```

```
     Credit_History Property_Area Loan_Status
609             1.0         Rural           Y
610             1.0         Rural           Y
611             1.0         Urban           Y
612             1.0         Urban           Y
613             0.0     Semiurban           N
```

[7]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 614 entries, 0 to 613
Data columns (total 14 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Loan_ID            614 non-null    object
 1   Gender             601 non-null    object
 2   Age                513 non-null    float64
 3   Married            611 non-null    object
 4   Dependents         599 non-null    object
 5   Education          614 non-null    object
 6   Self_Employed      582 non-null    object
 7   ApplicantIncome    614 non-null    int64
 8   CoapplicantIncome  614 non-null    float64
 9   LoanAmount         592 non-null    float64
 10  Loan_Amount_Term   600 non-null    float64
 11  Credit_History     564 non-null    float64
 12  Property_Area      614 non-null    object
 13  Loan_Status        614 non-null    object
dtypes: float64(5), int64(1), object(8)
memory usage: 67.3+ KB
```

[8]:
```
data.describe()
```

[8]:
```
              Age  ApplicantIncome  CoapplicantIncome  LoanAmount  \
count  513.000000       614.000000         614.000000  592.000000
mean    32.101365      5403.459283        1621.245798  146.412162
std      7.732178      6109.041673        2926.248369   85.587325
min     24.000000       150.000000           0.000000    9.000000
25%     25.000000      2877.500000           0.000000  100.000000
50%     30.000000      3812.500000        1188.500000  128.000000
75%     38.000000      5795.000000        2297.250000  168.000000
max     56.000000     81000.000000       41667.000000  700.000000

       Loan_Amount_Term  Credit_History
count         600.00000      564.000000
mean          342.00000        0.842199
```

```
std            65.12041        0.364878
min            12.00000        0.000000
25%           360.00000        1.000000
50%           360.00000        1.000000
75%           360.00000        1.000000
max           480.00000        1.000000
```

[9]:
```
data.isnull().sum()
```

[9]:
```
Loan_ID               0
Gender               13
Age                 101
Married               3
Dependents           15
Education             0
Self_Employed        32
ApplicantIncome       0
CoapplicantIncome     0
LoanAmount           22
Loan_Amount_Term     14
Credit_History       50
Property_Area         0
Loan_Status           0
dtype: int64
```

[10]:
```
data.mean()
```

```
C:\Users\ADMIN\AppData\Local\Temp\ipykernel_17776\531903386.py:1: FutureWarning:
Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None')
is deprecated; in a future version this will raise TypeError.  Select only valid
columns before calling the reduction.
  data.mean()
```

[10]:
```
Age                  32.101365
ApplicantIncome    5403.459283
CoapplicantIncome  1621.245798
LoanAmount          146.412162
Loan_Amount_Term    342.000000
Credit_History        0.842199
dtype: float64
```

[13]:
```
data['LoanAmount'].mean()
```

[13]:
```
146.41216216216216
```

[14]:
```
data['Loan_Amount_Term'].mean()
```

[14]:
```
342.0
```

[15]:
```
data.median()
```

```
C:\Users\ADMIN\AppData\Local\Temp\ipykernel_17776\4184645713.py:1:
FutureWarning: Dropping of nuisance columns in DataFrame reductions (with
'numeric_only=None') is deprecated; in a future version this will raise
TypeError.  Select only valid columns before calling the reduction.
  data.median()
```

[15]:
```
Age                  30.0
ApplicantIncome    3812.5
CoapplicantIncome  1188.5
LoanAmount          128.0
Loan_Amount_Term    360.0
Credit_History        1.0
dtype: float64
```

[16]:
```
data['Age'].median()
```

[16]:
```
30.0
```

[17]:
```
data.min()
```

```
C:\Users\ADMIN\AppData\Local\Temp\ipykernel_17776\927168777.py:1: FutureWarning:
Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None')
is deprecated; in a future version this will raise TypeError.  Select only valid
columns before calling the reduction.
  data.min()
```

[17]:
```
Loan_ID              LP001002
Age                      24.0
Education            Graduate
ApplicantIncome           150
CoapplicantIncome         0.0
LoanAmount                9.0
Loan_Amount_Term         12.0
Credit_History            0.0
Property_Area           Rural
Loan_Status                 N
dtype: object
```

[18]:
```
data.std()
```

```
C:\Users\ADMIN\AppData\Local\Temp\ipykernel_17776\2723740006.py:1:
FutureWarning: Dropping of nuisance columns in DataFrame reductions (with
'numeric_only=None') is deprecated; in a future version this will raise
```

```
TypeError.  Select only valid columns before calling the reduction.
  data.std()
```

[18]:
```
Age                    7.732178
ApplicantIncome     6109.041673
CoapplicantIncome   2926.248369
LoanAmount            85.587325
Loan_Amount_Term      65.120410
Credit_History         0.364878
dtype: float64
```

[19]:
```
data['Age'].std()
```

[19]:
```
7.732178229043358
```

[21]:
```
data.groupby('Age').count()
```

[21]:

Age	Loan_ID	Gender	Married	Dependents	Education	Self_Employed
24.0	22	21	21	19	22	20
25.0	107	105	107	105	107	102
26.0	87	86	87	87	87	81
27.0	23	23	22	22	23	22
28.0	4	4	4	4	4	2
30.0	53	53	53	52	53	52
31.0	23	22	23	20	23	23
32.0	18	18	18	18	18	18
35.0	7	7	7	6	7	7
37.0	18	17	18	18	18	16
38.0	23	23	23	23	23	23
40.0	22	20	22	22	22	20
42.0	4	4	4	4	4	4
43.0	45	44	45	42	45	40
45.0	31	31	30	30	31	30
46.0	6	6	6	6	6	5
47.0	18	17	18	18	18	18
50.0	1	1	1	1	1	1
56.0	1	1	1	1	1	1

Age	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term
24.0	22	22	21	21
25.0	107	107	102	104
26.0	87	87	86	86
27.0	23	23	22	21
28.0	4	4	3	3
30.0	53	53	51	52

31.0	23	23	22	23
32.0	18	18	17	17
35.0	7	7	6	6
37.0	18	18	17	18
38.0	23	23	22	23
40.0	22	22	22	22
42.0	4	4	4	4
43.0	45	45	44	44
45.0	31	31	31	31
46.0	6	6	6	6
47.0	18	18	18	18
50.0	1	1	1	1
56.0	1	1	1	1

Age	Credit_History	Property_Area	Loan_Status
24.0	20	22	22
25.0	100	107	107
26.0	81	87	87
27.0	23	23	23
28.0	4	4	4
30.0	47	53	53
31.0	20	23	23
32.0	15	18	18
35.0	7	7	7
37.0	16	18	18
38.0	23	23	23
40.0	19	22	22
42.0	4	4	4
43.0	41	45	45
45.0	27	31	31
46.0	6	6	6
47.0	14	18	18
50.0	1	1	1
56.0	1	1	1

0.1 3.2 iris.csv Dataset

[28]:
```
data=pd.read_csv("iris.csv")
data
```

[28]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	\
0	1	5.1	3.5	1.4	0.2	
1	2	4.9	3.0	1.4	0.2	
2	3	4.7	3.2	1.3	0.2	
3	4	4.6	3.1	1.5	0.2	
4	5	5.0	3.6	1.4	0.2	

```
..   …             …           …             …           …
145  146           6.7         3.0           5.2         2.3
146  147           6.3         2.5           5.0         1.9
147  148           6.5         3.0           5.2         2.0
148  149           6.2         3.4           5.4         2.3
149  150           5.9         3.0           5.1         1.8

            Species
0       Iris-setosa
1       Iris-setosa
2       Iris-setosa
3       Iris-setosa
4       Iris-setosa
..              …
145  Iris-virginica
146  Iris-virginica
147  Iris-virginica
148  Iris-virginica
149  Iris-virginica

[150 rows x 6 columns]
```

[31]:
```
data.groupby('Species').count()
```

[31]:
```
                Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm
Species
Iris-setosa     50             50            50             50            50
Iris-versicolor 50             50            50             50            50
Iris-virginica  50             50            50             50            50
```

[33]:
```
data.groupby('Species').mean()
```

[33]:
```
                   Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  \
Species
Iris-setosa      25.5          5.006         3.418          1.464
Iris-versicolor  75.5          5.936         2.770          4.260
Iris-virginica  125.5          6.588         2.974          5.552

                 PetalWidthCm
Species
Iris-setosa             0.244
Iris-versicolor         1.326
Iris-virginica          2.026
```

[41]:
```
data.Species.mode()
```

[41]:
```
0        Iris-setosa
1    Iris-versicolor
2     Iris-virginica
Name: Species, dtype: object
```

0.2 Standard Deviation

[44]:
```
data.SepalWidthCm.std()
```

[44]:
```
0.4335943113621737
```

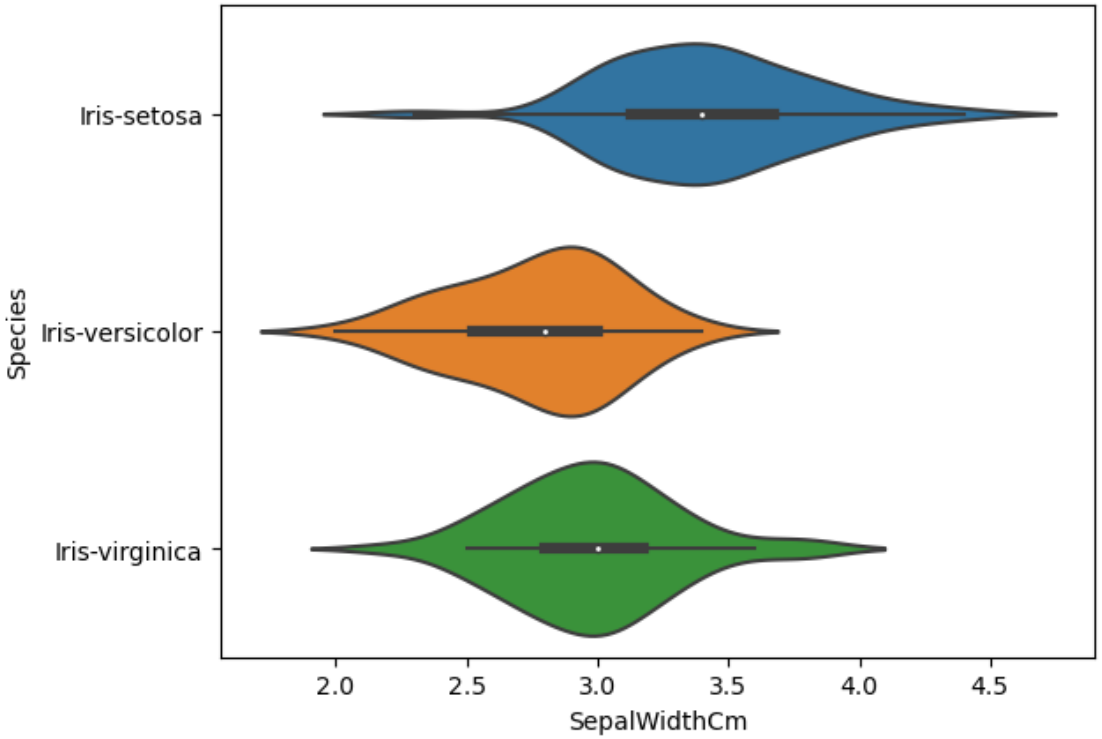
[42]:
```
data.SepalLengthCm.std()
```

[42]:
```
0.8280661279778629
```

[39]:
```
# Violien Plot of Graph

import seaborn as sns
sns.violinplot(x="SepalWidthCm", y="Species", data=df)
```

[39]:
```
<AxesSubplot:xlabel='SepalWidthCm', ylabel='Species'>
```



[46]:
```
data.corr(method='pearson')
```

[46]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm
Id	1.000000	0.716676	-0.397729	0.882747	0.899759
SepalLengthCm	0.716676	1.000000	-0.109369	0.871754	0.817954
SepalWidthCm	-0.397729	-0.109369	1.000000	-0.420516	-0.356544
PetalLengthCm	0.882747	0.871754	-0.420516	1.000000	0.962757
PetalWidthCm	0.899759	0.817954	-0.356544	0.962757	1.000000

[ ]:

Practical No. 4

April 29, 2025

[6]:
```
import numpy as np
import pandas as pd
boston = pd.DataFrame(housing_data.data)
boston.columns = housing_data.feature_names
boston
```

[6]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	\
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0	
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2.0	242.0	
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2.0	242.0	
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3.0	222.0	
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3.0	222.0	
..	…	…	…	…	…	…	…	…	…	…	
501	0.06263	0.0	11.93	0.0	0.573	6.593	69.1	2.4786	1.0	273.0	
502	0.04527	0.0	11.93	0.0	0.573	6.120	76.7	2.2875	1.0	273.0	
503	0.06076	0.0	11.93	0.0	0.573	6.976	91.0	2.1675	1.0	273.0	
504	0.10959	0.0	11.93	0.0	0.573	6.794	89.3	2.3889	1.0	273.0	
505	0.04741	0.0	11.93	0.0	0.573	6.030	80.8	2.5050	1.0	273.0	

	PTRATIO	B	LSTAT
0	15.3	396.90	4.98
1	17.8	396.90	9.14
2	17.8	392.83	4.03
3	18.7	394.63	2.94
4	18.7	396.90	5.33
..	…	…	…
501	21.0	391.99	9.67
502	21.0	396.90	9.08
503	21.0	396.90	5.64
504	21.0	393.45	6.48
505	21.0	396.90	7.88

[506 rows x 13 columns]

[7]:
```
boston.head()
```

[7]:
```
      CRIM    ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD    TAX  \
0  0.00632  18.0   2.31   0.0  0.538  6.575  65.2  4.0900  1.0  296.0
1  0.02731   0.0   7.07   0.0  0.469  6.421  78.9  4.9671  2.0  242.0
2  0.02729   0.0   7.07   0.0  0.469  7.185  61.1  4.9671  2.0  242.0
3  0.03237   0.0   2.18   0.0  0.458  6.998  45.8  6.0622  3.0  222.0
4  0.06905   0.0   2.18   0.0  0.458  7.147  54.2  6.0622  3.0  222.0

   PTRATIO       B  LSTAT
0     15.3  396.90   4.98
1     17.8  396.90   9.14
2     17.8  392.83   4.03
3     18.7  394.63   2.94
4     18.7  396.90   5.33
```

[8]:
```
boston.tail()
```

[8]:
```
        CRIM   ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD    TAX  \
501  0.06263  0.0  11.93   0.0  0.573  6.593  69.1  2.4786  1.0  273.0
502  0.04527  0.0  11.93   0.0  0.573  6.120  76.7  2.2875  1.0  273.0
503  0.06076  0.0  11.93   0.0  0.573  6.976  91.0  2.1675  1.0  273.0
504  0.10959  0.0  11.93   0.0  0.573  6.794  89.3  2.3889  1.0  273.0
505  0.04741  0.0  11.93   0.0  0.573  6.030  80.8  2.5050  1.0  273.0

     PTRATIO       B  LSTAT
501     21.0  391.99   9.67
502     21.0  396.90   9.08
503     21.0  396.90   5.64
504     21.0  393.45   6.48
505     21.0  396.90   7.88
```

[10]:
```
print("The shape of the data is:")
boston.shape
```

```
The shape of the data is:
```

[10]:
```
(506, 13)
```

[16]:
```
boston.isnull().sum()
```

[16]:
```
CRIM       0
ZN         0
INDUS      0
CHAS       0
NOX        0
RM         0
AGE        0
DIS        0
```

```
RAD        0
TAX        0
PTRATIO    0
B          0
LSTAT      0
dtype: int64
```

[ ]:
```
X = boston.iloc[:,0:13]
y = boston.iloc[:,-1]
```

[ ]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.
↪20,random_state=42)
```

[21]:
```
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(404, 13)
(102, 13)
(404,)
(102,)
```

[ ]:
```
from sklearn.linear_model import LinearRegression
```

[24]:
```
from sklearn.preprocessing import StandardScaler
from sklearn.pipeline import make_pipeline
model = make_pipeline(StandardScaler(with_mean=False), LinearRegression())
model.fit(X_train, y_train)
```

[24]:
```
Pipeline(steps=[('standardscaler', StandardScaler(with_mean=False)),
                ('linearregression', LinearRegression())])
```

[25]:
```
model.score(X_test,y_test)
```

[25]:
```
1.0
```

[ ]:

[ ]:

[ ]:

[ ]:

[ ]:

[ ]:

Practical No. 4 (using sklearn)

April 29, 2025

[ ]:
```
import pandas as pd
import numpy as np
import warnings
warnings.filterwarnings('ignore')
```

[5]:
```
from sklearn.datasets import load_boston
```

[31]:
```
boston=load_boston()
data= pd.DataFrame(data=boston.data, columns=boston.feature_names)
data
```

[31]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	\
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0	
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2.0	242.0	
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2.0	242.0	
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3.0	222.0	
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3.0	222.0	
..	…	…	…	…	…	…	…	…	…	…	
501	0.06263	0.0	11.93	0.0	0.573	6.593	69.1	2.4786	1.0	273.0	
502	0.04527	0.0	11.93	0.0	0.573	6.120	76.7	2.2875	1.0	273.0	
503	0.06076	0.0	11.93	0.0	0.573	6.976	91.0	2.1675	1.0	273.0	
504	0.10959	0.0	11.93	0.0	0.573	6.794	89.3	2.3889	1.0	273.0	
505	0.04741	0.0	11.93	0.0	0.573	6.030	80.8	2.5050	1.0	273.0	

	PTRATIO	B	LSTAT
0	15.3	396.90	4.98
1	17.8	396.90	9.14
2	17.8	392.83	4.03
3	18.7	394.63	2.94
4	18.7	396.90	5.33
..	…	…	…
501	21.0	391.99	9.67
502	21.0	396.90	9.08
503	21.0	396.90	5.64
504	21.0	393.45	6.48
505	21.0	396.90	7.88

```
[506 rows x 13 columns]
```

[17]:
```
data.head()
```

[17]:
```
      CRIM    ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD    TAX  \
0  0.00632  18.0   2.31   0.0  0.538  6.575  65.2  4.0900  1.0  296.0
1  0.02731   0.0   7.07   0.0  0.469  6.421  78.9  4.9671  2.0  242.0
2  0.02729   0.0   7.07   0.0  0.469  7.185  61.1  4.9671  2.0  242.0
3  0.03237   0.0   2.18   0.0  0.458  6.998  45.8  6.0622  3.0  222.0
4  0.06905   0.0   2.18   0.0  0.458  7.147  54.2  6.0622  3.0  222.0

   PTRATIO       B  LSTAT
0     15.3  396.90   4.98
1     17.8  396.90   9.14
2     17.8  392.83   4.03
3     18.7  394.63   2.94
4     18.7  396.90   5.33
```

[18]:
```
data.tail()
```

[18]:
```
        CRIM   ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD    TAX  \
501  0.06263  0.0  11.93   0.0  0.573  6.593  69.1  2.4786  1.0  273.0
502  0.04527  0.0  11.93   0.0  0.573  6.120  76.7  2.2875  1.0  273.0
503  0.06076  0.0  11.93   0.0  0.573  6.976  91.0  2.1675  1.0  273.0
504  0.10959  0.0  11.93   0.0  0.573  6.794  89.3  2.3889  1.0  273.0
505  0.04741  0.0  11.93   0.0  0.573  6.030  80.8  2.5050  1.0  273.0

     PTRATIO       B  LSTAT
501     21.0  391.99   9.67
502     21.0  396.90   9.08
503     21.0  396.90   5.64
504     21.0  393.45   6.48
505     21.0  396.90   7.88
```

[19]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 506 entries, 0 to 505
Data columns (total 13 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   CRIM     506 non-null    float64
 1   ZN       506 non-null    float64
 2   INDUS    506 non-null    float64
 3   CHAS     506 non-null    float64
 4   NOX      506 non-null    float64
 5   RM       506 non-null    float64
```

```
 6   AGE      506 non-null    float64
 7   DIS      506 non-null    float64
 8   RAD      506 non-null    float64
 9   TAX      506 non-null    float64
 10  PTRATIO  506 non-null    float64
 11  B        506 non-null    float64
 12  LSTAT    506 non-null    float64
dtypes: float64(13)
memory usage: 51.5 KB
```

[20]:
```
data.describe()
```

[20]:

	CRIM	ZN	INDUS	CHAS	NOX	RM
count	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000
mean	3.613524	11.363636	11.136779	0.069170	0.554695	6.284634
std	8.601545	23.322453	6.860353	0.253994	0.115878	0.702617
min	0.006320	0.000000	0.460000	0.000000	0.385000	3.561000
25%	0.082045	0.000000	5.190000	0.000000	0.449000	5.885500
50%	0.256510	0.000000	9.690000	0.000000	0.538000	6.208500
75%	3.677083	12.500000	18.100000	0.000000	0.624000	6.623500
max	88.976200	100.000000	27.740000	1.000000	0.871000	8.780000

	AGE	DIS	RAD	TAX	PTRATIO	B
count	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000
mean	68.574901	3.795043	9.549407	408.237154	18.455534	356.674032
std	28.148861	2.105710	8.707259	168.537116	2.164946	91.294864
min	2.900000	1.129600	1.000000	187.000000	12.600000	0.320000
25%	45.025000	2.100175	4.000000	279.000000	17.400000	375.377500
50%	77.500000	3.207450	5.000000	330.000000	19.050000	391.440000
75%	94.075000	5.188425	24.000000	666.000000	20.200000	396.225000
max	100.000000	12.126500	24.000000	711.000000	22.000000	396.900000

	LSTAT
count	506.000000
mean	12.653063
std	7.141062
min	1.730000
25%	6.950000
50%	11.360000
75%	16.955000
max	37.970000

[ ]:
```
data['prices']=boston.target
data
```

[ ]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0

```
1    0.02731   0.0   7.07   0.0  0.469  6.421  78.9  4.9671  2.0  242.0
2    0.02729   0.0   7.07   0.0  0.469  7.185  61.1  4.9671  2.0  242.0
3    0.03237   0.0   2.18   0.0  0.458  6.998  45.8  6.0622  3.0  222.0
4    0.06905   0.0   2.18   0.0  0.458  7.147  54.2  6.0622  3.0  222.0
..       …   …    …   …    …    …    …     …  …    …
501  0.06263   0.0  11.93   0.0  0.573  6.593  69.1  2.4786  1.0  273.0
502  0.04527   0.0  11.93   0.0  0.573  6.120  76.7  2.2875  1.0  273.0
503  0.06076   0.0  11.93   0.0  0.573  6.976  91.0  2.1675  1.0  273.0
504  0.10959   0.0  11.93   0.0  0.573  6.794  89.3  2.3889  1.0  273.0
505  0.04741   0.0  11.93   0.0  0.573  6.030  80.8  2.5050  1.0  273.0

     PTRATIO       B  LSTAT  prices
0       15.3  396.90   4.98    24.0
1       17.8  396.90   9.14    21.6
2       17.8  392.83   4.03    34.7
3       18.7  394.63   2.94    33.4
4       18.7  396.90   5.33    36.2
..       …     …    …     …
501     21.0  391.99   9.67    22.4
502     21.0  396.90   9.08    20.6
503     21.0  396.90   5.64    23.9
504     21.0  393.45   6.48    22.0
505     21.0  396.90   7.88    11.9

[506 rows x 14 columns]
```

[ ]:
```
x=data.drop(["prices"],axis=1)

y=data['prices']
```

[ ]:
```
from sklearn.model_selection import train_test_split as tts
```

[ ]:
```
x_train, x_test, y_train, y_test=tts(x, y, test_size=0.9)
```

[25]:
```
x_train
```

[25]:
```
         CRIM    ZN  INDUS  CHAS    NOX     RM    AGE     DIS   RAD    TAX  \
197   0.04666  80.0   1.52   0.0  0.404  7.107   36.6  7.3090   2.0  329.0
8     0.21124  12.5   7.87   0.0  0.524  5.631  100.0  6.0821   5.0  311.0
269   0.09065  20.0   6.96   1.0  0.464  5.920   61.5  3.9175   3.0  223.0
54    0.01360  75.0   4.00   0.0  0.410  5.888   47.6  7.3197   3.0  469.0
490   0.20746   0.0  27.74   0.0  0.609  5.093   98.0  1.8226   4.0  711.0
363   4.22239   0.0  18.10   1.0  0.770  5.803   89.0  1.9047  24.0  666.0
151   1.49632   0.0  19.58   0.0  0.871  5.404  100.0  1.5916   5.0  403.0
183   0.10008   0.0   2.46   0.0  0.488  6.563   95.6  2.8470   3.0  193.0
478  10.23300   0.0  18.10   0.0  0.614  6.185   96.7  2.1705  24.0  666.0
109   0.26363   0.0   8.56   0.0  0.520  6.229   91.2  2.5451   5.0  384.0
```

51	0.04337	21.0	5.64	0.0	0.439	6.115	63.0	6.8147	4.0	243.0
465	3.16360	0.0	18.10	0.0	0.655	5.759	48.2	3.0665	24.0	666.0
194	0.01439	60.0	2.93	0.0	0.401	6.604	18.8	6.2196	1.0	265.0
43	0.15936	0.0	6.91	0.0	0.448	6.211	6.5	5.7209	3.0	233.0
493	0.17331	0.0	9.69	0.0	0.585	5.707	54.0	2.3817	6.0	391.0
5	0.02985	0.0	2.18	0.0	0.458	6.430	58.7	6.0622	3.0	222.0
19	0.72580	0.0	8.14	0.0	0.538	5.727	69.5	3.7965	4.0	307.0
224	0.31533	0.0	6.20	0.0	0.504	8.266	78.3	2.8944	8.0	307.0
293	0.08265	0.0	13.92	0.0	0.437	6.127	18.4	5.5027	4.0	289.0
171	2.31390	0.0	19.58	0.0	0.605	5.880	97.3	2.3887	5.0	403.0
184	0.08308	0.0	2.46	0.0	0.488	5.604	89.8	2.9879	3.0	193.0
105	0.13262	0.0	8.56	0.0	0.520	5.851	96.7	2.1069	5.0	384.0
53	0.04981	21.0	5.64	0.0	0.439	5.998	21.4	6.8147	4.0	243.0
156	2.44668	0.0	19.58	0.0	0.871	5.272	94.0	1.7364	5.0	403.0
223	0.61470	0.0	6.20	0.0	0.507	6.618	80.8	3.2721	8.0	307.0
91	0.03932	0.0	3.41	0.0	0.489	6.405	73.9	3.0921	2.0	270.0
189	0.08370	45.0	3.44	0.0	0.437	7.185	38.9	4.5667	5.0	398.0
431	10.06230	0.0	18.10	0.0	0.584	6.833	94.3	2.0882	24.0	666.0
115	0.17134	0.0	10.01	0.0	0.547	5.928	88.2	2.4631	6.0	432.0
222	0.62356	0.0	6.20	1.0	0.507	6.879	77.7	3.2721	8.0	307.0
270	0.29916	20.0	6.96	0.0	0.464	5.856	42.1	4.4290	3.0	223.0
356	8.98296	0.0	18.10	1.0	0.770	6.212	97.4	2.1222	24.0	666.0
122	0.09299	0.0	25.65	0.0	0.581	5.961	92.9	2.0869	2.0	188.0
412	18.81100	0.0	18.10	0.0	0.597	4.628	100.0	1.5539	24.0	666.0
216	0.04560	0.0	13.89	1.0	0.550	5.888	56.0	3.1121	5.0	276.0
133	0.32982	0.0	21.89	0.0	0.624	5.822	95.4	2.4699	4.0	437.0
217	0.07013	0.0	13.89	0.0	0.550	6.642	85.1	3.4211	5.0	276.0
371	9.23230	0.0	18.10	0.0	0.631	6.216	100.0	1.1691	24.0	666.0
369	5.66998	0.0	18.10	1.0	0.631	6.683	96.8	1.3567	24.0	666.0
325	0.19186	0.0	7.38	0.0	0.493	6.431	14.7	5.4159	5.0	287.0
333	0.05083	0.0	5.19	0.0	0.515	6.316	38.1	6.4584	5.0	224.0
353	0.01709	90.0	2.02	0.0	0.410	6.728	36.1	12.1265	5.0	187.0
112	0.12329	0.0	10.01	0.0	0.547	5.913	92.9	2.3534	6.0	432.0
396	5.87205	0.0	18.10	0.0	0.693	6.405	96.0	1.6768	24.0	666.0
357	3.84970	0.0	18.10	1.0	0.770	6.395	91.0	2.5052	24.0	666.0
322	0.35114	0.0	7.38	0.0	0.493	6.041	49.9	4.7211	5.0	287.0
262	0.52014	20.0	3.97	0.0	0.647	8.398	91.5	2.2885	5.0	264.0
58	0.15445	25.0	5.13	0.0	0.453	6.145	29.2	7.8148	8.0	284.0
195	0.01381	80.0	0.46	0.0	0.422	7.875	32.0	5.6484	4.0	255.0
378	23.64820	0.0	18.10	0.0	0.671	6.380	96.2	1.3861	24.0	666.0

	PTRATIO	B	LSTAT
197	12.6	354.31	8.61
8	15.2	386.63	29.93
269	18.6	391.34	13.65
54	21.1	396.90	14.80
490	20.1	318.43	29.68

363	20.2	353.04	14.64
151	14.7	341.60	13.28
183	17.8	396.90	5.68
478	20.2	379.70	18.03
109	20.9	391.23	15.55
51	16.8	393.97	9.43
465	20.2	334.40	14.13
194	15.6	376.70	4.38
43	17.9	394.46	7.44
493	19.2	396.90	12.01
5	18.7	394.12	5.21
19	21.0	390.95	11.28
224	17.4	385.05	4.14
293	16.0	396.90	8.58
171	14.7	348.13	12.03
184	17.8	391.00	13.98
105	20.9	394.05	16.47
53	16.8	396.90	8.43
156	14.7	88.63	16.14
223	17.4	396.90	7.60
91	17.8	393.55	8.20
189	15.2	396.90	5.39
431	20.2	81.33	19.69
115	17.8	344.91	15.76
222	17.4	390.39	9.93
270	18.6	388.65	13.00
356	20.2	377.73	17.60
122	19.1	378.09	17.93
412	20.2	28.79	34.37
216	16.4	392.80	13.51
133	21.2	388.69	15.03
217	16.4	392.78	9.69
371	20.2	366.15	9.53
369	20.2	375.33	3.73
325	19.6	393.68	5.08
333	20.2	389.71	5.68
353	17.0	384.46	4.50
112	17.8	394.95	16.21
396	20.2	396.90	19.37
357	20.2	391.34	13.27
322	19.6	396.90	7.70
262	13.0	386.86	5.91
58	19.7	390.68	6.86
195	14.4	394.23	2.97
378	20.2	396.90	23.69

[26]:
```
from sklearn.linear_model import LinearRegression
LR= LinearRegression()
```

[27]:
```
LR.fit(x_train, y_train)
```

[27]:
```
LinearRegression()
```

[28]:
```
y_pred=LR.predict(x_test)
y_pred
```

[28]:
```
array([23.96695786, 27.32764652, 23.59069333, 14.38306214, 40.47100122,
       22.62181773, 25.72651964, 21.04945668, 30.07084464, 26.67322068,
       22.6271916 ,  5.76374259, 30.37708703, 20.69956544,  9.46170486,
       19.57973536,  4.98068697, 23.46889039, 23.67919909, 16.01244053,
       22.79184367, 38.20447489, 18.97822579, 18.82788027, 15.54153889,
       39.2101596 , 16.17645313, 20.22373859, 25.80673383, 19.3846326 ,
       36.86528933, 27.78187383, 23.63927932, 33.13180889, 18.19234098,
       20.09822656, 29.66151415, 21.67754745, 26.02344237,  1.30502251,
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       20.50269414, 14.73610596, 19.09168532, 39.0921352 , 22.47880861,
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       29.43039495, 15.5836375 , 15.76455256, 31.99604745, 30.24844727,
       19.19737162,  5.73844042, 19.6728348 , 34.83599441, 23.52885454,
       24.30636392, 23.1775103 , 20.91617302, 17.23885098, 29.44196902,
       21.06096773, -0.06706068, 25.03388056, 30.70763206, 17.56124929,
       40.616149  , 11.38085433, 20.86545465, 32.07044461, 13.60725743,
       29.82690501, 28.95155539, 22.23170539, 19.04538439, 28.78207543,
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```

```
16.0691059 , 39.97362591, 19.22062203, 27.68572221, 23.34148829,
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41.37821747, 25.12331001, 31.9035244 , 19.61482116, 23.95897124,
34.54468094, 23.85723302, 28.22175363, 17.39388775, 30.16589491,
20.30770489, 25.85518095, 26.53605513, 34.00560666, 37.17229996,
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27.38301836, 34.85792715, 16.87620741, 26.142471  , 14.41036711,
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18.13453115, 34.32561142, 20.44560986, 33.52001887, 16.11081359,
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25.899063  , 22.37991638, 20.65982721, 23.42013595, 35.68320345,
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16.487738  ,  2.80432161, 17.55857715,  7.30346439, 16.20062854,
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16.28915123, 23.79929809, 17.73260791, 21.40797545, 20.09202366,
30.89691274, 12.09622365, 27.97980921, 21.4901934 , 14.24197192,
35.16617076, 39.05390117, 20.55973512, 22.86457532, 15.6612507 ,
22.84079159, 24.9123188 ,  1.846985  , 27.30997799, 32.65702624,
21.16925778, 25.08123425, 20.69873605, 25.63249402, 33.60951126,
21.16845455, 20.67875255, 16.0419055 , 20.53484202, 34.39563538,
17.6866589 , 29.46742029, 29.886236  , 23.19433154, 16.48128812,
20.57564767, 30.59946671, 16.81119547, 25.0781536 , 25.95251282,
29.73964203, 29.94211617, 31.7967442 , 40.49323598, 21.57939115,
12.28675583, 10.30873468, 22.49481153, 21.96658275,  4.018475  ,
```

```
       23.16684291, 24.16526265, 19.75794672, 22.43049375, 31.21324951,
       22.03409561, 22.46072708, 25.98246363, 33.18487354, 21.68848558,
       25.82575326, 34.21799696, 37.82464321, 32.27188632, 27.60943718,
       39.37721595, 14.12417114, 20.03282627, 26.84661763, 21.24242279,
       28.34190405, 19.93044348, 27.20409038, 27.74710729, 22.15158469,
       21.7058948 , 22.77293646, 27.82562968, 16.55778218, 32.88574576,
       28.63683884, 10.53872522, 26.95865613, 18.46193337, 21.81713107,
       25.65604186])
```

[29]:
```
LR.score(x_test, y_pred)
```

[29]: 1.0

Practical No. 5

April 29, 2025

[1]:
```
import pandas as pd
import numpy as np
```

[2]:
```
df=pd.read_csv('Social_Network_Ads.csv')
```

[3]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 5 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   User ID          400 non-null    int64  
 1   Gender           400 non-null    object 
 2   Age              400 non-null    float64
 3   EstimatedSalary  400 non-null    float64
 4   Purchased        400 non-null    int64  
dtypes: float64(2), int64(2), object(1)
memory usage: 15.8+ KB
```

[4]:
```
df.tail()
```

[4]:

	User ID	Gender	Age	EstimatedSalary	Purchased
395	15691863	Female	46.0	41000.0	1
396	15706071	Male	51.0	23000.0	1
397	15654296	Female	50.0	20000.0	1
398	15755018	Male	36.0	33000.0	0
399	15594041	Female	49.0	36000.0	1

[5]:
```
x=pd.DataFrame(df.iloc[:,:-1])
```

[6]:
```
y=pd.DataFrame(df.iloc[:,-1])
```

[7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 5 columns):
```

```
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   User ID          400 non-null    int64
 1   Gender           400 non-null    object
 2   Age              400 non-null    float64
 3   EstimatedSalary  400 non-null    float64
 4   Purchased        400 non-null    int64
dtypes: float64(2), int64(2), object(1)
memory usage: 15.8+ KB
```

[8]:
```
x
```

[8]:
```
       User ID  Gender   Age  EstimatedSalary
0     15624510    Male  19.0          19000.0
1     15810944    Male  35.0          20000.0
2     15668575  Female  26.0          43000.0
3     15603246  Female  27.0          57000.0
4     15804002    Male  19.0          76000.0
..         …     …   …                …
395   15691863  Female  46.0          41000.0
396   15706071    Male  51.0          23000.0
397   15654296  Female  50.0          20000.0
398   15755018    Male  36.0          33000.0
399   15594041  Female  49.0          36000.0

[400 rows x 4 columns]
```

[9]:
```
y
```

[9]:
```
     Purchased
0            0
1            0
2            0
3            0
4            0
..         …
395          1
396          1
397          1
398          0
399          1

[400 rows x 1 columns]
```

[10]:
```
from sklearn.model_selection import train_test_split
```

[11]:
```
X_train, X_test,y_train,y_test=train_test_split(x,y,test_size=0.1)
```

[12]:
```
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(360, 4)
(40, 4)
(360, 1)
(40, 1)
```

[13]:
```
#feature scaling
from sklearn.preprocessing import StandardScaler
```

[14]:
```
Scaler=StandardScaler()
v=Scaler.fit_transform(y)
```

[15]:
```
v
```

[15]:
```
array([[-0.74593581],
       [-0.74593581],
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       [-0.74593581],
       [ 1.34059793]])
```

[16]:
```
from sklearn.linear_model import LogisticRegression
```

[17]:
```
df['Gender'].value_counts(normalize=True)
```

[17]:
```
Female    0.51
Male      0.49
Name: Gender, dtype: float64
```

[18]:
```
df['Gender']=df.Gender.map({"Male":1,"Female":0})
```

[19]:
```
df["Gender"]
```

[19]:
```
0      1
1      1
2      0
3      0
4      1
      ..
395    0
396    1
397    0
398    1
399    0
Name: Gender, Length: 400, dtype: int64
```

[20]:
```
df.head()
```

[20]:

	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	1	19.0	19000.0	0
1	15810944	1	35.0	20000.0	0
2	15668575	0	26.0	43000.0	0
3	15603246	0	27.0	57000.0	0
4	15804002	1	19.0	76000.0	0

Practical No. 5

April 29, 2025

[1]:
```
import numpy as np
import pandas as pd
import warnings
df=pd.read_csv("Social_Network_Adds.csv")
df
```

[1]:
```
      User ID  Age  EstimatedSalary  Purchased  Gender
0    15624510   19            19000          0    Male
1    15810944   35            20000          0    Male
2    15668575   26            43000          0  Female
3    15603246   27            57000          0  Female
4    15804002   19            76000          0    Male
..        ...  ...              ...        ...     ...
395  15691863   46            41000          1  Female
396  15706071   51            23000          1    Male
397  15654296   50            20000          1  Female
398  15755018   36            33000          0    Male
399  15594041   49            36000          1  Female

[400 rows x 5 columns]
```

[2]:
```
df.head
```

[2]:
```
<bound method NDFrame.head of       User ID  Age  EstimatedSalary  Purchased
Gender
0    15624510   19            19000          0    Male
1    15810944   35            20000          0    Male
2    15668575   26            43000          0  Female
3    15603246   27            57000          0  Female
4    15804002   19            76000          0    Male
..        ...  ...              ...        ...     ...
395  15691863   46            41000          1  Female
396  15706071   51            23000          1    Male
397  15654296   50            20000          1  Female
398  15755018   36            33000          0    Male
399  15594041   49            36000          1  Female
```

```
[400 rows x 5 columns]>
```

[3]:
```
print(df.shape)
```

```
(400, 5)
```

[4]:
```
x = pd.DataFrame(df.iloc[:, :-1])
y = pd.DataFrame(df.iloc[:, -1])
```

[5]:
```
x
```

[5]:

	User ID	Age	EstimatedSalary	Purchased
0	15624510	19	19000	0
1	15810944	35	20000	0
2	15668575	26	43000	0
3	15603246	27	57000	0
4	15804002	19	76000	0
..	…	…	…	…
395	15691863	46	41000	1
396	15706071	51	23000	1
397	15654296	50	20000	1
398	15755018	36	33000	0
399	15594041	49	36000	1

```
[400 rows x 4 columns]
```

[6]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,x_test=train_test_split(x,y,test_size=0.2,random_state=1)
```

[7]:
```
from sklearn.linear_model import LogisticRegression
classifier=LogisticRegression()
print (classifier.fit(x_train,y_train))
```

```
LogisticRegression()

C:\Users\ADMIN\anaconda3\lib\site-packages\sklearn\utils\validation.py:993:
DataConversionWarning: A column-vector y was passed when a 1d array was
expected. Please change the shape of y to (n_samples, ), for example using
ravel().
  y = column_or_1d(y, warn=True)
```

[11]:
```
y_pred = classifier.predict(x_train)
```

[12]:
```
y_pred
```

[12]:
```
array(['Male', 'Male', 'Female', 'Male', 'Female', 'Female', 'Male',
       'Male', 'Male', 'Male', 'Female', 'Male', 'Male', 'Male', 'Female',
       'Male', 'Female', 'Female', 'Female', 'Male', 'Male', 'Female',
```

```
'Male', 'Male', 'Male', 'Female', 'Female', 'Female', 'Female',
'Male', 'Male', 'Male', 'Female', 'Female', 'Female', 'Female',
'Male', 'Male', 'Female', 'Male', 'Male', 'Female', 'Male',
'Female', 'Female', 'Female', 'Female', 'Female', 'Male', 'Male',
'Male', 'Female', 'Male', 'Female', 'Female', 'Male', 'Female',
'Male', 'Male', 'Female', 'Female', 'Male', 'Male', 'Male',
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'Female', 'Male', 'Female', 'Female', 'Female', 'Female', 'Male',
'Female', 'Male', 'Female', 'Female', 'Female', 'Male', 'Female',
'Female', 'Female', 'Male', 'Female', 'Female', 'Male', 'Male',
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'Female', 'Male', 'Female', 'Female', 'Female', 'Male', 'Female',
'Female', 'Female', 'Female', 'Male', 'Male', 'Female', 'Female',
'Female', 'Female', 'Male', 'Male', 'Male', 'Male', 'Female',
'Male', 'Male', 'Female', 'Male', 'Female', 'Male', 'Male',
'Female', 'Female', 'Female', 'Female', 'Male', 'Male', 'Female',
'Female', 'Female', 'Male', 'Female', 'Male', 'Female', 'Female',
'Female', 'Male', 'Female', 'Female', 'Female', 'Male', 'Female',
'Female', 'Male', 'Male', 'Male', 'Male', 'Female', 'Male', 'Male',
'Male', 'Female', 'Female', 'Male', 'Female', 'Female', 'Female',
'Female', 'Female', 'Female', 'Female', 'Male', 'Male', 'Male',
'Female', 'Male', 'Female', 'Female', 'Male', 'Female', 'Female',
'Male', 'Female', 'Male', 'Female', 'Male', 'Female', 'Male',
'Female', 'Male', 'Male', 'Male', 'Female', 'Female', 'Male',
'Female', 'Male', 'Female', 'Male', 'Male', 'Male', 'Female',
'Female', 'Male', 'Female', 'Male', 'Male', 'Female', 'Male',
'Female', 'Male', 'Male', 'Female', 'Female', 'Male', 'Female',
'Male', 'Male', 'Female', 'Male'], dtype=object)
```

[14]:
```
from sklearn.metrics import confusion_matrix
cm=confusion_matrix(y_train,y_pred)
```

[15]:
```
cm
```

[15]:
```
array([[80, 80],
       [78, 82]], dtype=int64)
```

[24]:
```
from sklearn.metrics import classification_report
print(classification_report(y_train,y_pred))
```

```
              precision    recall  f1-score   support

      Female       0.51      0.50      0.50       160
        Male       0.51      0.51      0.51       160

    accuracy                           0.51       320
   macro avg       0.51      0.51      0.51       320
weighted avg       0.51      0.51      0.51       320
```

[19]:
```
pp = (80+80)/(80+0+78+82)
```

[20]:
```
print(pp)
```

```
0.6666666666666666
```

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[3]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as pit
```

[6]:
```
data=pd.read_csv("iris.csv")
x=data.iloc[:,:4].values
y=data['Species'].values
```

[9]:
```
data
```

[9]:
```
       Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm  \
0       1            5.1           3.5            1.4           0.2
1       2            4.9           3.0            1.4           0.2
2       3            4.7           3.2            1.3           0.2
3       4            4.6           3.1            1.5           0.2
4       5            5.0           3.6            1.4           0.2
..    ...            ...           ...            ...           ...
145   146            6.7           3.0            5.2           2.3
146   147            6.3           2.5            5.0           1.9
147   148            6.5           3.0            5.2           2.0
148   149            6.2           3.4            5.4           2.3
149   150            5.9           3.0            5.1           1.8

            Species
0       Iris-setosa
1       Iris-setosa
2       Iris-setosa
3       Iris-setosa
4       Iris-setosa
..              ...
145  Iris-virginica
146  Iris-virginica
147  Iris-virginica
148  Iris-virginica
149  Iris-virginica

[150 rows x 6 columns]
```

[10]:
```
data.head(5)
```

[10]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa

[11]:
```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, x_test = train_test_split(x,y,test_size=0.2)
```

[17]:
```
from sklearn.preprocessing import StandardScaler
sc=StandardScaler()
x_train=sc.fit_transform(x_train)
x_test=sc.transform(x_test)
```

[25]:
```
from sklearn.naive_bayes import GaussianNB
classifier = GaussianNB()
classifier.fit(x_train, y_train)
```

[25]:
```
GaussianNB()
```

[26]:
```
y_pred = classifier.predict(x_test)
y_pred
```

[26]:
```
array(['Iris-setosa', 'Iris-versicolor', 'Iris-versicolor',
       'Iris-versicolor', 'Iris-virginica', 'Iris-setosa', 'Iris-setosa',
       'Iris-virginica', 'Iris-setosa', 'Iris-virginica',
       'Iris-virginica', 'Iris-setosa', 'Iris-virginica', 'Iris-setosa',
       'Iris-virginica', 'Iris-versicolor', 'Iris-setosa', 'Iris-setosa',
       'Iris-setosa', 'Iris-setosa', 'Iris-virginica', 'Iris-versicolor',
       'Iris-virginica', 'Iris-versicolor', 'Iris-setosa',
       'Iris-versicolor', 'Iris-setosa', 'Iris-versicolor',
       'Iris-versicolor', 'Iris-versicolor', 'Iris-virginica',
       'Iris-setosa', 'Iris-setosa', 'Iris-versicolor', 'Iris-setosa',
       'Iris-versicolor', 'Iris-virginica', 'Iris-setosa',
       'Iris-virginica', 'Iris-versicolor', 'Iris-versicolor',
       'Iris-virginica', 'Iris-virginica', 'Iris-setosa',
       'Iris-versicolor', 'Iris-versicolor', 'Iris-versicolor',
       'Iris-versicolor', 'Iris-virginica', 'Iris-versicolor',
       'Iris-virginica', 'Iris-virginica', 'Iris-setosa', 'Iris-setosa',
       'Iris-virginica', 'Iris-versicolor', 'Iris-versicolor',
       'Iris-setosa', 'Iris-virginica', 'Iris-setosa', 'Iris-versicolor',
       'Iris-virginica', 'Iris-setosa', 'Iris-versicolor', 'Iris-setosa',
       'Iris-versicolor', 'Iris-versicolor', 'Iris-versicolor',
       'Iris-setosa', 'Iris-virginica', 'Iris-versicolor',
```

```
       'Iris-versicolor', 'Iris-setosa', 'Iris-setosa', 'Iris-setosa',
       'Iris-setosa', 'Iris-versicolor', 'Iris-virginica',
       'Iris-virginica', 'Iris-setosa', 'Iris-setosa', 'Iris-virginica',
       'Iris-setosa', 'Iris-virginica', 'Iris-versicolor',
       'Iris-versicolor', 'Iris-virginica', 'Iris-versicolor',
       'Iris-versicolor', 'Iris-versicolor', 'Iris-virginica',
       'Iris-setosa', 'Iris-virginica', 'Iris-virginica', 'Iris-setosa',
       'Iris-virginica', 'Iris-setosa', 'Iris-virginica', 'Iris-setosa',
       'Iris-virginica', 'Iris-setosa', 'Iris-virginica',
       'Iris-virginica', 'Iris-versicolor', 'Iris-virginica',
       'Iris-versicolor', 'Iris-versicolor', 'Iris-versicolor',
       'Iris-setosa', 'Iris-versicolor', 'Iris-versicolor',
       'Iris-virginica', 'Iris-versicolor', 'Iris-versicolor',
       'Iris-versicolor', 'Iris-virginica', 'Iris-setosa',
       'Iris-versicolor', 'Iris-virginica', 'Iris-setosa'], dtype='<U15')
```

[31]:
```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_train, y_pred)
from sklearn.metrics import accuracy_score
print("Accuracy:",accuracy_score(y_train,y_pred))
cm
```

```
Accuracy: 0.9916666666666667
```

[31]:
```
array([[39,  0,  0],
       [ 0, 43,  0],
       [ 0,  1, 37]], dtype=int64)
```

[34]:
```
data1 = pd.DataFrame({'Actual Values':y_train,'predicted Values':y_pred})
```

[35]:
```
data1
```

[35]:

	Actual Values	predicted Values
0	Iris-setosa	Iris-setosa
1	Iris-versicolor	Iris-versicolor
2	Iris-versicolor	Iris-versicolor
3	Iris-versicolor	Iris-versicolor
4	Iris-virginica	Iris-virginica
..	…	…
115	Iris-virginica	Iris-virginica
116	Iris-setosa	Iris-setosa
117	Iris-versicolor	Iris-versicolor
118	Iris-virginica	Iris-virginica
119	Iris-setosa	Iris-setosa

[120 rows x 2 columns]

[ ]:

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[6]:
```
import nltk
from nltk.tokenize import word_tokenize as wt, sent_tokenize as st
```

[7]:
```
kn="Kunal is Engineering Student"
w=wt(kn)
```

[8]:
```
w
```

[8]:
```
['Kunal', 'is', 'Engineering', 'Student']
```

[13]:
```
from nltk.corpus import gutenberg
```

[18]:
```
k=gutenberg.fileids()
```

[19]:
```
k
```

[19]:
```
['austen-emma.txt',
 'austen-persuasion.txt',
 'austen-sense.txt',
 'bible-kjv.txt',
 'blake-poems.txt',
 'bryant-stories.txt',
 'burgess-busterbrown.txt',
 'carroll-alice.txt',
 'chesterton-ball.txt',
 'chesterton-brown.txt',
 'chesterton-thursday.txt',
 'edgeworth-parents.txt',
 'melville-moby_dick.txt',
 'milton-paradise.txt',
 'shakespeare-caesar.txt',
 'shakespeare-hamlet.txt',
 'shakespeare-macbeth.txt',
 'whitman-leaves.txt']
```

[21]:
```
k=gutenberg.raw("austen-emma.txt")
```

[24]:
```
knn=k[50:447]
```

[25]:
```
knn
```

[25]:
```
"Emma Woodhouse, handsome, clever, and rich, with a comfortable home\nand happy
disposition, seemed to unite some of the best blessings\nof existence; and had
lived nearly twenty-one years in the world\nwith very little to distress or vex
her.\n\nShe was the youngest of the two daughters of a most
affectionate,\nindulgent father; and had, in consequence of her sister's
marriage,\nbeen mistress of his h"
```

[27]:
```
s=st(knn)
```

[28]:
```
s[1]
```

[28]:
```
"She was the youngest of the two daughters of a most affectionate,\nindulgent
father; and had, in consequence of her sister's marriage,\nbeen mistress of his
h"
```

[36]:
```
w=wt(s[1])
```

[38]:
```
w
```

[38]:
```
['She',
 'was',
 'the',
 'youngest',
 'of',
 'the',
 'two',
 'daughters',
 'of',
 'a',
 'most',
 'affectionate',
 ',',
 'indulgent',
 'father',
 ';',
 'and',
 'had',
 ',',
 'in',
 'consequence',
 'of',
 'her',
 'sister',
```

```
 "'s",
 'marriage',
 ',',
 'been',
 'mistress',
 'of',
 'his',
 'h']
```

0.1 STEMMER

[39]:
```
from nltk.stem import PorterStemmer
```

[40]:
```
ps=PorterStemmer()
```

[44]:
```
words=["Walking", "Rocking", 'Running',"Swimming", "Riding"]
for x in words:
    print(ps.stem(x))
```

```
walk
rock
run
swim
ride
```

0.2 POS Tagging

[46]:
```
# convert text into word_token with these tags

from nltk import pos_tag
def postag(text):
    w=wt(text)
    return pos_tag(w)

postag("Kunal is regulat at College")
```

[46]:
```
[('Kunal', 'NNP'),
 ('is', 'VBZ'),
 ('regulat', 'JJ'),
 ('at', 'IN'),
 ('College', 'NNP')]
```

[47]:
```
from nltk.corpus import stopwords
```

[53]:
```
w=stopwords.words("French")
```

[54]:
```
print(w)
```

```
['au', 'aux', 'avec', 'ce', 'ces', 'dans', 'de', 'des', 'du', 'elle', 'en',
'et', 'eux', 'il', 'ils', 'je', 'la', 'le', 'les', 'leur', 'lui', 'ma', 'mais',
'me', 'même', 'mes', 'moi', 'mon', 'ne', 'nos', 'notre', 'nous', 'on', 'ou',
'par', 'pas', 'pour', 'qu', 'que', 'qui', 'sa', 'se', 'ses', 'son', 'sur', 'ta',
'te', 'tes', 'toi', 'ton', 'tu', 'un', 'une', 'vos', 'votre', 'vous', 'c', 'd',
'j', 'l', 'à', 'm', 'n', 's', 't', 'y', 'été', 'étée', 'étées', 'étés', 'étant',
'étante', 'étants', 'étantes', 'suis', 'es', 'est', 'sommes', 'êtes', 'sont',
'serai', 'seras', 'sera', 'serons', 'serez', 'seront', 'serais', 'serait',
'serions', 'seriez', 'seraient', 'étais', 'était', 'étions', 'étiez', 'étaient',
'fus', 'fut', 'fûmes', 'fûtes', 'furent', 'sois', 'soit', 'soyons', 'soyez',
'soient', 'fusse', 'fusses', 'fût', 'fussions', 'fussiez', 'fussent', 'ayant',
'ayante', 'ayantes', 'ayants', 'eu', 'eue', 'eues', 'eus', 'ai', 'as', 'avons',
'avez', 'ont', 'aurai', 'auras', 'aura', 'aurons', 'aurez', 'auront', 'aurais',
'aurait', 'aurions', 'auriez', 'auraient', 'avais', 'avait', 'avions', 'aviez',
'avaient', 'eut', 'eûmes', 'eûtes', 'eurent', 'aie', 'aies', 'ait', 'ayons',
'ayez', 'aient', 'eusse', 'eusses', 'eût', 'eussions', 'eussiez', 'eussent']
```

[ ]:

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[ ]:
```
import nltk
```

[ ]:
```
from nltk.tokenize import word_tokenize
w1 = word_tokenize("Between _them_ it was more the intimacy\nof sister.")
nltk.download('stopwords')
print(w1)
```

[ ]:
```
nltk.download('punkt')
```

[ ]:
```
import nltk
from nltk.tokenize import word_tokenize
w1 = word_tokenize("Between _them_ it was more the intimacy\nof sister.")
nltk.download('stopwords')
print(w1)
```

[7]:
```
def myToken(str):
    ans = []
    curr = ""
    for i in range(len(str)):
        if(str[i] == " "):
            ans.append(curr)
            curr = ""
        else:
            curr = curr + str[i]
    ans.append(curr)
    print(ans)
```

[ ]:
```
form nltk.tokenize import word_tokenize, sent_tokenize
from nltk.corpus import gutenberg
```

[ ]:
```
nltk.download('gutenberg')
```

[9]:
```
from nltk.tokenize import word_tokenize, sent_tokenize
from nltk.corpus import gutenberg
```

[10]:
```
gutenberg.fileids()
```

[10]:
```
['austen-emma.txt',
 'austen-persuasion.txt',
 'austen-sense.txt',
 'bible-kjv.txt',
 'blake-poems.txt',
 'bryant-stories.txt',
 'burgess-busterbrown.txt',
 'carroll-alice.txt',
 'chesterton-ball.txt',
 'chesterton-brown.txt',
 'chesterton-thursday.txt',
 'edgeworth-parents.txt',
 'melville-moby_dick.txt',
 'milton-paradise.txt',
 'shakespeare-caesar.txt',
 'shakespeare-hamlet.txt',
 'shakespeare-macbeth.txt',
 'whitman-leaves.txt']
```

[11]:
```
r = gutenberg.raw(['blake-poems.txt'])
```

[12]:
```
emma = r[0:]
emma
```

[12]:
```
'[Poems by William Blake 1789]\n\n \nSONGS OF INNOCENCE AND OF EXPERIENCE\nand
THE BOOK of THEL\n\n\n SONGS OF INNOCENCE\n \n \n INTRODUCTION\n \n Piping down
the valleys wild,\n   Piping songs of pleasant glee,\n On a cloud I saw a
child,\n   And he laughing said to me:\n \n "Pipe a song about a Lamb!"\n   So I
piped with merry cheer.\n "Piper, pipe that song again;"\n   So I piped: he wept
to hear.\n \n "Drop thy pipe, thy happy pipe;\n   Sing thy songs of happy
cheer:!"\n So I sang the same again,\n   While he wept with joy to hear.\n \n
"Piper, sit thee down and write\n   In a book, that all may read."\n So he
vanish\'d from my sight;\n   And I pluck\'d a hollow reed,\n \n And I made a
rural pen,\n   And I stain\'d the water clear,\n And I wrote my happy songs\n
Every child may joy to hear.\n \n \n THE SHEPHERD\n \n How sweet is the
Shepherd\'s sweet lot!\n From the morn to the evening he stays;\n He shall
follow his sheep all the day,\n And his tongue shall be filled with praise.\n \n
For he hears the lambs\' innocent call,\n And he hears the ewes\' tender
reply;\n He is watching while they are in peace,\n For they know when their
Shepherd is nigh.\n \n \n THE ECHOING GREEN\n \n The sun does arise,\n And make
happy the skies;\n The merry bells ring\n To welcome the Spring;\n The skylark
and thrush,\n The birds of the bush,\n Sing louder around\n To the bells\'
cheerful sound;\n While our sports shall be seen\n On the echoing Green.\n \n
Old John, with white hair,\n Does laugh away care,\n Sitting under the oak,\n
Among the old folk.\n They laugh at our play,\n And soon they all say,\n "Such,
such were the joys\n When we all -- girls and boys --\n In our youth-time were
seen\n On the echoing Green."\n \n Till the little ones, weary,\n No more can be
```

merry:\n The sun does descend,\n And our sports have an end.\n Round the laps of their mothers\n Many sisters and brothers,\n Like birds in their nest,\n Are ready for rest,\n And sport no more seen\n On the darkening green.\n \n \n THE LAMB\n \n Little Lamb, who make thee\n Dost thou know who made thee,\n Gave thee life, and bid thee feed\n By the stream and o\'er the mead;\n Gave thee clothing of delight,\n Softest clothing, wolly, bright;\n Gave thee such a tender voice,\n Making all the vales rejoice?\n Little Lamb, who made thee?\n Dost thou know who made thee?\n \n Little Lamb, I\'ll tell thee;\n Little Lamb, I\'ll tell thee:\n He is called by thy name,\n For He calls Himself a Lamb\n He is meek, and He is mild,\n He became a little child.\n I a child, and thou a lamb,\n We are called by His name.\n Little Lamb, God bless thee!\n Little Lamb, God bless thee!\n \n \n THE LITTLE BLACK BOY\n \n My mother bore me in the southern wild,\n And I am black, but oh my soul is white!\n White as an angel is the English child,\n But I am black, as if bereaved of light.\n \n My mother taught me underneath a tree,\n And, sitting down before the heat of day,\n She took me on her lap and kissed me,\n And, pointed to the east, began to say:\n \n "Look on the rising sun: there God does live,\n And gives His light, and gives His heat away,\n And flowers and trees and beasts and men receive\n Comfort in morning, joy in the noonday.\n \n "And we are put on earth a little space,\n That we may learn to bear the beams of love\n And these black bodies and this sunburnt face\n Is but a cloud, and like a shady grove.\n \n "For when our souls have learn\'d the heat to bear,\n The cloud will vanish, we shall hear His voice,\n Saying, \'Come out from the grove, my love and care\n And round my golden tent like lambs rejoice\',"\n \n Thus did my mother say, and kissed me;\n And thus I say to little English boy.\n When I from black and he from white cloud free,\n And round the tent of God like lambs we joy\n \n I\'ll shade him from the heat till he can bear\n To lean in joy upon our Father\'s knee;\n And then I\'ll stand and stroke his silver hair,\n And be like him, and he will then love me.\n \n \n THE BLOSSOM\n \n Merry, merry sparrow!\n Under leaves so green\n A happy blossom \n Sees you, swift as arrow,\n Seek your cradle narrow,\n Near my bosom.\n Pretty, pretty robin!\n Under leaves so green\n A happy blossom\n Hears you sobbing, sobbing,\n Pretty, pretty robin,\n Near my bosom.\n \n\n THE CHIMNEY-SWEEPER\n \n When my mother died I was very young,\n And my father sold me while yet my tongue\n Could scarcely cry "Weep! weep! weep! weep!"\n So your chimneys I sweep, and in soot I sleep.\n \n There\'s little Tom Dacre, who cried when his head,\n That curled like a lamb\'s back, was shaved; so I said,\n "Hush, Tom! never mind it, for, when your head\'s bare,\n You know that the soot cannot spoil your white hair."\n \n And so he was quiet, and that very night,\n As Tom was a-sleeping, he had such a sight! --\n That thousands of sweepers, Dick, Joe, Ned, and Jack,\n Were all of them locked up in coffins of black.\n \n And by came an angel, who had a bright key,\n And he opened the coffins, and let them all free;\n Then down a green plain, leaping, laughing, they run,\n And wash in a river, and shine in the sun.\n \n Then naked and white, all their bags left behind,\n They rise upon clouds, and sport in the wind;\n And the Angel told Tom, if he\'d be a good boy,\n He\'d have God for his father, and never want joy.\n \n And so Tom awoke, and we rose in the dark,\n And got with our bags and

our brushes to work.\n Though the morning was cold, Tom was happy and warm:\n So, if all do their duty, they need not fear harm.\n \n \n THE LITTLE BOY LOST\n \n "Father, father, where are you going?\n Oh do not walk so fast!\n Speak, father, speak to you little boy,\n Or else I shall be lost."\n \n The night was dark, no father was there,\n The child was wet with dew;\n The mire was deep, and the child did weep,\n And away the vapour flew.\n \n \n THE LITTLE BOY FOUND\n \n The little boy lost in the lonely fen,\n Led by the wandering light,\n Began to cry, but God, ever nigh,\n Appeared like his father, in white.\n \n He kissed the child, and by the hand led,\n And to his mother brought,\n Who in sorrow pale, through the lonely dale,\n The little boy weeping sought.\n \n \n LAUGHING SONG\n \n When the green woods laugh with the voice of joy,\n And the dimpling stream runs laughing by;\n When the air does laugh with our merry wit,\n And the green hill laughs with the noise of it;\n \n when the meadows laugh with lively green,\n And the grasshopper laughs in the merry scene,\n When Mary and Susan and Emily\n With their sweet round mouths sing "Ha, ha he!"\n \n When the painted birds laugh in the shade,\n Where our table with cherries and nuts is spread:\n Come live, and be merry, and join with me,\n To sing the sweet chorus of "Ha, ha, he!"\n \n \n A SONG\n \n Sweet dreams, form a shade\n O\'er my lovely infant\'s head!\n Sweet dreams of pleasant streams\n By happy, silent, moony beams!\n \n Sweet Sleep, with soft down\n Weave thy brows an infant crown\n Sweet Sleep, angel mild,\n Hover o\'er my happy child!\n \n Sweet smiles, in the night\n Hover over my delight!\n Sweet smiles, mother\'s smile,\n All the livelong night beguile.\n \n Sweet moans, dovelike sighs,\n Chase not slumber from thine eyes!\n Sweet moan, sweeter smile,\n All the dovelike moans beguile.\n \n Sleep, sleep, happy child!\n All creation slept and smiled.\n Sleep, sleep, happy sleep,\n While o\'er thee doth mother weep.\n \n Sweet babe, in thy face\n Holy image I can trace;\n Sweet babe, once like thee\n Thy Maker lay, and wept for me:\n \n Wept for me, for thee, for all,\n When He was an infant small.\n Thou His image ever see,\n Heavenly face that smiles on thee!\n \n Smiles on thee, on me, on all,\n Who became an infant small;\n Infant smiles are his own smiles;\n Heaven and earth to peace beguiles.\n \n \n DIVINE IMAGE\n \n To Mercy, Pity, Peace, and Love,\n All pray in their distress,\n And to these virtues of delight\n Return their thankfulness.\n \n For Mercy, Pity, Peace, and Love,\n Is God our Father dear;\n And Mercy, Pity, Peace, and Love,\n Is man, his child and care.\n \n For Mercy has a human heart\n Pity, a human face;\n And Love, the human form divine;\n And Peace, the human dress.\n \n Then every man, of every clime,\n That prays in his distress,\n Prays to the human form divine:\n Love, Mercy, Pity, Peace.\n \n And all must love the human form,\n In heathen, Turk, or Jew.\n Where Mercy, Love, and Pity dwell,\n There God is dwelling too.\n \n \n HOLY THURSDAY\n \n \'Twas on a Holy Thursday, their innocent faces clean,\n Came children walking two and two, in read, and blue, and green:\n Grey-headed beadles walked before, with wands as white as snow,\n Till into the high dome of Paul\'s they like Thames waters flow.\n \n Oh what a multitude they seemed, these flowers of London town!\n Seated in companies they sit, with radiance all their own.\n The hum of multitudes was there, but multitudes of lambs,\n Thousands of little boys and girls raising their innocent hands.\n \n Now like a

mighty wild they raise to heaven the voice of song,\n Or like harmonious thunderings the seats of heaven among:\n Beneath them sit the aged man, wise guardians of the poor.\n Then cherish pity, lest you drive an angel from your door.\n \n \n NIGHT\n \n The sun descending in the west,\n The evening star does shine;\n The birds are silent in their nest,\n And I must seek for mine.\n The moon, like a flower\n In heaven\'s high bower,\n With silent delight,\n Sits and smiles on the night.\n \n Farewell, green fields and happy grove,\n Where flocks have ta\'en delight.\n Where lambs have nibbled, silent move\n The feet of angels bright;\n Unseen they pour blessing,\n And joy without ceasing,\n On each bud and blossom,\n And each sleeping bosom.\n \n They look in every thoughtless nest\n Where birds are covered warm;\n They visit caves of every beast,\n To keep them all from harm:\n If they see any weeping\n That should have been sleeping,\n They pour sleep on their head,\n And sit down by their bed.\n \n When wolves and tigers howl for prey,\n They pitying stand and weep;\n Seeking to drive their thirst away,\n And keep them from the sheep.\n But, if they rush dreadful,\n The angels, most heedful,\n Receive each mild spirit,\n New worlds to inherit.\n \n \n And there the lion\'s ruddy eyes\n Shall flow with tears of gold:\n And pitying the tender cries,\n And walking round the fold:\n Saying: "Wrath by His meekness,\n And, by His health, sickness,\n Are driven away\n From our immortal day.\n \n "And now beside thee, bleating lamb,\n I can lie down and sleep,\n Or think on Him who bore thy name,\n Graze after thee, and weep.\n For, washed in life\'s river,\n My bright mane for ever\n Shall shine like the gold,\n As I guard o\'er the fold."\n \n \n SPRING\n \n Sound the flute!\n Now it\'s mute!\n Bird\'s delight,\n Day and night,\n Nightingale,\n In the dale,\n Lark in sky,--\n Merrily,\n Merrily merrily, to welcome in the year.\n \n Little boy,\n Full of joy;\n Little girl,\n Sweet and small;\n Cock does crow,\n So do you;\n Merry voice,\n Infant noise;\n Merrily, merrily, to welcome in the year.\n \n Little lamb,\n Here I am;\n Come and lick\n My white neck;\n Let me pull\n Your soft wool;\n Let me kiss\n Your soft face;\n Merrily, merrily, to welcome in the year.\n \n \n NURSE\'S SONG\n \n When the voices of children are heard on the green,\n And laughing is heard on the hill,\n My heart is at rest within my breast,\n And everything else is still.\n "Then come home, my children, the sun is gone down,\n And the dews of night arise;\n Come, come, leave off play, and let us away,\n Till the morning appears in the skies."\n \n "No, no, let us play, for it is yet day,\n And we cannot go to sleep;\n Besides, in the sky the little birds fly,\n And the hills are all covered with sheep."\n "Well, well, go and play till the light fades away,\n And then go home to bed."\n The little ones leaped, and shouted, and laughed,\n And all the hills echoed.\n \n \n INFANT JOY\n \n "I have no name;\n I am but two days old."\n What shall I call thee?\n "I happy am,\n Joy is my name."\n Sweet joy befall thee!\n \n Pretty joy!\n Sweet joy, but two days old.\n Sweet Joy I call thee:\n Thou dost smile,\n I sing the while;\n Sweet joy befall thee!\n \n \n A DREAM\n \n Once a dream did weave a shade\n O\'er my angel-guarded bed,\n That an emmet lost its way\n Where on grass methought I lay.\n \n Troubled, wildered, and forlorn,\n Dark, benighted, travel-worn,\n Over many a

tangle spray,\n All heart-broke, I heard her say:\n \n "Oh my children! do they cry,\n Do they hear their father sigh?\n Now they look abroad to see,\n Now return and weep for me."\n \n Pitying, I dropped a tear:\n But I saw a glow-worm near,\n Who replied, "What wailing wight\n Calls the watchman of the night?\n \n "I am set to light the ground,\n While the beetle goes his round:\n Follow now the beetle\'s hum;\n Little wanderer, hie thee home!"\n \n \n ON ANOTHER\'S SORROW\n \n Can I see another\'s woe,\n And not be in sorrow too?\n Can I see another\'s grief,\n And not seek for kind relief?\n \n Can I see a falling tear,\n And not feel my sorrow\'s share?\n Can a father see his child\n Weep, nor be with sorrow filled?\n \n Can a mother sit and hear\n An infant groan, an infant fear?\n No, no! never can it be!\n Never, never can it be!\n \n And can He who smiles on all\n Hear the wren with sorrows small,\n Hear the small bird\'s grief and care,\n Hear the woes that infants bear --\n \n And not sit beside the next,\n Pouring pity in their breast,\n And not sit the cradle near,\n Weeping tear on infant\'s tear?\n \n And not sit both night and day,\n Wiping all our tears away?\n Oh no! never can it be!\n Never, never can it be!\n \n He doth give his joy to all:\n He becomes an infant small,\n He becomes a man of woe,\n He doth feel the sorrow too.\n \n Think not thou canst sigh a sigh,\n And thy Maker is not by:\n Think not thou canst weep a tear,\n And thy Maker is not year.\n \n Oh He gives to us his joy,\n That our grief He may destroy:\n Till our grief is fled an gone\n He doth sit by us and moan.\n \n \n SONGS OF EXPERIENCE\n \n \n INTRODUCTION\n \n Hear the voice of the Bard,\n Who present, past, and future, sees;\n Whose ears have heard\n The Holy Word\n That walked among the ancient tree;\n \n Calling the lapsed soul,\n And weeping in the evening dew;\n That might control\n The starry pole,\n And fallen, fallen light renew!\n \n "O Earth, O Earth, return!\n Arise from out the dewy grass!\n Night is worn,\n And the morn\n Rises from the slumbrous mass.\n \n "Turn away no more;\n Why wilt thou turn away?\n The starry floor,\n The watery shore,\n Are given thee till the break of day."\n \n \n EARTH\'S ANSWER\n \n Earth raised up her head\n From the darkness dread and drear,\n Her light fled,\n Stony, dread,\n And her locks covered with grey despair.\n \n "Prisoned on watery shore,\n Starry jealousy does keep my den\n Cold and hoar;\n Weeping o\'re,\n I hear the father of the ancient men.\n \n "Selfish father of men!\n Cruel, jealous, selfish fear!\n Can delight,\n Chained in night,\n The virgins of youth and morning bear?\n \n \n "Does spring hide its joy,\n When buds and blossoms grow?\n Does the sower \n Sow by night,\n Or the plowman in darkness plough?\n \n "Break this heavy chain,\n That does freeze my bones around!\n Selfish, vain,\n Eternal bane,\n That free love with bondage bound."\n \n \n THE CLOD AND THE PEBBLE\n \n "Love seeketh not itself to please,\n Nor for itself hath any care,\n But for another gives it ease,\n And builds a heaven in hell\'s despair."\n \n So sang a little clod of clay,\n Trodden with the cattle\'s feet,\n But a pebble of the brook\n Warbled out these metres meet:\n \n "Love seeketh only Self to please,\n To bind another to its delight,\n Joys in another\'s loss of ease,\n And builds a hell in heaven\'s despite."\n \n \n HOLY THURSDAY\n \n Is this a holy thing to see\n In a rich and fruitful land, --\n Babes reduced to misery,\n Fed with cold and usurous hand?\n \n Is that trembling cry a song?\n Can it be a song of joy?\n And so many children

poor?\n It is a land of poverty!\n \n And their son does never shine,\n And their fields are bleak and bare,\n And their ways are filled with thorns:\n It is eternal winter there.\n \n For where\'er the sun does shine,\n And where\'er the rain does fall,\n Babes should never hunger there,\n Nor poverty the mind appall.\n \n \n THE LITTLE GIRL LOST\n \n In futurity\n I prophetic see\n That the earth from sleep\n (Grave the sentence deep)\n \n Shall arise, and seek\n for her Maker meek;\n And the desert wild\n Become a garden mild.\n \n In the southern clime,\n Where the summer\'s prime\n Never fades away,\n Lovely Lyca lay.\n \n Seven summers old\n Lovely Lyca told.\n She had wandered long,\n Hearing wild birds\' song.\n \n "Sweet sleep, come to me\n Underneath this tree;\n Do father, mother, weep?\n Where can Lyca sleep?\n \n "Lost in desert wild\n Is your little child.\n How can Lyca sleep\n If her mother weep?\n \n "If her heart does ache,\n Then let Lyca wake;\n If my mother sleep,\n Lyca shall not weep.\n \n "Frowning, frowning night,\n O\'er this desert bright\n Let thy moon arise,\n While I close my eyes."\n \n Sleeping Lyca lay\n While the beasts of prey,\n Come from caverns deep,\n Viewed the maid asleep.\n \n The kingly lion stood,\n And the virgin viewed:\n Then he gambolled round\n O\'er the hallowed ground.\n \n Leopards, tigers, play\n Round her as she lay;\n While the lion old\n Bowed his mane of gold,\n \n And her breast did lick\n And upon her neck,\n From his eyes of flame,\n Ruby tears there came;\n \n While the lioness\n Loosed her slender dress,\n And naked they conveyed\n To caves the sleeping maid.\n \n \n THE LITTLE GIRL FOUND\n \n All the night in woe\n Lyca\'s parents go\n Over valleys deep,\n While the deserts weep.\n \n Tired and woe-begone,\n Hoarse with making moan,\n Arm in arm, seven days\n They traced the desert ways.\n \n Seven nights they sleep\n Among shadows deep,\n And dream they see their child\n Starved in desert wild.\n \n Pale through pathless ways\n The fancied image strays,\n Famished, weeping, weak,\n With hollow piteous shriek.\n \n Rising from unrest,\n The trembling woman presse\n With feet of weary woe;\n She could no further go.\n \n In his arms he bore\n Her, armed with sorrow sore;\n Till before their way\n A couching lion lay.\n \n Turning back was vain:\n Soon his heavy mane\n Bore them to the ground,\n Then he stalked around,\n \n Smelling to his prey;\n But their fears allay\n When he licks their hands,\n And silent by them stands.\n \n They look upon his eyes,\n Filled with deep surprise;\n And wondering behold\n A spirit armed in gold.\n \n On his head a crown,\n On his shoulders down\n Flowed his golden hair.\n Gone was all their care.\n \n "Follow me," he said;\n "Weep not for the maid;\n In my palace deep,\n Lyca lies asleep."\n \n Then they followed\n Where the vision led,\n And saw their sleeping child\n Among tigers wild.\n \n To this day they dwell\n In a lonely dell,\n Nor fear the wolvish howl\n Nor the lion\'s growl.\n \n \n THE CHIMNEY SWEEPER\n \n A little black thing in the snow,\n Crying "weep! weep!" in notes of woe!\n "Where are thy father and mother? Say!"--\n "They are both gone up to the church to pray.\n \n "Because I was happy upon the heath,\n And smiled among the winter\'s snow,\n They clothed me in the clothes of death,\n And taught me to sing the notes of woe.\n \n "And because I am happy and dance and sing,\n They think they have done me no injury,\n And are gone to praise God and his priest and king,\n Who make up a heaven of our misery."\n \n \n NURSE\'S SONG\n \n When voices of children are heard on the green,\n And whisperings are

in the dale,\n The days of my youth rise fresh in my mind,\n My face turns green and pale.\n \n Then come home, my children, the sun is gone down,\n And the dews of night arise;\n Your spring and your day are wasted in play,\n And your winter and night in disguise.\n \n \n THE SICK ROSE\n \n O rose, thou art sick!\n The invisible worm,\n That flies in the night,\n In the howling storm,\n \n Has found out thy bed\n Of crimson joy,\n And his dark secret love\n Does thy life destroy.\n \n \n THE FLY\n \n Little Fly,\n Thy summer\'s play\n My thoughtless hand\n Has brushed away.\n \n Am not I\n A fly like thee?\n Or art not thou\n A man like me?\n \n For I dance\n And drink, and sing,\n Till some blind hand\n Shall brush my wing.\n \n If thought is life\n And strength and breath\n And the want \n Of thought is death;\n \n Then am I\n A happy fly,\n If I live,\n Or if I die.\n \n \n THE ANGEL\n \n I dreamt a dream! What can it mean?\n And that I was a maiden Queen\n Guarded by an Angel mild:\n Witless woe was ne\'er beguiled!\n \n And I wept both night and day,\n And he wiped my tears away;\n And I wept both day and night,\n And hid from him my heart\'s delight.\n \n So he took his wings, and fled;\n Then the morn blushed rosy red.\n I dried my tears, and armed my fears\n With ten-thousand shields and spears.\n \n Soon my Angel came again;\n I was armed, he came in vain;\n For the time of youth was fled,\n And grey hairs were on my head.\n \n \n THE TIGER\n \n Tiger, tiger, burning bright\n In the forest of the night,\n What immortal hand or eye\n Could Frame thy fearful symmetry?\n \n In what distant deeps or skies\n Burnt the fire of thine eyes?\n On what wings dare he aspire?\n What the hand dare seize the fire?\n \n And what shoulder and what art\n Could twist the sinews of thy heart?\n And, when thy heart began to beat,\n What dread hand and what dread feet?\n \n What the hammer? what the chain?\n In what furnace was thy brain?\n What the anvil? what dread grasp\n Dare its deadly terrors clasp?\n \n When the stars threw down their spears,\n And watered heaven with their tears,\n Did he smile his work to see?\n Did he who made the lamb make thee?\n \n Tiger, tiger, burning bright\n In the forests of the night,\n What immortal hand or eye\n Dare frame thy fearful symmetry?\n \n \n MY PRETTY ROSE TREE\n \n A flower was offered to me,\n Such a flower as May never bore;\n But I said "I\'ve a pretty rose tree,"\n And I passed the sweet flower o\'er.\n \n Then I went to my pretty rose tree,\n To tend her by day and by night;\n But my rose turned away with jealousy,\n And her thorns were my only delight.\n \n \n AH SUNFLOWER\n \n Ah Sunflower, weary of time,\n Who countest the steps of the sun;\n Seeking after that sweet golden clime\n Where the traveller\'s journey is done;\n \n Where the Youth pined away with desire,\n And the pale virgin shrouded in snow,\n Arise from their graves, and aspire\n Where my Sunflower wishes to go!\n \n \n THE LILY\n \n The modest Rose puts forth a thorn,\n The humble sheep a threat\'ning horn:\n While the Lily white shall in love delight,\n Nor a thorn nor a threat stain her beauty bright.\n \n \n THE GARDEN OF LOVE\n \n I laid me down upon a bank,\n Where Love lay sleeping;\n I heard among the rushes dank\n Weeping, weeping.\n \n Then I went to the heath and the wild,\n To the thistles and thorns of the waste;\n And they told me how they were beguiled,\n Driven out, and compelled to the chaste.\n \n I went to the Garden of Love,\n And saw what I never had seen;\n A Chapel was built in the midst,\n Where I used to play on the green.\n \n And the gates of this Chapel were shut\n And

"Thou shalt not," writ over the door;\n So I turned to the Garden of Love\n That so many sweet flowers bore.\n \n And I saw it was filled with graves,\n And tombstones where flowers should be;\n And priests in black gowns were walking their rounds,\n And binding with briars my joys and desires.\n \n \n THE LITTLE VAGABOND\n \n Dear mother, dear mother, the Church is cold;\n But the Alehouse is healthy, and pleasant, and warm.\n Besides, I can tell where I am used well;\n The poor parsons with wind like a blown bladder swell.\n \n But, if at the Church they would give us some ale,\n And a pleasant fire our souls to regale,\n We\'d sing and we\'d pray all the livelong day,\n Nor ever once wish from the Church to stray.\n \n Then the Parson might preach, and drink, and sing,\n And we\'d be as happy as birds in the spring;\n And modest Dame Lurch, who is always at church,\n Would not have bandy children, nor fasting, nor birch.\n \n And God, like a father, rejoicing to see\n His children as pleasant and happy as he,\n Would have no more quarrel with the Devil or the barrel,\n But kiss him, and give him both drink and apparel.\n \n \n LONDON\n \n I wandered through each chartered street,\n Near where the chartered Thames does flow,\n A mark in every face I meet,\n Marks of weakness, marks of woe.\n \n In every cry of every man,\n In every infant\'s cry of fear,\n In every voice, in every ban,\n The mind-forged manacles I hear:\n \n How the chimney-sweeper\'s cry\n Every blackening church appals,\n And the hapless soldier\'s sigh\n Runs in blood down palace-walls.\n \n But most, through midnight streets I hear\n How the youthful harlot\'s curse\n Blasts the new-born infant\'s tear,\n And blights with plagues the marriage-hearse.\n \n \n THE HUMAN ABSTRACT\n \n Pity would be no more\n If we did not make somebody poor,\n And Mercy no more could be\n If all were as happy as we.\n \n And mutual fear brings Peace,\n Till the selfish loves increase\n Then Cruelty knits a snare,\n And spreads his baits with care.\n \n He sits down with his holy fears,\n And waters the ground with tears;\n Then Humility takes its root\n Underneath his foot.\n \n Soon spreads the dismal shade\n Of Mystery over his head,\n And the caterpillar and fly\n Feed on the Mystery.\n \n And it bears the fruit of Deceit,\n Ruddy and sweet to eat,\n And the raven his nest has made\n In its thickest shade.\n \n The gods of the earth and sea\n Sought through nature to find this tree,\n But their search was all in vain:\n There grows one in the human Brain.\n \n \n INFANT SORROW\n \n My mother groaned, my father wept:\n Into the dangerous world I leapt,\n Helpless, naked, piping loud,\n Like a fiend hid in a cloud.\n \n Struggling in my father\'s hands,\n Striving against my swaddling-bands,\n Bound and weary, I thought best\n To sulk upon my mother\'s breast.\n \n \n A POISON TREE\n \n I was angry with my friend:\n I told my wrath, my wrath did end.\n I was angry with my foe:\n I told it not, my wrath did grow.\n \n And I watered it in fears\n Night and morning with my tears,\n And I sunned it with smiles\n And with soft deceitful wiles.\n \n And it grew both day and night,\n Till it bore an apple bright,\n And my foe beheld it shine,\n and he knew that it was mine, --\n \n And into my garden stole\n When the night had veiled the pole;\n In the morning, glad, I see\n My foe outstretched beneath the tree.\n \n \n A LITTLE BOY LOST\n \n "Nought loves another as itself,\n Nor venerates another so,\n Nor is it possible to thought\n A greater than itself to know.\n \n "And, father, how can I love you

\n Or any of my brothers more?\n I love you like the little bird\n That picks up crumbs around the door."\n \n The Priest sat by and heard the child;\n In trembling zeal he seized his hair,\n He led him by his little coat,\n And all admired the priestly care. \n \n And standing on the altar high,\n "Lo, what a fiend is here! said he:\n "One who sets reason up for judge\n Of our most holy mystery."\n \n The weeping child could not be heard,\n The weeping parents wept in vain:\n They stripped him to his little shirt,\n And bound him in an iron chain,\n \n And burned him in a holy place\n Where many had been burned before;\n The weeping parents wept in vain.\n Are such thing done on Albion\'s shore?\n \n \n A LITTLE GIRL LOST\n \n Children of the future age,\n Reading this indignant page,\n Know that in a former time\n Love, sweet love, was thought a crime.\n \n In the age of gold,\n Free from winter\'s cold,\n Youth and maiden bright,\n To the holy light,\n Naked in the sunny beams delight.\n \n Once a youthful pair,\n Filled with softest care,\n Met in garden bright\n Where the holy light\n Had just removed the curtains of the night.\n \n Then, in rising day,\n On the grass they play;\n Parents were afar,\n Strangers came not near,\n And the maiden soon forgot her fear.\n \n Tired with kisses sweet,\n They agree to meet\n When the silent sleep\n Waves o\'er heaven\'s deep,\n And the weary tired wanderers weep.\n \n To her father white\n Came the maiden bright;\n But his loving look,\n Like the holy book\n All her tender limbs with terror shook.\n \n "Ona, pale and weak,\n To thy father speak!\n Oh the trembling fear!\n Oh the dismal care\n That shakes the blossoms of my hoary hair!"\n \n \n THE SCHOOLBOY\n \n I love to rise on a summer morn, \n When birds are singing on every tree;\n The distant huntsman winds his horn,\n And the skylark sings with me:\n Oh what sweet company!\n \n But to go to school in a summer morn, --\n Oh it drives all joy away!\n Under a cruel eye outworn,\n The little ones spend the day\n In sighing and dismay.\n \n Ah then at times I drooping sit,\n And spend many an anxious hour;\n Nor in my book can I take delight,\n Nor sit in learning\'s bower,\n Worn through with the dreary shower.\n \n How can the bird that is born for joy\n Sit in a cage and sing?\n How can a child, when fears annoy,\n But droop his tender wing,\n And forget his youthful spring?\n \n Oh father and mother, if buds are nipped,\n And blossoms blown away;\n And if the tender plants are stripped\n Of their joy in the springing day,\n By sorrow and care\'s dismay, --\n \n How shall the summer arise in joy,\n Or the summer fruits appear?\n Or how shall we gather what griefs destroy,\n Or bless the mellowing year,\n When the blasts of winter appear?\n \n \n TO TERZAH\n \n Whate\'er is born of mortal birth\n Must be consumed with the earth,\n To rise from generation free:\n Then what have I to do with thee?\n The sexes sprang from shame and pride,\n Blown in the morn, in evening died;\n But mercy changed death into sleep;\n The sexes rose to work and weep.\n \n Thou, mother of my mortal part,\n With cruelty didst mould my heart,\n And with false self-deceiving tears\n Didst bind my nostrils, eyes, and ears,\n \n Didst close my tongue in senseless clay,\n And me to mortal life betray.\n The death of Jesus set me free:\n Then what have I to do with thee?\n \n \n THE VOICE OF THE ANCIENT BARD\n \n Youth of delight! come hither\n And see the opening morn,\n Image of Truth new-born.\n Doubt is fled, and clouds of reason,\n Dark disputes and artful teazing.\n Folly is an endless maze;\n

Tangled roots perplex her ways;\n How many have fallen there!\n They stumble all night over bones of the dead;\n And feel -- they know not what but care;\n And wish to lead others, when they should be led.\n\n\nAPPENDIX\n\n A DIVINE IMAGE\n \n Cruelty has a human heart,\n And Jealousy a human face;\n Terror the human form divine,\n And Secresy the human dress.\n \n The human dress is forged iron,\n The human form a fiery forge,\n The human face a furnace sealed,\n The human heart its hungry gorge.\n \n NOTE: Though written and engraved by Blake, "A DIVINE IMAGE" was never\nincluded in the SONGS OF INNOCENCE AND OF EXPERIENCE.\n\n\n\n\n\n\nWilliam Blake\'s \n\nTHE BOOK of THEL\n\n\nTHEL\'S Motto\n\nDoes the Eagle know what is in the pit?\nOr wilt thou go ask the Mole:\nCan Wisdom be put in a silver rod?\nOr Love in a golden bowl?\n\n\nTHE BOOK of THEL\n\nThe Author & Printer Willm. Blake. 1780\n\n\nTHEL\n\nI\n\nThe daughters of Mne Seraphim led round their sunny flocks,\nAll but the youngest: she in paleness sought the secret air.\nTo fade away like morning beauty from her mortal day:\nDown by the river of Adona her soft voice is heard;\nAnd thus her gentle lamentation falls like morning dew.\n\nO life of this our spring! why fades the lotus of the water?\nWhy fade these children of the spring? born but to smile & fall.\nAh! Thel is like a watry bow, and like a parting cloud,\nLike a reflection in a glass: like shadows in the water\nLike dreams of infants, like a smile upon an infants face.\nLike the doves voice, like transient day, like music in the air:\nAh! gentle may I lay me down and gentle rest my head.\nAnd gentle sleep the sleep of death, and gently hear the voice \nOf him that walketh in the garden in the evening time.\n\nThe Lilly of the valley breathing in the humble grass\nAnswerd the lovely maid and said: I am a watry weed,\nAnd I am very small and love to dwell in lowly vales:\nSo weak the gilded butterfly scarce perches on my head\nYet I am visited from heaven and he that smiles on all\nWalks in the valley, and each morn over me spreads his hand\nSaying, rejoice thou humble grass, thou new-born lily flower.\nThou gentle maid of silent valleys and of modest brooks:\nFor thou shall be clothed in light, and fed with morning manna:\nTill summers heat melts thee beside the fountains and the springs\nTo flourish in eternal vales: they why should Thel complain.\nWhy should the mistress of the vales of Har, utter a sigh.\n\nShe ceasd & smild in tears, then sat down in her silver shrine.\n\nThel answerd, O thou little virgin of the peaceful valley.\nGiving to those that cannot crave, the voiceless, the o\'er tired\nThe breath doth nourish the innocent lamb, he smells the milky garments\nHe crops thy flowers while thou sittest smiling in his face,\nWiping his mild and meekin mouth from all contagious taints.\nThy wine doth purify the golden honey; thy perfume.\nWhich thou dost scatter on every little blade of grass that springs\nRevives the milked cow, & tames the fire-breathing steed.\nBut Thel is like a faint cloud kindled at the rising sun:\nI vanish from my pearly throne, and who shall find my place.\n\nQueen of the vales the Lily answered, ask the tender cloud,\nAnd it shall tell thee why it glitters in the morning sky.\nAnd why it scatters its bright beauty thro the humid air.\nDescend O little cloud & hover before the eyes of Thel.\n\nThe Cloud descended and the Lily bowd her modest head:\nAnd went to mind her numerous charge among the verdant grass.\n\n\nII.\n\nO little Cloud the virgin said, I charge thee to tell me\nWhy thou complainest now when in one hour thou fade

away:\nThen we shall seek thee but not find: ah Thel is like to thee.\nI pass away, yet I complain, and no one hears my voice.\n\nThe Cloud then shewd his golden head & his bright form emerg\'d.\nHovering and glittering on the air before the face of Thel.\n\nO virgin know\'st thou not our steeds drink of the golden springs\nWhere Luvah doth renew his horses: lookst thou on my youth.\nAnd fearest thou because I vanish and am seen no more.\nNothing remains; O maid I tell thee, when I pass away.\nIt is to tenfold life, to love, to peace, and raptures holy:\nUnseen descending, weigh my light wings upon balmy flowers:\nAnd court the fair eyed dew, to take me to her shining tent\nThe weeping virgin, trembling kneels before the risen sun.\nTill we arise link\'d in a golden band and never part:\nBut walk united bearing food to all our tender flowers.\n\nDost thou O little cloud? I fear that I am not like thee:\nFor I walk through the vales of Har, and smell the sweetest flowers:\nBut I feed not the little flowers: I hear the warbling birds,\nBut I feed not the warbling birds, they fly and seek their food:\nBut Thel delights in these no more because I fade away\nAnd all shall say, without a use this shining women liv\'d,\nOr did she only live to be at death the food of worms.\n\nThe Cloud reclind upon his airy throne and answerd thus.\n\nThen if thou art the food of worms, O virgin of the skies,\nHow great thy use, how great thy blessing, every thing that lives.\nLives not alone nor or itself: fear not and I will call,\nThe weak worm from its lowly bed, and thou shalt hear its voice.\nCome forth worm and the silent valley, to thy pensive queen.\n\nThe helpless worm arose and sat upon the Lillys leaf,\nAnd the bright Cloud saild on, to find his partner in the vale.\n\n\nIII.\n\nThen Thel astonish\'d view\'d the Worm upon its dewy bed.\n\nArt thou a Worm? image of weakness. art thou but a Worm?\nI see thee like an infant wrapped in the Lillys leaf;\nAh weep not little voice, thou can\'st not speak, but thou can\'st weep:\nIs this a Worm? I see they lay helpless & naked: weeping\nAnd none to answer, none to cherish thee with mothers smiles.\n\nThe Clod of Clay heard the Worms voice & rais\'d her pitying head:\nShe bowd over the weeping infant, and her life exhald\nIn milky fondness, then on Thel she fix\'d her humble eyes\n\nO beauty of the vales of Har, we live not for ourselves,\nThou seest me the meanest thing, and so I am indeed:\nMy bosom of itself is cold, and of itself is dark,\n\nBut he that loves the lowly, pours his oil upon my head\nAnd kisses me, and binds his nuptial bands around my breast.\nAnd says; Thou mother of my children, I have loved thee\nAnd I have given thee a crown that none can take away.\nBut how this is sweet maid, I know not, and I cannot know\nI ponder, and I cannot ponder; yet I live and love.\n\nThe daughter of beauty wip\'d her pitying tears with her white veil,\nAnd said, Alas! I knew not this, and therefore did I weep:\nThat God would love a Worm I knew, and punish the evil foot\nThat wilful bruis\'d its helpless form: but that he cherish\'d it\nWith milk and oil I never knew, and therefore did I weep,\nAnd I complaind in the mild air, because I fade away.\nAnd lay me down in thy cold bed, and leave my shining lot.\n\nQueen of the vales, the matron Clay answered: I heard thy sighs.\nAnd all thy moans flew o\'er my roof, but I have call\'d them down:\nWilt thou O Queen enter my house, tis given thee to enter,\nAnd to return: fear nothing, enter with thy virgin feet.\n\n\nIV.\n\nThe eternal gates terrific porter lifted the northern

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bar:\nThel enter\'d in & saw the secrets of the land unknown;\nShe saw the
couches of the dead, & where the fibrous roots\nOf every heart on earth infixes
deep its restless twists:\nA land of sorrows & of tears where never smile was
seen.\n\nShe wandered in the land of clouds thro\' valleys dark,
listning\nDolors & lamentations: waiting oft beside the dewy grave\nShe stood in
silence, listning to the voices of the ground,\nTill to her own grave plot she
came, & there she sat down.\nAnd heard this voice of sorrow breathed from the
hollow pit.\n\nWhy cannot the Ear be closed to its own destruction?\nOr the
glistening Eye to the poison of a smile!\nWhy are Eyelids stord with arrows
ready drawn,\nWhere a thousand fighting men in ambush lie!\nOr an Eye of gifts &
graces showring fruits & coined gold!\n\nWhy a Tongue impress\'d with honey from
every wind?\nWhy an Ear, a whirlpool fierce to draw creations in?\nWhy a Nostril
wide inhaling terror trembling & affright\nWhy a tender curb upon the youthful
burning boy?\nWhy a little curtain of flesh on the bed of our desire?\n\nThe
Virgin started from her seat, & with a shriek,\nFled back unhinderd till she
came into the vales of Har\n\n\n'
```

[13]:
```
s1 = emma.split('.')
```

[14]:
```
s1[0]
```

[14]:
```
'[Poems by William Blake 1789]\n\n \nSONGS OF INNOCENCE AND OF EXPERIENCE\nand
THE BOOK of THEL\n\n\n SONGS OF INNOCENCE\n \n \n INTRODUCTION\n \n Piping down
the valleys wild,\n   Piping songs of pleasant glee,\n On a cloud I saw a
child,\n   And he laughing said to me:\n \n "Pipe a song about a Lamb!"\n   So I
piped with merry cheer'
```

[15]:
```
w1 = word_tokenize(s1[0])
w1
```

[15]:
```
['[',
 'Poems',
 'by',
 'William',
 'Blake',
 '1789',
 ']',
 'SONGS',
 'OF',
 'INNOCENCE',
 'AND',
 'OF',
 'EXPERIENCE',
 'and',
 'THE',
 'BOOK',
 'of',
```

```
'THEL',
'SONGS',
'OF',
'INNOCENCE',
'INTRODUCTION',
'Piping',
'down',
'the',
'valleys',
'wild',
',',
'Piping',
'songs',
'of',
'pleasant',
'glee',
',',
'On',
'a',
'cloud',
'I',
'saw',
'a',
'child',
',',
'And',
'he',
'laughing',
'said',
'to',
'me',
':',
'``',
'Pipe',
'a',
'song',
'about',
'a',
'Lamb',
'!',
"''",
'So',
'I',
'piped',
'with',
'merry',
'cheer']
```

[16]:
```
myToken(s1[0])
```

```
['[Poems', 'by', 'William', 'Blake', '1789]\n\n', '\nSONGS', 'OF', 'INNOCENCE',
'AND', 'OF', 'EXPERIENCE\nand', 'THE', 'BOOK', 'of', 'THEL\n\n\n', 'SONGS',
'OF', 'INNOCENCE\n', '\n', '\n', 'INTRODUCTION\n', '\n', 'Piping', 'down',
'the', 'valleys', 'wild,\n', '', '', 'Piping', 'songs', 'of', 'pleasant',
'glee,\n', 'On', 'a', 'cloud', 'I', 'saw', 'a', 'child,\n', '', '', 'And', 'he',
'laughing', 'said', 'to', 'me:\n', '\n', '"Pipe', 'a', 'song', 'about', 'a',
'Lamb!"\n', '', '', 'So', 'I', 'piped', 'with', 'merry', 'cheer']
```

[17]:
```
import nltk
from nltk.corpus import stopwords
stop1 = set(stopwords.words('english'))
print(stop1)
```

```
{'during', 'how', 'wasn', 're', 'below', 'himself', 'they', 'own', 'myself',
'so', 'these', "weren't", 'does', 'all', 'both', 'that', 'because', "you'd",
'what', 'too', 'of', 'up', "didn't", 'your', 'had', 'doesn', 'mustn',
"shouldn't", 'into', 'if', "wasn't", 'which', 'over', 'while', "wouldn't",
'shouldn', 'him', 'hasn', "hasn't", 'themselves', 'very', 'll', 'did', 'from',
'not', "couldn't", 'between', 'this', 'once', 'were', 'here', 'in', 'needn',
'to', 'i', 'again', 'for', 'out', 'their', "you'll", 's', 'theirs', 'haven',
'by', 'd', "needn't", 'each', 'same', 'was', 'than', 'her', 'off', 'whom',
"won't", 't', 'when', 'aren', 'hadn', 'isn', 'our', 'as', 'nor', 'is', 'should',
'been', 'doing', 'those', 'can', 'ain', 'the', 'm', "it's", 'other',
'ourselves', "that'll", 'didn', 'after', "she's", 'having', 'you', 'few', 've',
'weren', 'ma', 'won', 'herself', 'further', 'has', 'am', 'hers', "mustn't",
'we', 'ours', "haven't", 'yourselves', 'with', 'where', 'couldn', 'there', 'on',
'now', "mightn't", "shan't", 'o', 'under', 'have', 'its', 'itself', 'until',
'then', 'yourself', 'at', 'why', 'such', 'are', 'an', "you've", 'y', 'through',
'only', 'who', 'mightn', 'me', 'no', 'do', 'a', 'just', 'don', 'wouldn', 'some',
'above', 'she', 'my', 'about', 'he', 'it', "doesn't", 'or', 'yours', 'most',
"you're", "should've", "hadn't", "isn't", 'any', 'down', "aren't", 'against',
'and', 'but', 'before', 'more', 'be', 'will', "don't", 'shan', 'his', 'them',
'being'}
```

[18]:
```
stop1 = set(stopwords.words('German'))
print(stop1)
```

```
{'deine', 'aber', 'ihnen', 'ander', 'oder', 'derselben', 'eine', 'muss',
'sollte', 'unser', 'jenem', 'seinem', 'derer', 'dich', 'dass', 'durch', 'ihre',
'so', 'viel', 'deiner', 'mich', 'werde', 'daß', 'sehr', 'denn', 'einig',
'während', 'als', 'indem', 'hin', 'alles', 'seiner', 'euer', 'also', 'jene',
'desselben', 'welche', 'einiges', 'einigem', 'anderes', 'einmal', 'dieses',
'war', 'diesen', 'unter', 'andern', 'anderen', 'deinem', 'hab', 'eures',
'allen', 'manche', 'keines', 'einem', 'ihn', 'könnte', 'derselbe', 'auch',
'noch', 'zu', 'sind', 'ihm', 'ihr', 'anderer', 'keinen', 'und', 'meiner',
'dessen', 'den', 'ist', 'in', 'ihrem', 'er', 'einige', 'andere', 'wird', 'habe',
```

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'eines', 'für', 'werden', 'unserem', 'sie', 'wenn', 'eure', 'damit', 'nichts',
'seinen', 'bin', 'hier', 'jeder', 'dem', 'dann', 'was', 'kein', 'jede', 'bist',
'jener', 'keinem', 'dieselbe', 'unseres', 'einen', 'meines', 'solche', 'bei',
'dasselbe', 'vom', 'des', 'jedes', 'zur', 'meine', 'deinen', 'seines', 'ohne',
'mit', 'dieser', 'können', 'ob', 'denselben', 'im', 'waren', 'wollte', 'eurer',
'keiner', 'ich', 'jedem', 'manches', 'wir', 'die', 'deines', 'man', 'machen',
'nur', 'das', 'ihren', 'wirst', 'jeden', 'euren', 'soll', 'dazu', 'diese',
'einer', 'am', 'mancher', 'anderr', 'wieder', 'alle', 'allem', 'dein', 'dies',
'meinen', 'euch', 'haben', 'jetzt', 'welchen', 'ihrer', 'doch', 'ihres', 'dir',
'weg', 'aus', 'ein', 'eurem', 'hat', 'musste', 'dieselben', 'sein', 'welchem',
'jenes', 'wollen', 'kann', 'von', 'der', 'bis', 'weil', 'anderm', 'unseren',
'es', 'würde', 'an', 'sondern', 'unsere', 'wo', 'wie', 'würden', 'ins',
'solchen', 'über', 'welcher', 'zwischen', 'sonst', 'seine', 'zwar', 'hatten',
'auf', 'selbst', 'einiger', 'manchem', 'zum', 'welches', 'solches', 'aller',
'uns', 'demselben', 'anders', 'da', 'einigen', 'nicht', 'jenen', 'um',
'anderem', 'etwas', 'nun', 'gegen', 'diesem', 'will', 'weiter', 'nach',
'gewesen', 'meinem', 'sich', 'hatte', 'mein', 'manchen', 'du', 'dort', 'warst',
'keine', 'solchem', 'mir', 'vor', 'hinter', 'solcher'}
```

[19]:
```
stop1 = set(stopwords.words('french'))
print(stop1)
```

```
{'ai', 'aurais', 'fûtes', 'aies', 'aie', 'étant', 'sa', 'tu', 'furent', 'eux',
'c', 'ton', 'sera', 'seras', 'fusse', 'aura', 'la', 'avez', 'fussent',
'auraient', 'une', 'étés', 'pas', 'seraient', 'étais', 'votre', 'soient',
'avons', 'eusses', 'leur', 'un', 'serez', 'soit', 'ont', 'de', 'mais', 'eue',
'ce', 'avais', 'ne', 'notre', 'ces', 'ayons', 'fût', 'serai', 'sont', 'eusse',
'pour', 'j', 'auront', 'aurait', 's', 'serait', 'lui', 'soyez', 'qu', 'tes',
'eût', 'd', 'sur', 'aurai', 'suis', 'ta', 'fussions', 'auras', 'eurent',
'étants', 'en', 't', 'même', 'aux', 'des', 'as', 'ayants', 'dans', 'eûmes',
'serons', 'étante', 'm', 'mon', 'aient', 'eussions', 'soyons', 'ayantes',
'fusses', 'été', 'vos', 'sois', 'les', 'était', 'l', 'ma', 'serais', 'ses',
'avec', 'ayez', 'aurons', 'étée', 'est', 'qui', 'vous', 'étiez', 'eues', 'eu',
'te', 'que', 'aurez', 'on', 'avait', 'eut', 'ou', 'son', 'nous', 'fus', 'et',
'eus', 'ayant', 'ils', 'seront', 'es', 'serions', 'avaient', 'y', 'êtes',
'étaient', 'eûtes', 'fut', 'étées', 'eussiez', 'ait', 'me', 'sommes', 'par',
'au', 'aurions', 'il', 'eussent', 'elle', 'mes', 'moi', 'avions', 'à', 'ayante',
'auriez', 'étantes', 'aviez', 'n', 'nos', 'fussiez', 'du', 'seriez', 'le',
'toi', 'étions', 'je', 'se', 'fûmes'}
```

[20]:
```
len(stop1)
```

[20]: 157

[21]:
```
stop1 = set(stopwords.words('english'))
print(stop1)
len(stop1)
```

```
{'during', 'how', 'wasn', 're', 'below', 'himself', 'they', 'own', 'myself',
'so', 'these', "weren't", 'does', 'all', 'both', 'that', 'because', "you'd",
'what', 'too', 'of', 'up', "didn't", 'your', 'had', 'doesn', 'mustn',
"shouldn't", 'into', 'if', "wasn't", 'which', 'over', 'while', "wouldn't",
'shouldn', 'him', 'hasn', "hasn't", 'themselves', 'very', 'll', 'did', 'from',
'not', "couldn't", 'between', 'this', 'once', 'were', 'here', 'in', 'needn',
'to', 'i', 'again', 'for', 'out', 'their', "you'll", 's', 'theirs', 'haven',
'by', 'd', "needn't", 'each', 'same', 'was', 'than', 'her', 'off', 'whom',
"won't", 't', 'when', 'aren', 'hadn', 'isn', 'our', 'as', 'nor', 'is', 'should',
'been', 'doing', 'those', 'can', 'ain', 'the', 'm', "it's", 'other',
'ourselves', "that'll", 'didn', 'after', "she's", 'having', 'you', 'few', 've',
'weren', 'ma', 'won', 'herself', 'further', 'has', 'am', 'hers', "mustn't",
'we', 'ours', "haven't", 'yourselves', 'with', 'where', 'couldn', 'there', 'on',
'now', "mightn't", "shan't", 'o', 'under', 'have', 'its', 'itself', 'until',
'then', 'yourself', 'at', 'why', 'such', 'are', 'an', "you've", 'y', 'through',
'only', 'who', 'mightn', 'me', 'no', 'do', 'a', 'just', 'don', 'wouldn', 'some',
'above', 'she', 'my', 'about', 'he', 'it', "doesn't", 'or', 'yours', 'most',
"you're", "should've", "hadn't", "isn't", 'any', 'down', "aren't", 'against',
'and', 'but', 'before', 'more', 'be', 'will', "don't", 'shan', 'his', 'them',
'being'}
```

[21]:
```
179
```

[ ]:
```
+
```

[33]:
```
import nltk
```

[40]:
```
from nltk.stem import PorterStemmer
```

[43]:
```
from nltk.tokenize import sent_tokenize, word_tokenize
```

[50]:
```
words = ["game", "gaming", "gamed", "games"]
ps = PorterStemmer()

for word in words:
    print(ps.stem(word))
```

```
game
game
game
game
```

[48]:
```
words = ["walking", "walked"]
ps = PorterStemmer()
```

[53]:
```
from nltk.stem.porter import PorterStemmer
tokens = ['Working', 'gaming', 'walked']
```

```
porter = PorterStemmer()
stems = []
for t in tokens:
    stems.append(porter.stem(t))
print(stems)
```

```
['work', 'game', 'walk']
```

[63]:
```
# Lemmanatization
```

[64]:
```
from nltk.corpus import wordnet as wn
```

[76]:
```
wn.synsets('spoke')
```

[76]:
```
[Synset('spoke.n.01'),
 Synset('rundle.n.01'),
 Synset('talk.v.02'),
 Synset('talk.v.01'),
 Synset('speak.v.03'),
 Synset('address.v.02'),
 Synset('speak.v.05')]
```

[ ]:
```
nltk.download('wordnet')
```

[ ]:
```
nltk.download('omw-1.4')
```

[78]:
```
wn.synsets('spoke')
```

[78]:
```
[Synset('spoke.n.01'),
 Synset('rundle.n.01'),
 Synset('talk.v.02'),
 Synset('talk.v.01'),
 Synset('speak.v.03'),
 Synset('address.v.02'),
 Synset('speak.v.05')]
```

[79]:
```
wn.synset('talk.v.01').definition()
```

[79]:
```
'exchange thoughts; talk with'
```

[82]:
```
wn.synset('talk.v.01').examples()
```

[82]:
```
['We often talk business', 'Actions talk louder than words']
```

[83]:
```
for syn in wn.synsets('spoke'):
  print(syn,':',syn.lemma_names)
```

```
Synset('spoke.n.01') : <bound method Synset.lemma_names of Synset('spoke.n.01')>
Synset('rundle.n.01') : <bound method Synset.lemma_names of
Synset('rundle.n.01')>
Synset('talk.v.02') : <bound method Synset.lemma_names of Synset('talk.v.02')>
Synset('talk.v.01') : <bound method Synset.lemma_names of Synset('talk.v.01')>
Synset('speak.v.03') : <bound method Synset.lemma_names of Synset('speak.v.03')>
Synset('address.v.02') : <bound method Synset.lemma_names of
Synset('address.v.02')>
Synset('speak.v.05') : <bound method Synset.lemma_names of Synset('speak.v.05')>
```

[84]:
```
wn.synsets('spoken')
```

[84]:
```
[Synset('talk.v.02'),
 Synset('talk.v.01'),
 Synset('speak.v.03'),
 Synset('address.v.02'),
 Synset('speak.v.05'),
 Synset('spoken.a.01')]
```

[85]:
```
for syn in wn.synsets('spoken'):
  print(syn,':',syn.lemma_names())
```

```
Synset('talk.v.02') : ['talk', 'speak', 'utter', 'mouth', 'verbalize',
'verbalise']
Synset('talk.v.01') : ['talk', 'speak']
Synset('speak.v.03') : ['speak', 'talk']
Synset('address.v.02') : ['address', 'speak']
Synset('speak.v.05') : ['speak']
Synset('spoken.a.01') : ['spoken']
```

[86]:
```
from nltk.stem import WordNetLemmatizer
```

[87]:
```
wn1=WordNetLemmatizer()
```

[88]:
```
wn1.lemmatize('spoken')
```

[88]:
```
'spoken'
```

[89]:
```
wn1.lemmatize('spoken','v')
```

[89]:
```
'speak'
```

[90]:
```
wn1.lemmatize('worst','a')
```

[90]:
```
'bad'
```

[ ]:
```

```

[ ]:
```
import nltk
from nltk.tokenize import word_tokenize
from nltk import pos_tag
nltk.download('averaged_perceptron_tagger')
```

[97]:
```
def pos_tagg(text):
  word_tokens = word_tokenize(text)
  return pos_tag(word_tokens)
pos_tagg('Are you afraid of something?')
```

[97]:
```
[('Are', 'NNP'),
 ('you', 'PRP'),
 ('afraid', 'IN'),
 ('of', 'IN'),
 ('something', 'NN'),
 ('?', '.')]
```

[ ]:
```
nltk.download('tagsets')

nltk.help.upenn_tagset('PRP')
```

[100]:
```
from nltk .text import TextCollection
from nltk.tokenize import word_tokenize

sents=['this is senteamce one','this is sentence two','this is sentence three']

sents=[word_tokenize(sent) for sent in sents]
print(sents)
corpus=TextCollection(sents)
print(corpus)

tf=corpus.tf('one',corpus)
print(tf)

idf=corpus.idf('one')
print(idf)

tf_idf=corpus.tf_idf('one',corpus)
print(tf_idf)
```

```
[['this', 'is', 'senteamce', 'one'], ['this', 'is', 'sentence', 'two'], ['this',
'is', 'sentence', 'three']]
<Text: this is senteamce one this is sentence two…>
0.08333333333333333
1.0986122886681098
0.0915510240556758
```

[ ]:

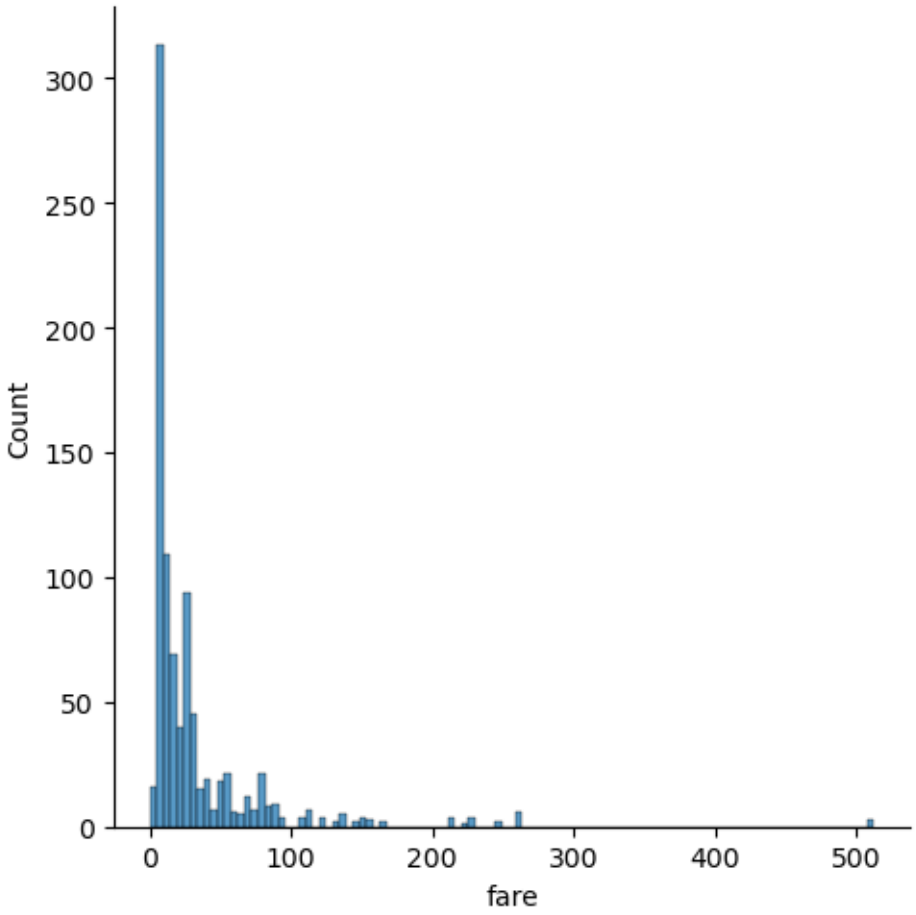
Practical No. 8

April 29, 2025

[ ]:
```
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import pandas as pd
Titanic = sns.load_dataset('titanic')
Titanic.head()
```

[ ]:
```
sns.displot(Titanic['fare'])
```

[ ]:
```
<seaborn.axisgrid.FacetGrid at 0x17b6fcb7f40>
```



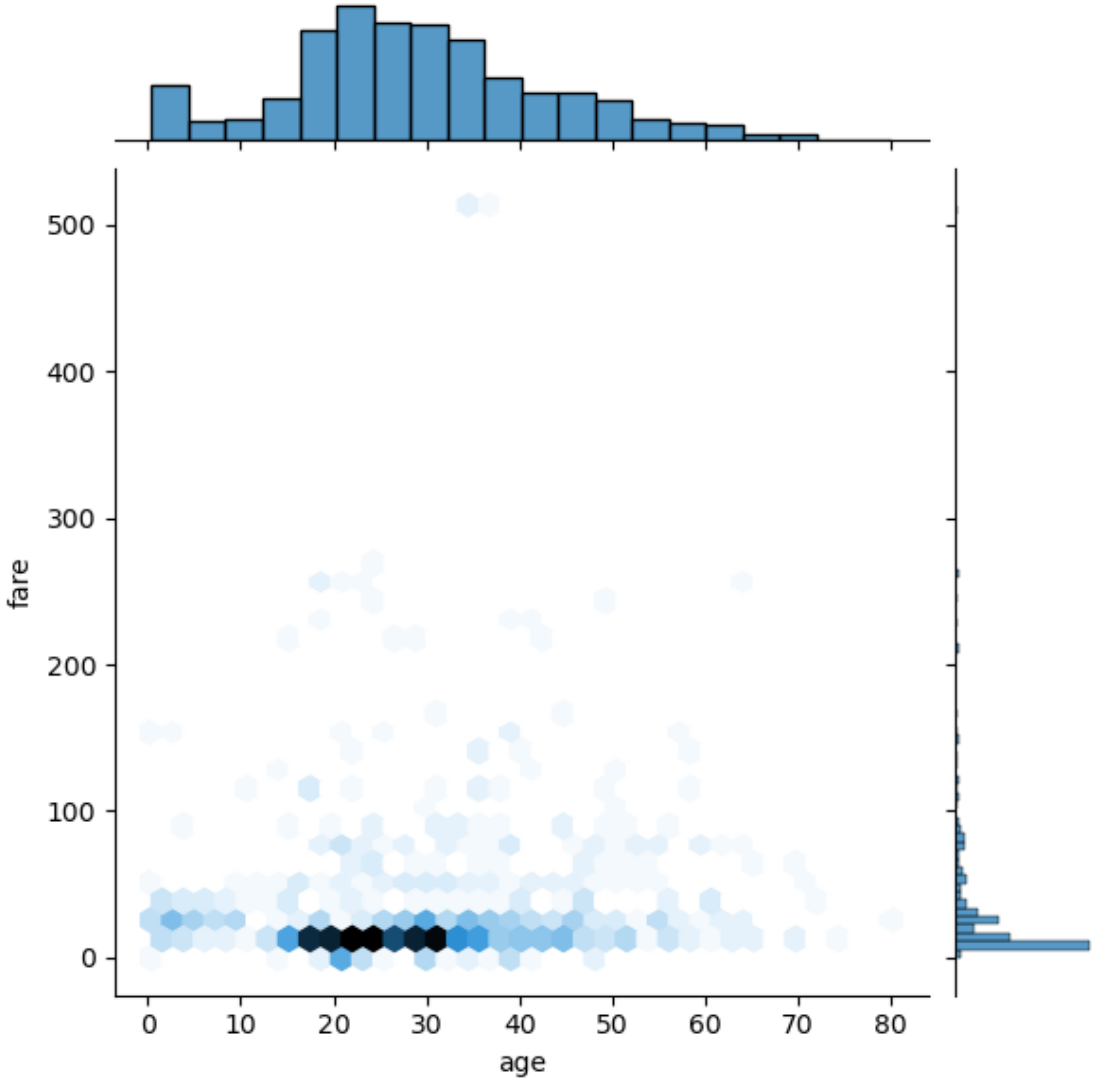
[ ]:
```
sns.jointplot(x='age', y='fare', data= Titanic)
```

[ ]:
```
<seaborn.axisgrid.JointGrid at 0x17b71481760>
```

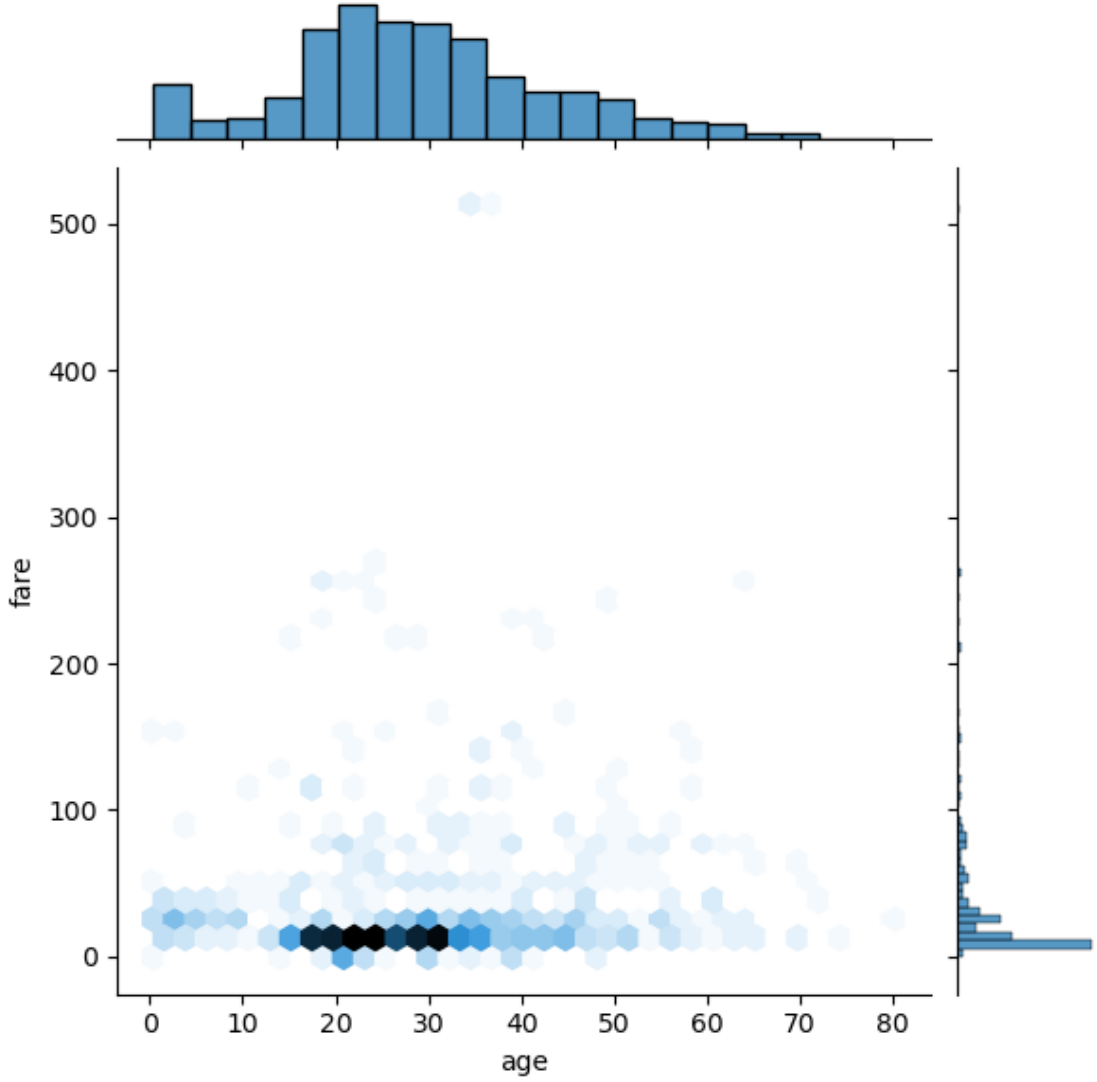
[ ]:
```
sns.jointplot(x='age',y='fare',data=Titanic,kind='hex')
```

[ ]:
```
<seaborn.axisgrid.JointGrid at 0x17b737bcb80>
```

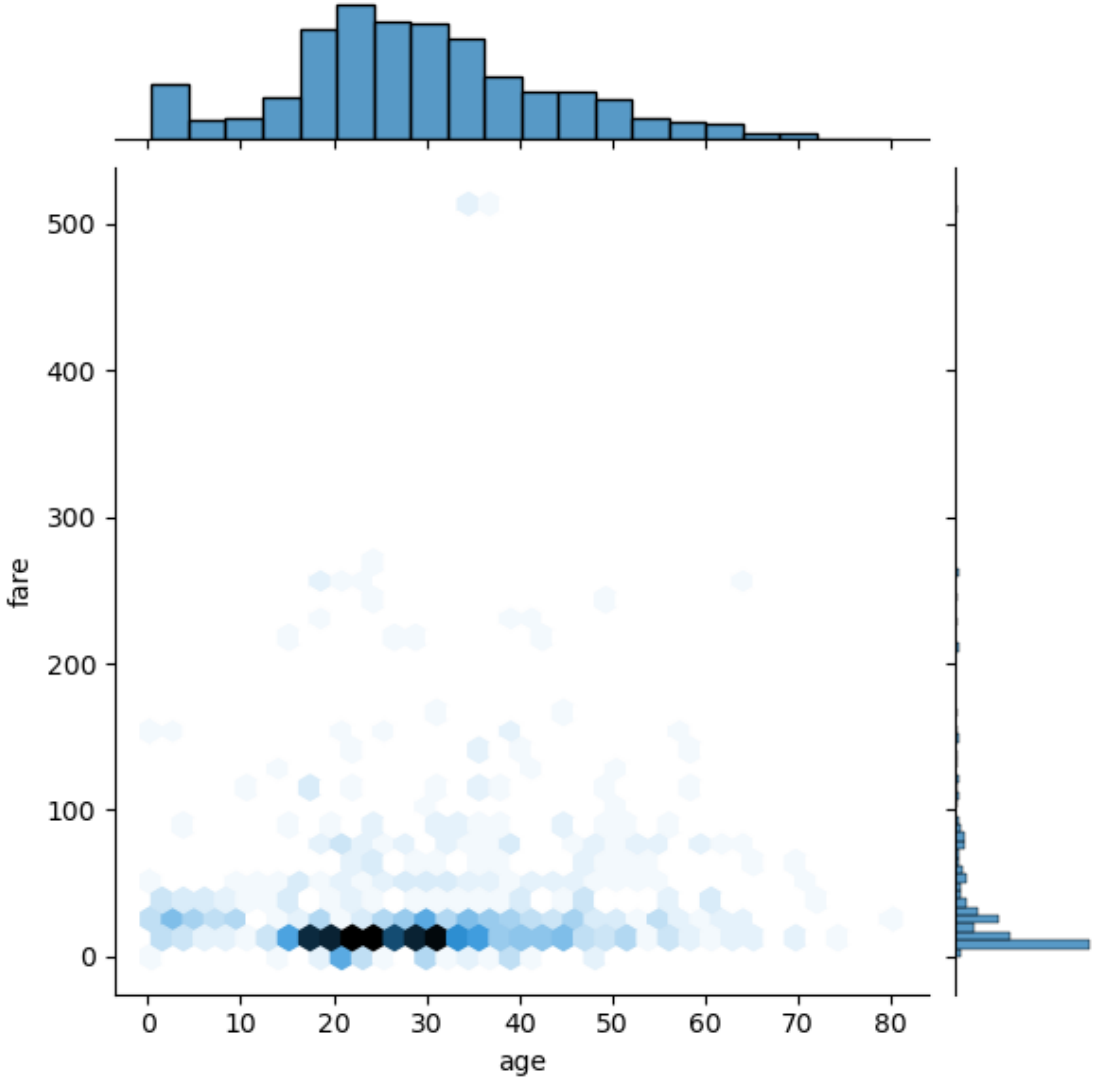
[ ]:
```
plt.show()
```



[ ]:
```

```

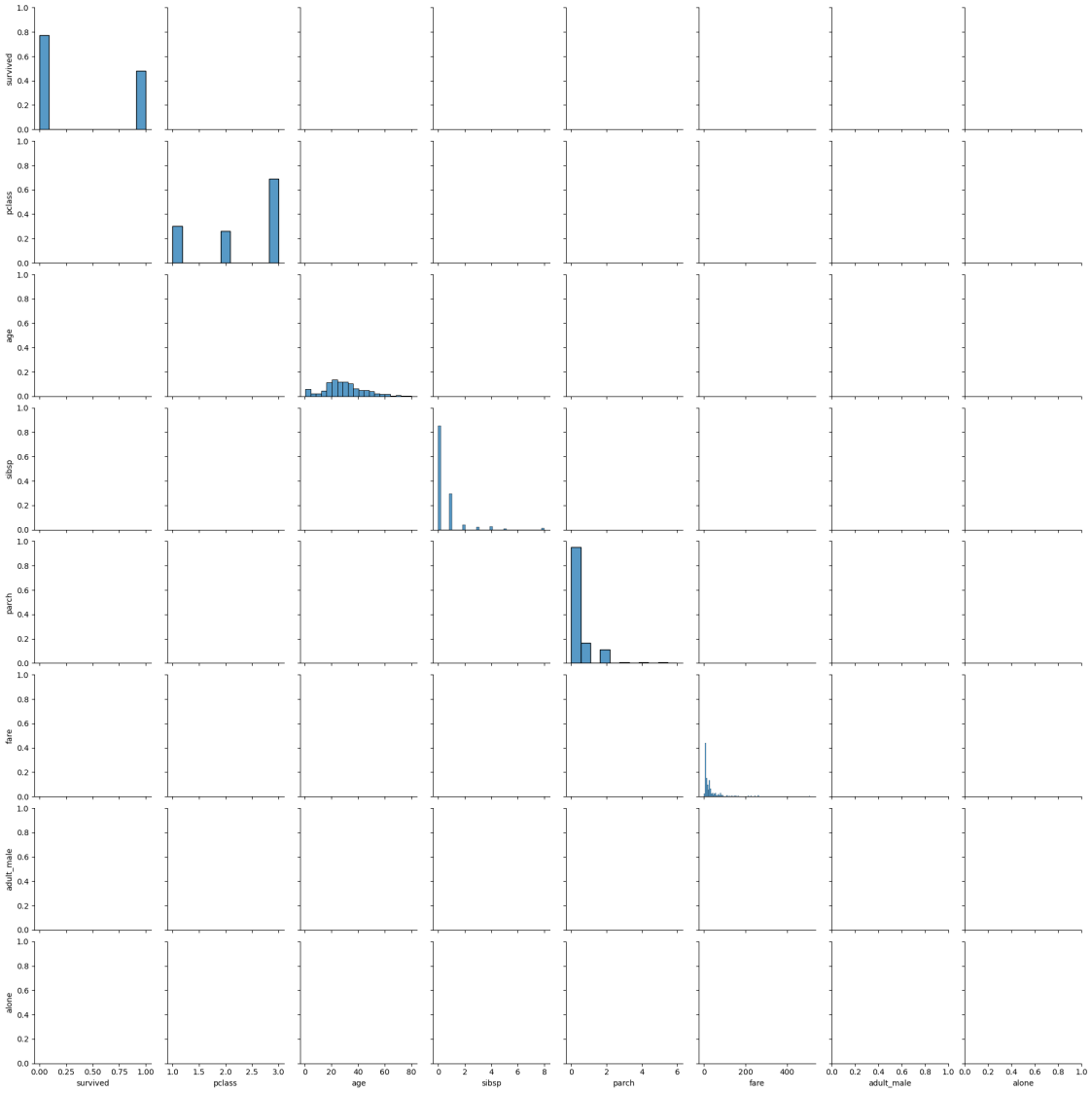

500
400
300
200
100
0
fare
0
10
20
30
40
50
60
70
80
age

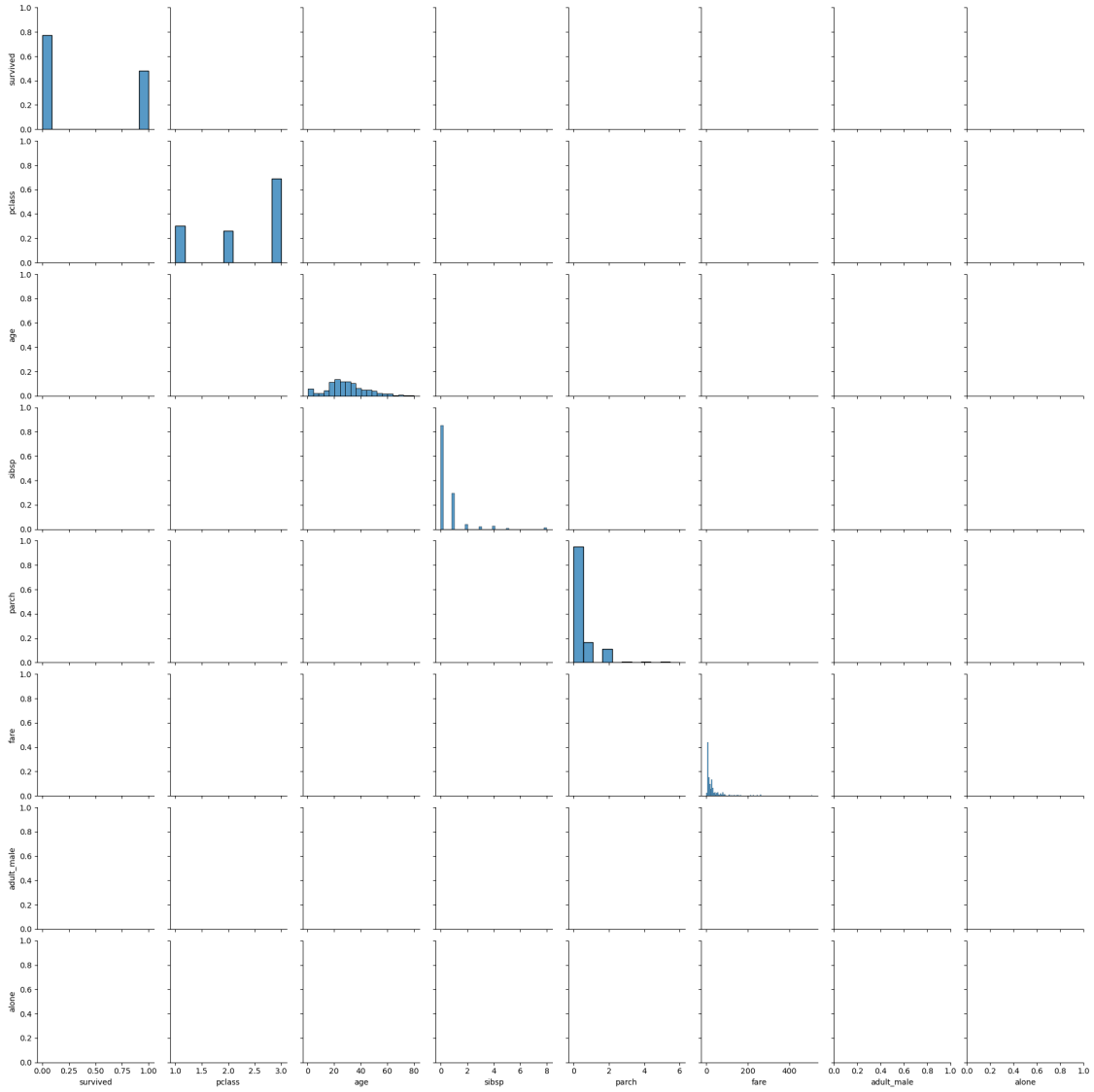
[ ]:



[ ]:
```
sns.pairplot(Titanic)
```

[ ]:
```
plt.show()
```


survived
pclass
age
sibsp
parch
fare
adult_male
alone



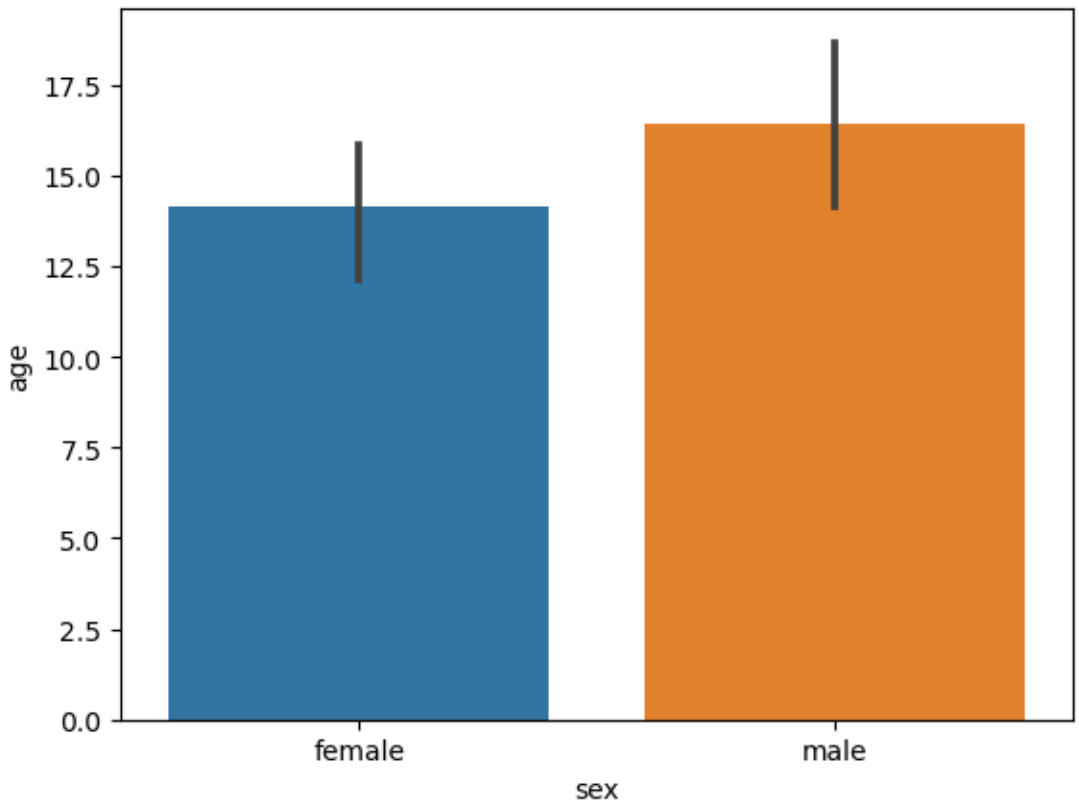
[ ]:
```
Titanic = Titanic.dropna()
```

[ ]:
```
sns.pairplot(Titanic,hue='sex')
```

[ ]:
```
sns.barplot(x='sex',y='age', data=Titanic)
```

[ ]:
```
<AxesSubplot:xlabel='sex', ylabel='age'>
```

[ ]:
```
plt.show()
```



[ ]:
```
import numpy as np

import matplotlib.pyplot as plt
import seaborn as sns

sns.barplot(x='sex',y='age',data=Titanic,estimator=np.std)
```

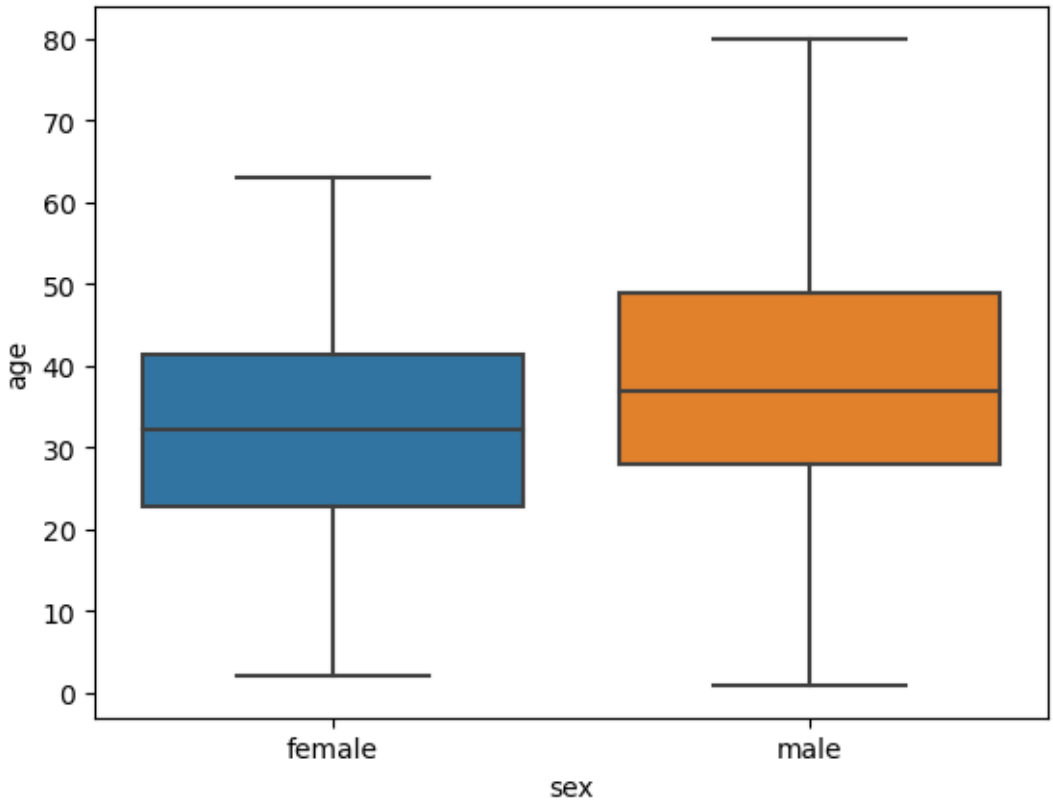
[ ]:
```
<AxesSubplot:xlabel='sex', ylabel='age'>
```

[ ]:
```
plt.show()
```

[ ]:
```
sns.boxplot(x='sex',y='age',data=Titanic)
```

[ ]:
```
<AxesSubplot:xlabel='sex', ylabel='age'>
```

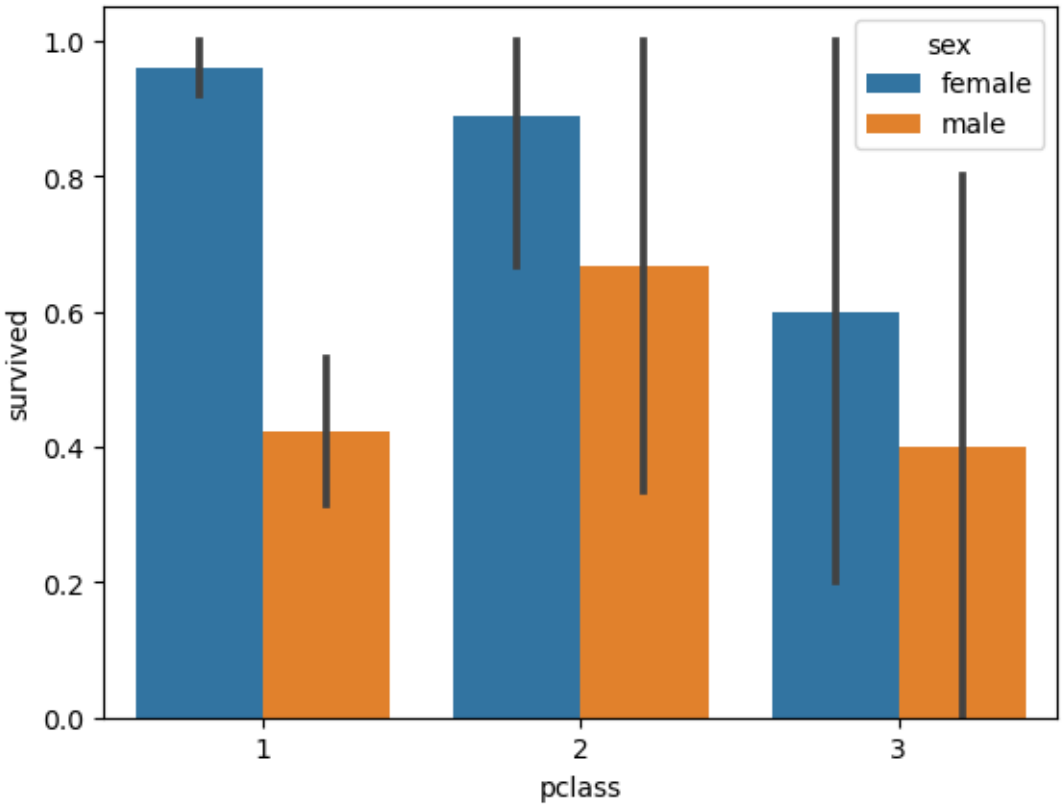
[ ]:
```
plt.show()
```



[ ]:
```
sns.barplot(x='pclass',y='survived',data=Titanic, hue='sex')
```

[ ]:
```
<AxesSubplot:xlabel='pclass', ylabel='survived'>
```

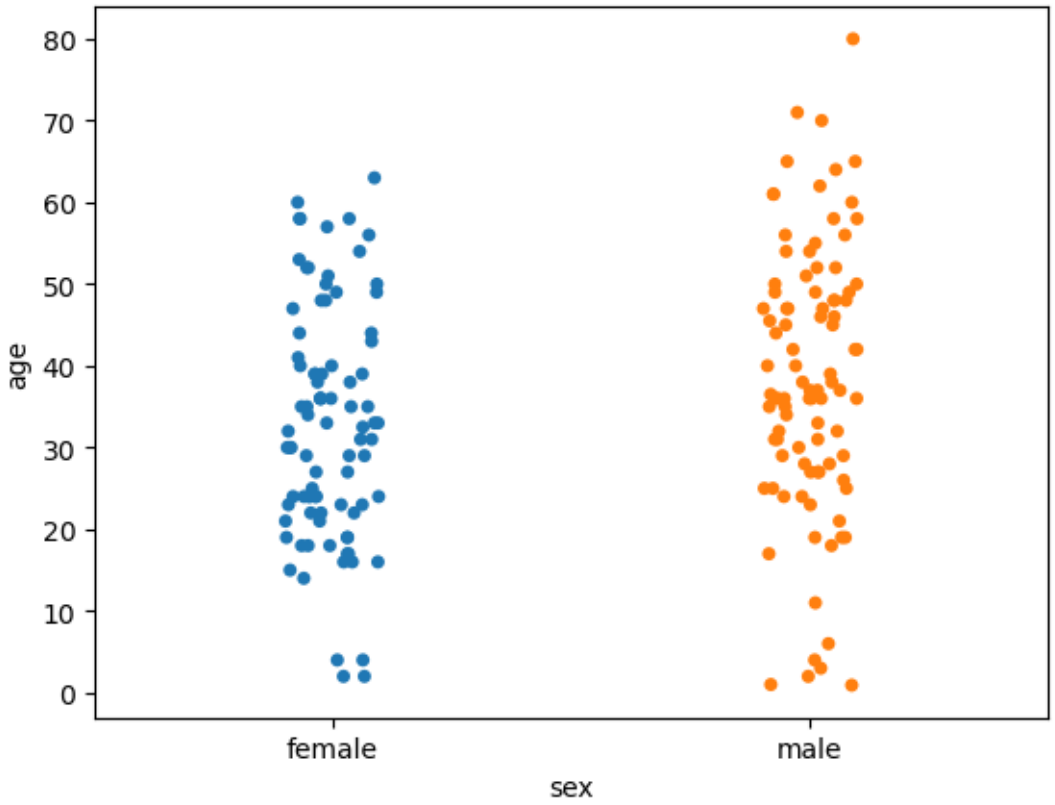
[ ]:
```
plt.show()
```



[ ]:
```
sns.stripplot(x='sex', y='age', data=Titanic)
```

[ ]:
```
<AxesSubplot:xlabel='sex', ylabel='age'>
```

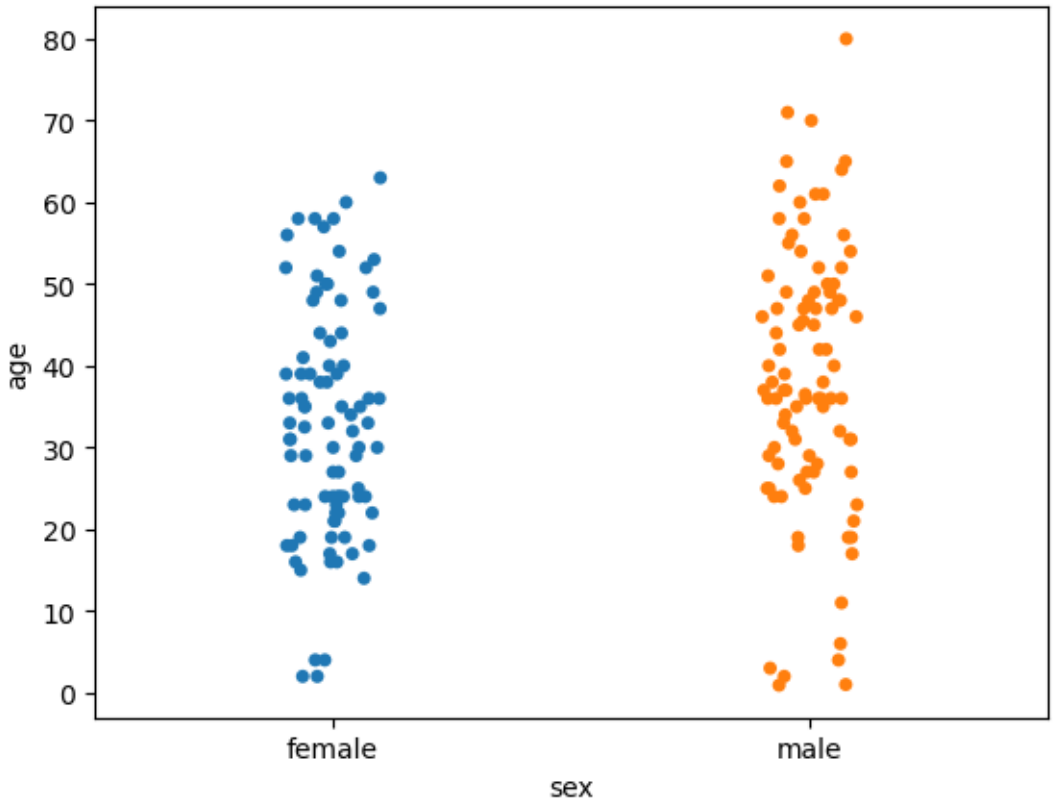
[ ]:
```
plt.show()
```



[ ]:
```
sns.stripplot(x='sex', y='age', data=Titanic, jitter=True)
```

[ ]:
```
<AxesSubplot:xlabel='sex', ylabel='age'>
```

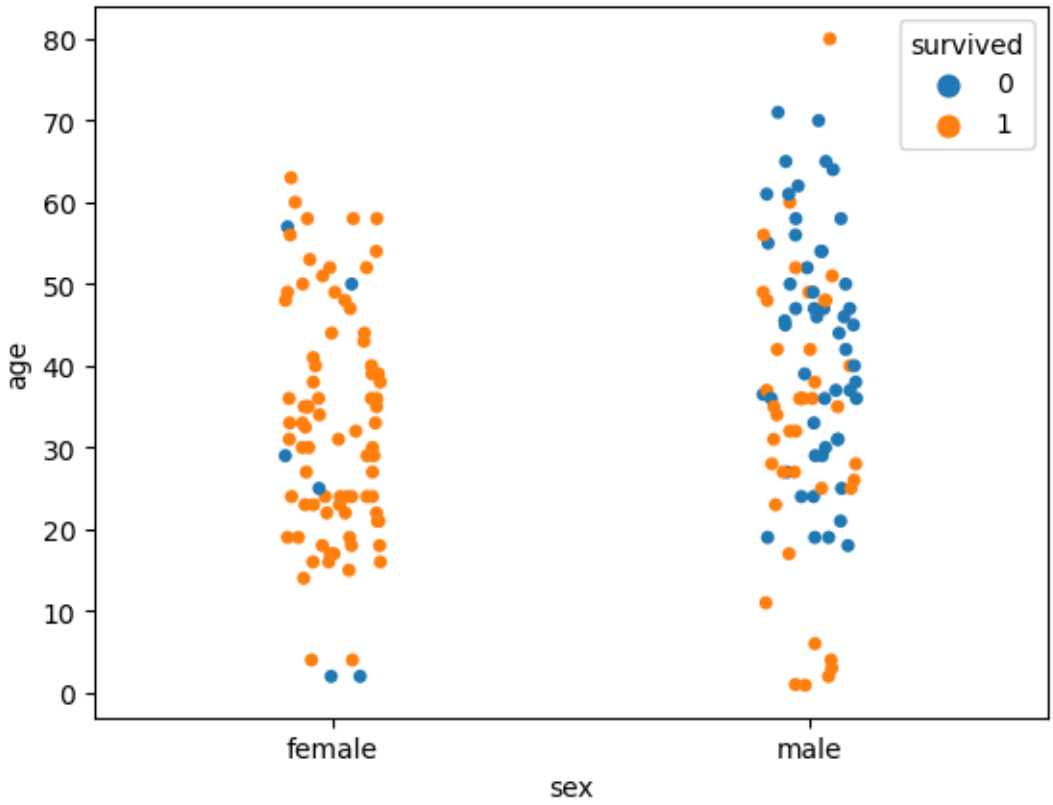
[ ]:
```
plt.show()
```



[ ]:
```
sns.stripplot(x='sex', y='age', data=Titanic, jitter=True, hue='survived')
```

[ ]:
```
<AxesSubplot:xlabel='sex', ylabel='age'>
```

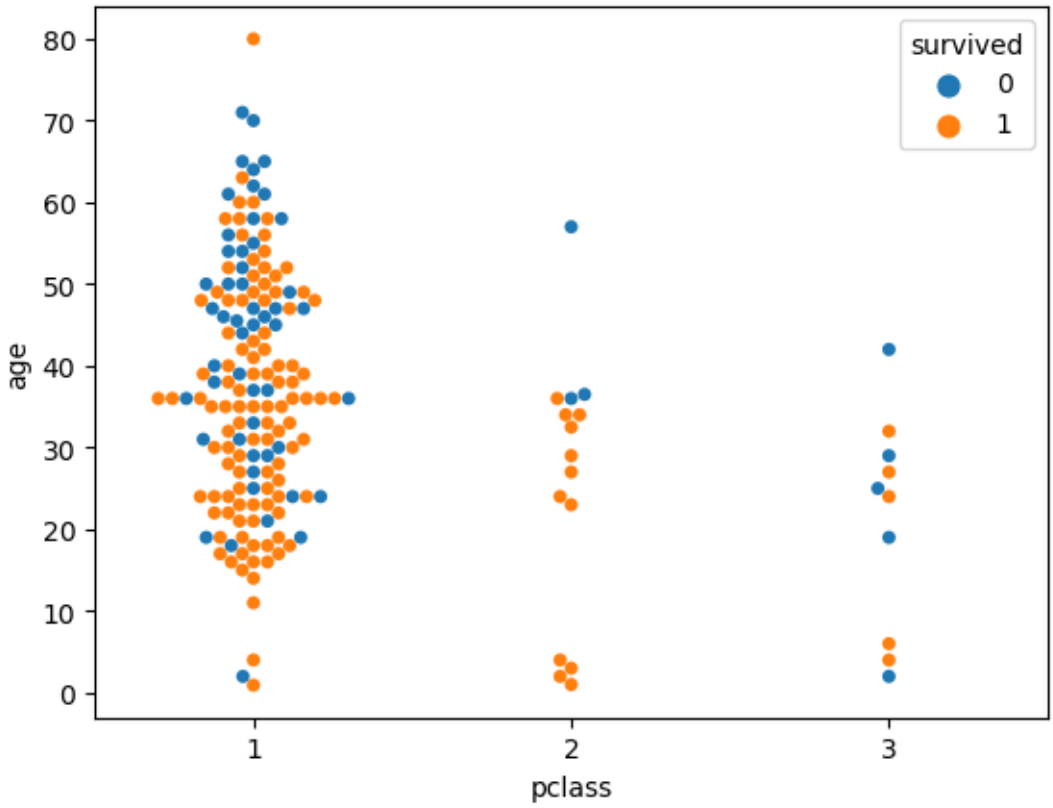
[ ]:
```
plt.show()
```



[ ]:
```
sns.swarmplot(data=Titanic, x='pclass', y='age', hue='survived')
```

[ ]:
```
<AxesSubplot:xlabel='pclass', ylabel='age'>
```

[ ]:
```
plt.show()
```


survived
0
1
age
80
70
60
50
40
30
20
10
0
1
2
3
pclass

[ ]:

Practical No. 9

April 29, 2025

[16]:
```
import seaborn as sns
data = sns.load_dataset("titanic")
data
```

[16]:

	survived	pclass	sex	age	sibsp	parch	fare	embarked	class	\
0	0	3	male	22.0	1	0	7.2500	S	Third	
1	1	1	female	38.0	1	0	71.2833	C	First	
2	1	3	female	26.0	0	0	7.9250	S	Third	
3	1	1	female	35.0	1	0	53.1000	S	First	
4	0	3	male	35.0	0	0	8.0500	S	Third	
..	…	…	…	…	…	…	…	…	…	
886	0	2	male	27.0	0	0	13.0000	S	Second	
887	1	1	female	19.0	0	0	30.0000	S	First	
888	0	3	female	NaN	1	2	23.4500	S	Third	
889	1	1	male	26.0	0	0	30.0000	C	First	
890	0	3	male	32.0	0	0	7.7500	Q	Third	

	who	adult_male	deck	embark_town	alive	alone
0	man	True	NaN	Southampton	no	False
1	woman	False	C	Cherbourg	yes	False
2	woman	False	NaN	Southampton	yes	True
3	woman	False	C	Southampton	yes	False
4	man	True	NaN	Southampton	no	True
..	…	…	…	…	…	…
886	man	True	NaN	Southampton	no	True
887	woman	False	B	Southampton	yes	True
888	woman	False	NaN	Southampton	no	False
889	man	True	C	Cherbourg	yes	True
890	man	True	NaN	Queenstown	no	True

[891 rows x 15 columns]

[10]:
```

```

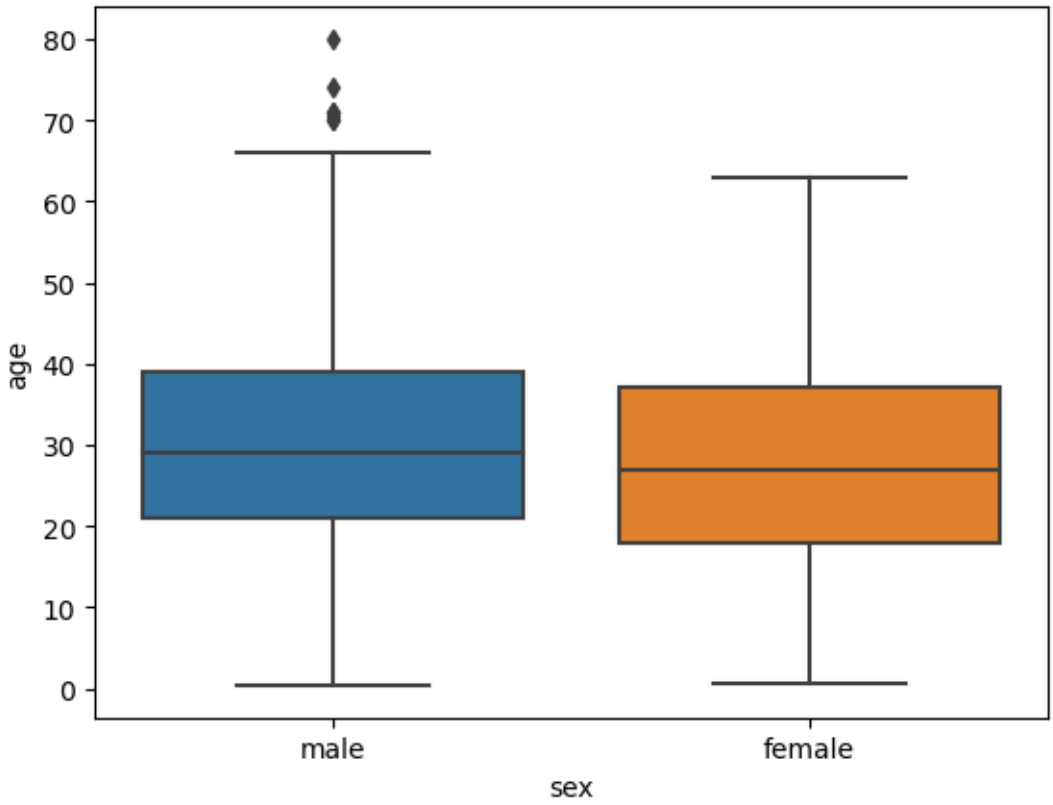
[10]:

	survived	pclass	sex	age	sibsp	parch	fare	embarked	class	\
0	0	3	male	22.0	1	0	7.2500	S	Third	
1	1	1	female	38.0	1	0	71.2833	C	First	

```
2           1       3  female  26.0      0      0   7.9250        S   Third
3           1       1  female  35.0      1      0  53.1000        S   First
4           0       3    male  35.0      0      0   8.0500        S   Third
..        …     …      …   …    …     …       …      …     …
886         0       2    male  27.0      0      0  13.0000        S  Second
887         1       1  female  19.0      0      0  30.0000        S   First
888         0       3  female   NaN      1      2  23.4500        S   Third
889         1       1    male  26.0      0      0  30.0000        C   First
890         0       3    male  32.0      0      0   7.7500        Q   Third

       who  adult_male deck  embark_town alive  alone
0      man        True  NaN  Southampton    no  False
1    woman       False    C    Cherbourg   yes  False
2    woman       False  NaN  Southampton   yes   True
3    woman       False    C  Southampton   yes  False
4      man        True  NaN  Southampton    no   True
..     …          …  …          …    …    …
886    man        True  NaN  Southampton    no   True
887  woman       False    B  Southampton   yes   True
888  woman       False  NaN  Southampton    no  False
889    man        True    C    Cherbourg   yes   True
890    man        True  NaN   Queenstown    no   True

[891 rows x 15 columns]
```

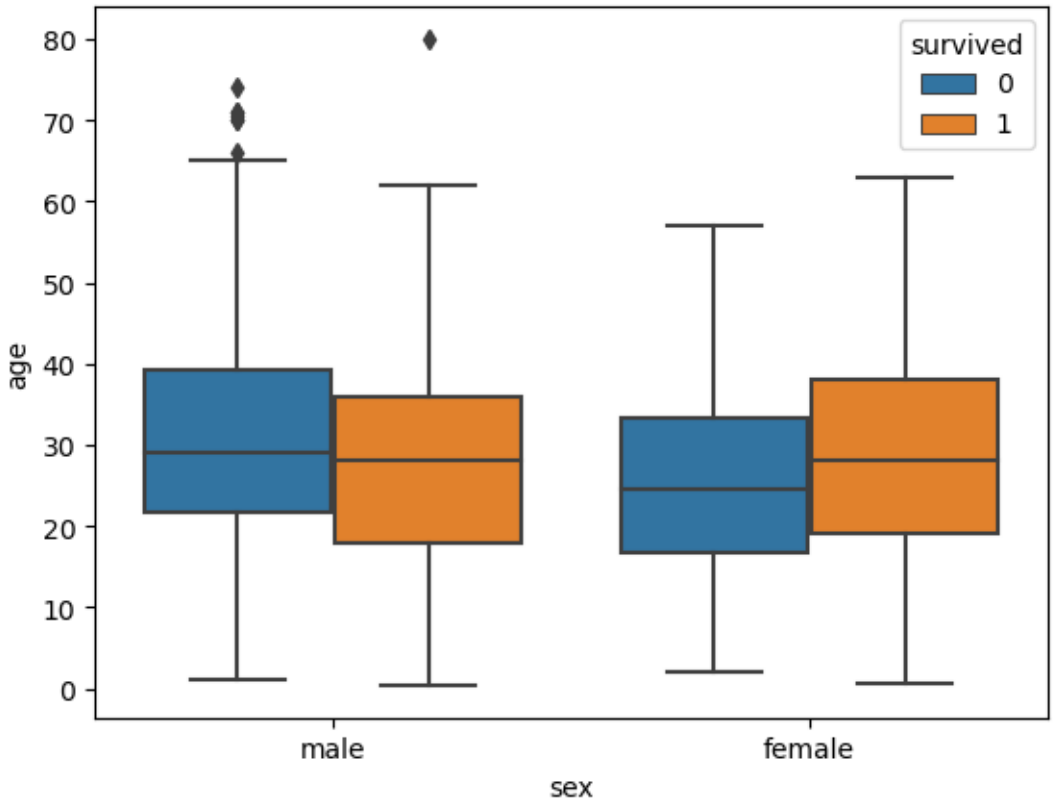
[14]:
```
sns.boxplot(x="sex", y="age", data=data)
```

[14]:
```
<AxesSubplot:xlabel='sex', ylabel='age'>
```



[15]:
```
sns.boxplot(x="sex", y="age", data=data, hue="survived")
```

[15]:
```
<AxesSubplot:xlabel='sex', ylabel='age'>
```


survived
0
1
80
70
60
50
40
30
20
10
0
age
male
female
sex

[ ]:

Practical No. 10

April 29, 2025

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

[2]:
```
data=pd.read_csv('iris.csv')
```

[3]:
```
data
```

[3]:
```
       Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm  \
0       1            5.1           3.5            1.4           0.2
1       2            4.9           3.0            1.4           0.2
2       3            4.7           3.2            1.3           0.2
3       4            4.6           3.1            1.5           0.2
4       5            5.0           3.6            1.4           0.2
..    ...            ...           ...            ...           ...
145   146            6.7           3.0            5.2           2.3
146   147            6.3           2.5            5.0           1.9
147   148            6.5           3.0            5.2           2.0
148   149            6.2           3.4            5.4           2.3
149   150            5.9           3.0            5.1           1.8

            Species
0       Iris-setosa
1       Iris-setosa
2       Iris-setosa
3       Iris-setosa
4       Iris-setosa
..              ...
145  Iris-virginica
146  Iris-virginica
147  Iris-virginica
148  Iris-virginica
149  Iris-virginica

[150 rows x 6 columns]
```

[4]:
```
data.head()
```

[4]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa

[5]:
```
data.tail()
```

[5]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	\
145	146	6.7	3.0	5.2	2.3	
146	147	6.3	2.5	5.0	1.9	
147	148	6.5	3.0	5.2	2.0	
148	149	6.2	3.4	5.4	2.3	
149	150	5.9	3.0	5.1	1.8	

	Species
145	Iris-virginica
146	Iris-virginica
147	Iris-virginica
148	Iris-virginica
149	Iris-virginica

[6]:
```
data.describe()
```

[6]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm
count	150.000000	150.000000	150.000000	150.000000	150.000000
mean	75.500000	5.843333	3.054000	3.758667	1.198667
std	43.445368	0.828066	0.433594	1.764420	0.763161
min	1.000000	4.300000	2.000000	1.000000	0.100000
25%	38.250000	5.100000	2.800000	1.600000	0.300000
50%	75.500000	5.800000	3.000000	4.350000	1.300000
75%	112.750000	6.400000	3.300000	5.100000	1.800000
max	150.000000	7.900000	4.400000	6.900000	2.500000

[7]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 6 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Id             150 non-null    int64
 1   SepalLengthCm  150 non-null    float64
 2   SepalWidthCm   150 non-null    float64
```

```
 3   PetalLengthCm  150 non-null    float64
 4   PetalWidthCm   150 non-null    float64
 5   Species        150 non-null    object
dtypes: float64(4), int64(1), object(1)
memory usage: 7.2+ KB
```

[8]:
```
data.isnull().sum()
```

[8]:
```
Id               0
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

0.1 1. Features of dataset

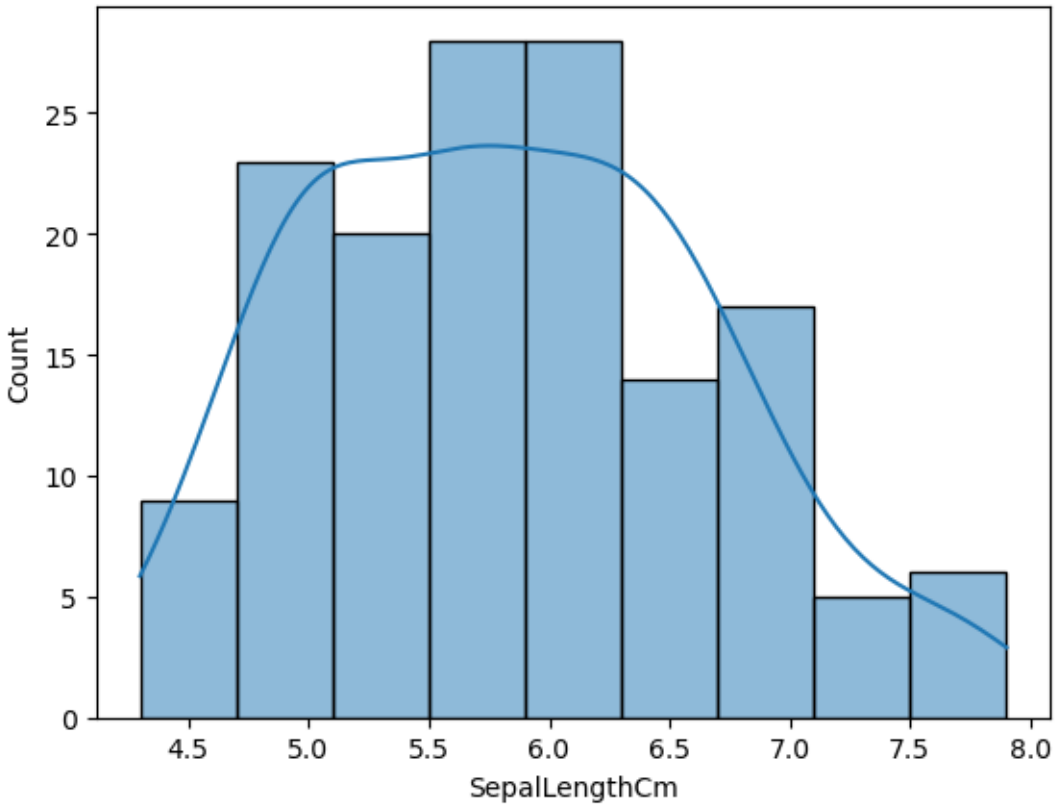
[9]:
```
print("The features in the dataset are as follows: ")

print("1. SepalLengthCm : ", data['SepalLengthCm'].dtype)
print("2. SepalWidthCm : ", data['SepalWidthCm'].dtype)
print("3. PetalLengthCm : ", data['PetalLengthCm'].dtype)
print("4. PetalWidthCm : ", data['PetalWidthCm'].dtype)
print("5. Species : ", data['Species'].dtype)
```

```
The features in the dataset are as follows:
1. SepalLengthCm :  float64
2. SepalWidthCm :  float64
3. PetalLengthCm :  float64
4. PetalWidthCm :  float64
5. Species :  object
```

0.2 2. Creating Histogram

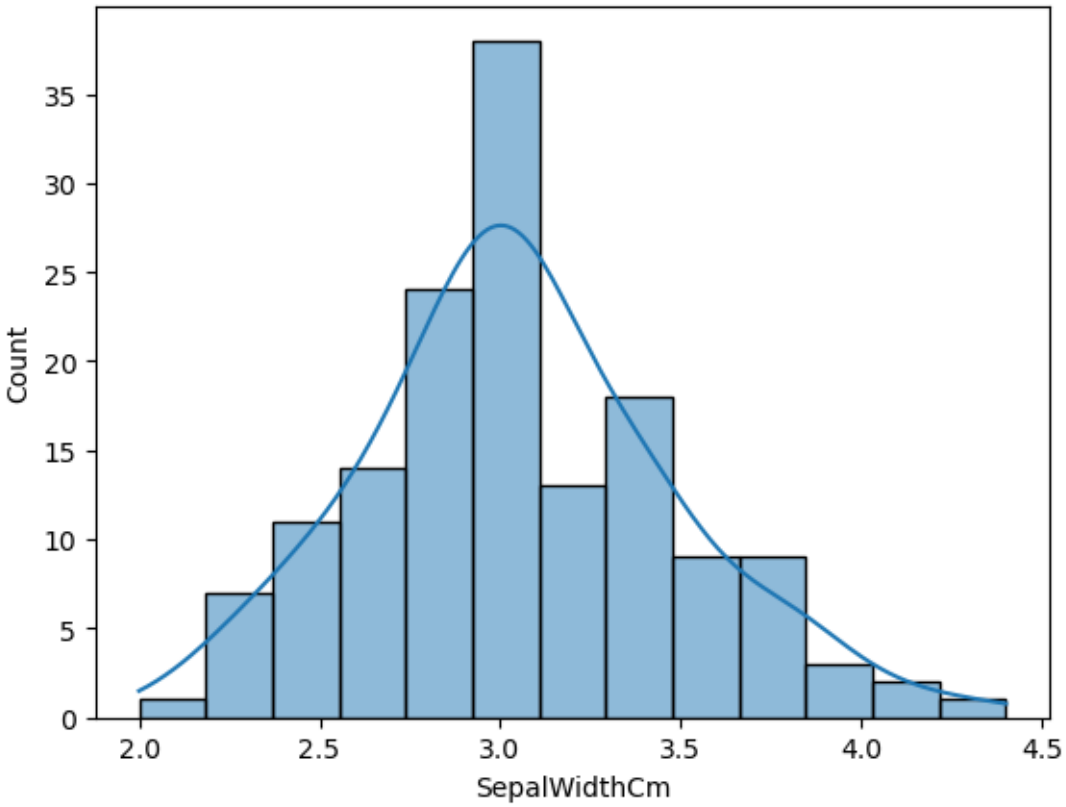
[10]:
```
sns.histplot(x = data['SepalLengthCm'], kde=True)
```

[10]:
```
<AxesSubplot:xlabel='SepalLengthCm', ylabel='Count'>
```



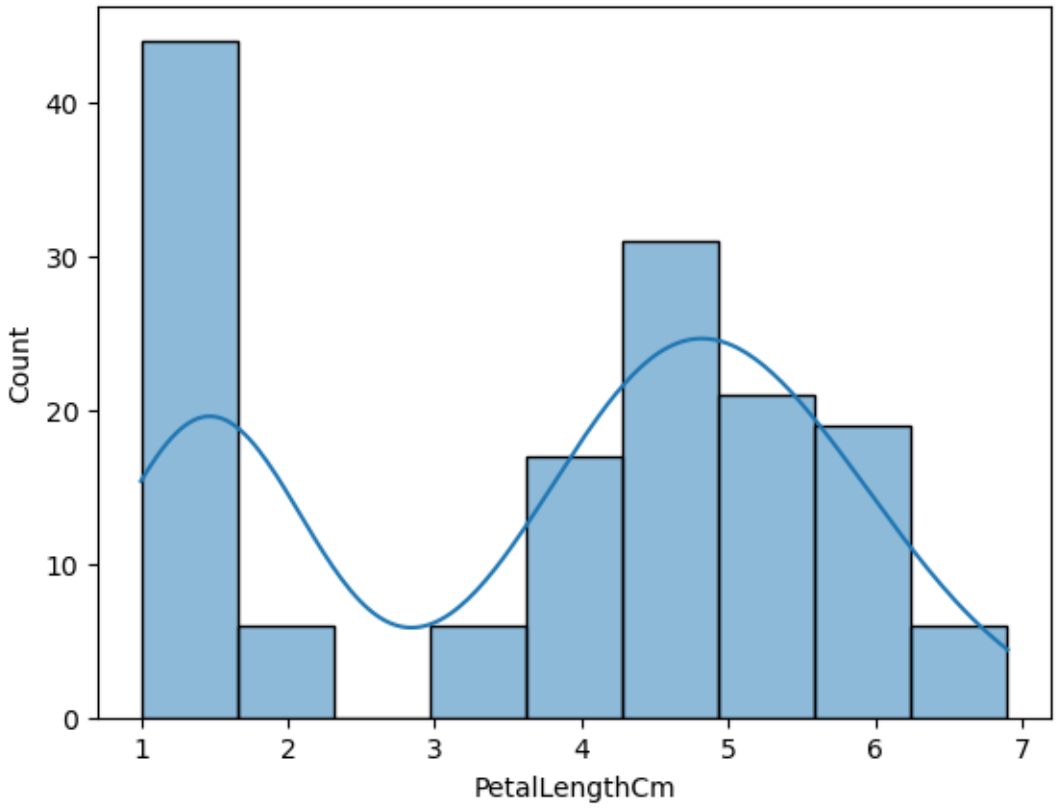
[11]:
```
sns.histplot(x = data['SepalWidthCm'], kde=True)
```

[11]:
```
<AxesSubplot:xlabel='SepalWidthCm', ylabel='Count'>
```



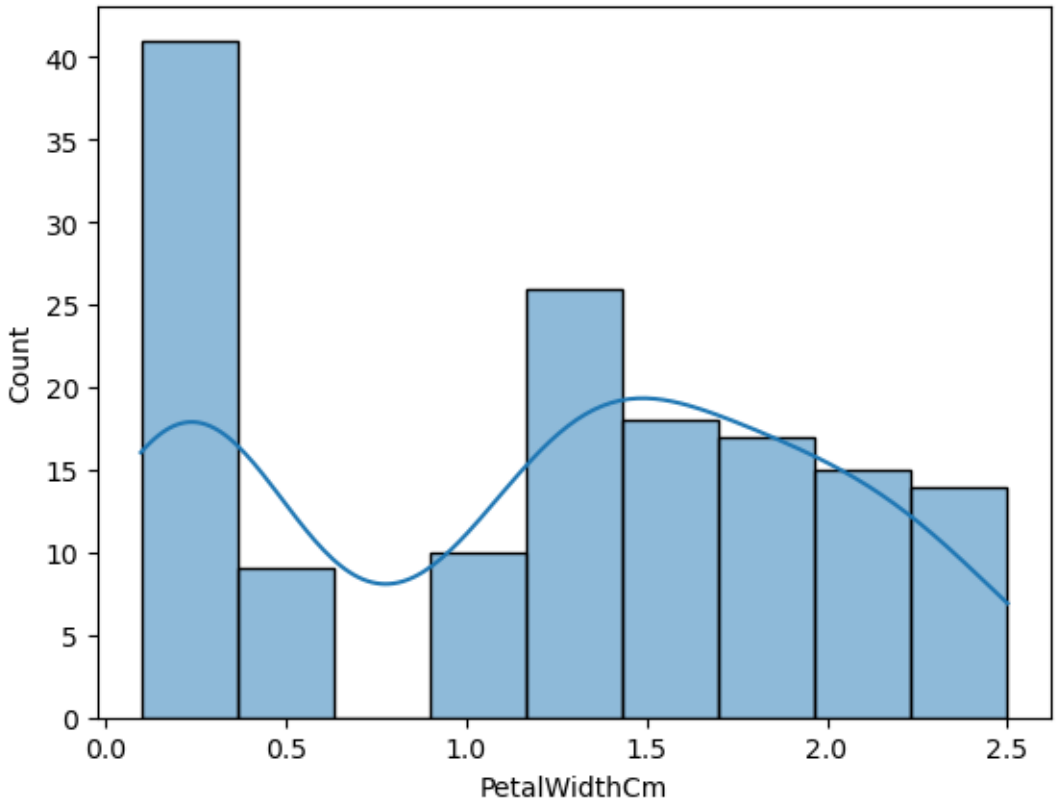
[12]:
```
sns.histplot(x = data['PetalLengthCm'], kde=True)
```

[12]:
```
<AxesSubplot:xlabel='PetalLengthCm', ylabel='Count'>
```



[13]:
```
sns.histplot(x = data['PetalWidthCm'], kde=True)
```

[13]:
```
<AxesSubplot:xlabel='PetalWidthCm', ylabel='Count'>
```

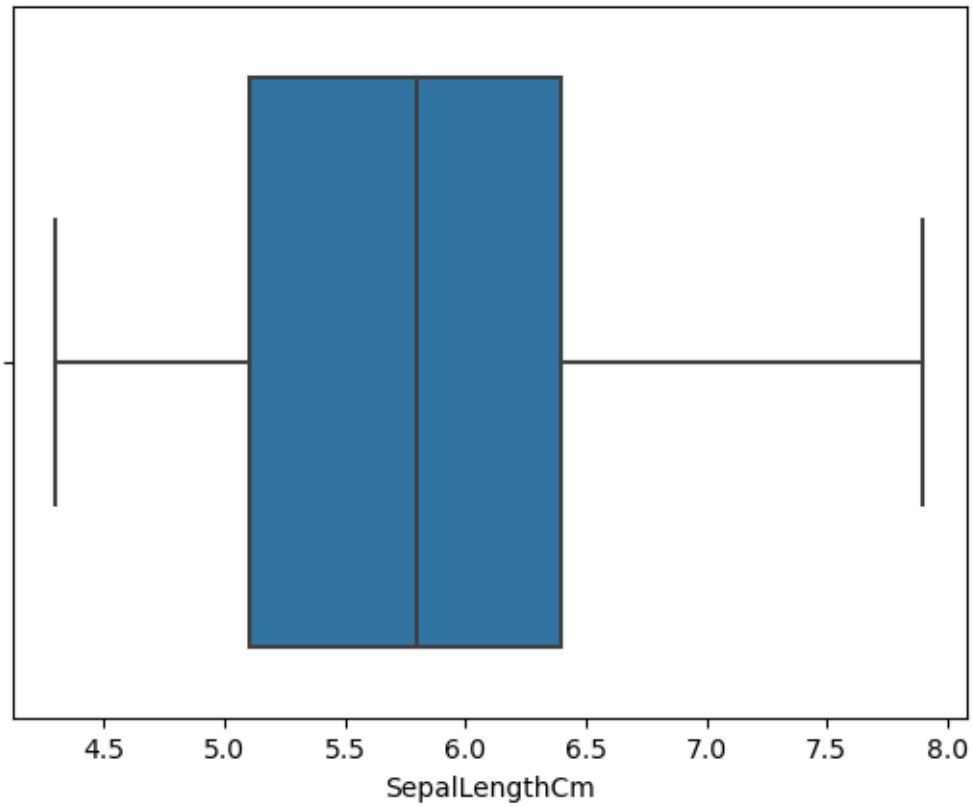


0.3 3. Boxplot

[14]:
```
sns.boxplot(data['SepalLengthCm'])
```

```
C:\Users\ADMIN\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variable as a keyword arg: x. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(
```

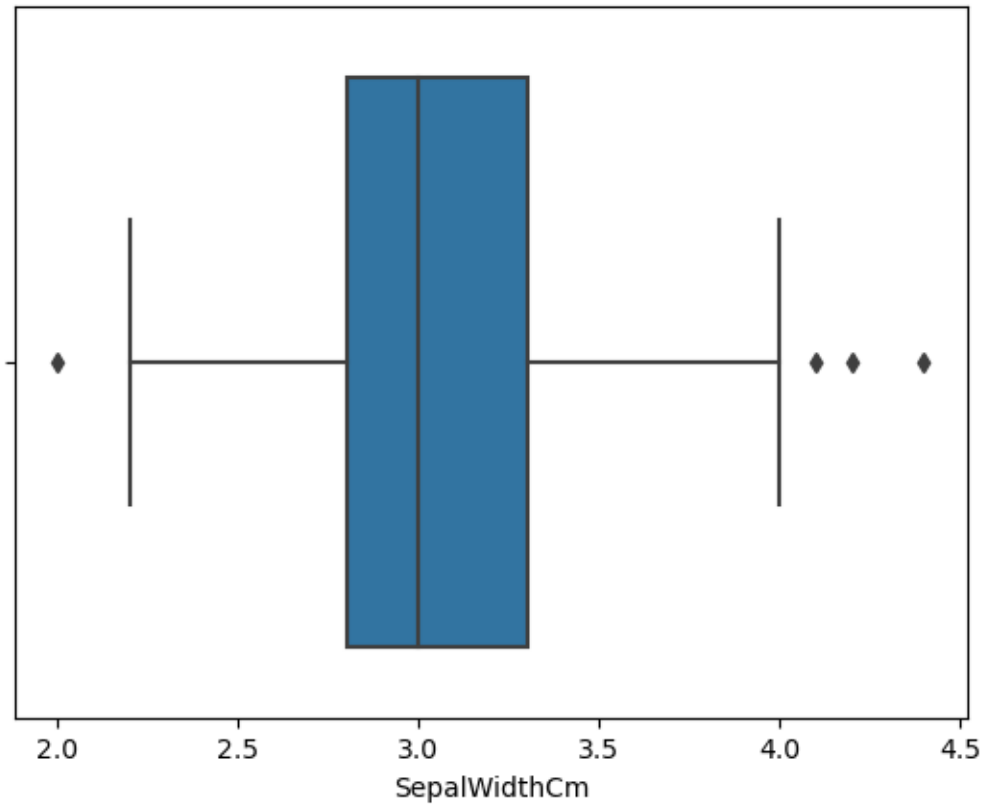
[14]:
```
<AxesSubplot:xlabel='SepalLengthCm'>
```



[15]:
```
sns.boxplot(data['SepalWidthCm'])
```

```
C:\Users\ADMIN\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variable as a keyword arg: x. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(
```

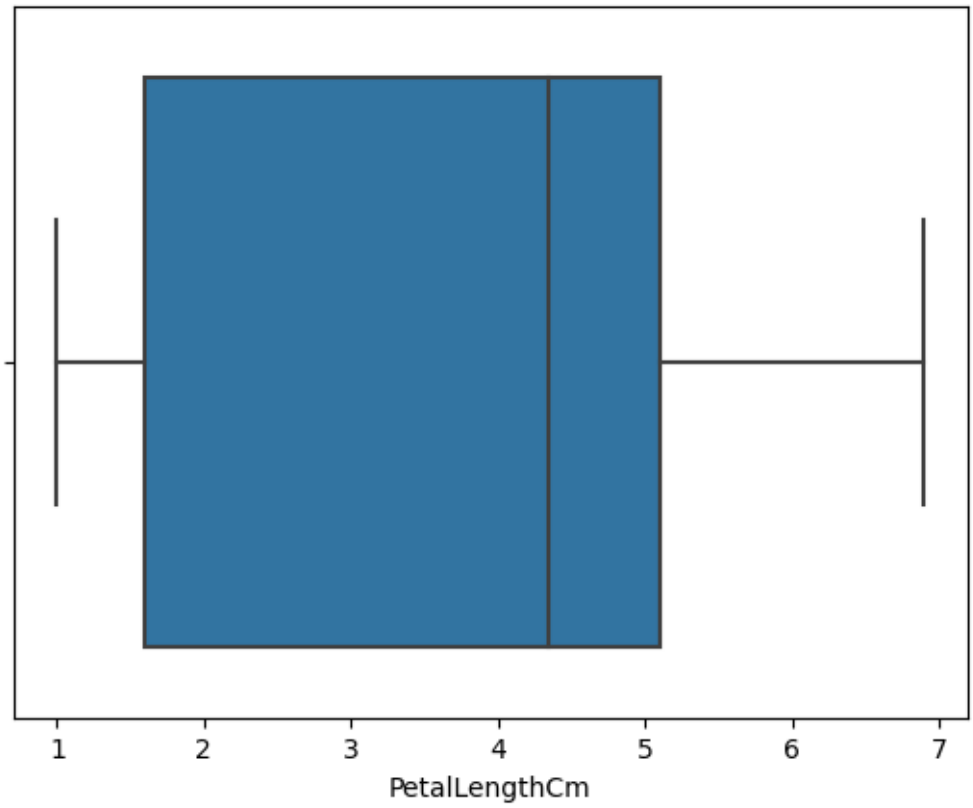
[15]:
```
<AxesSubplot:xlabel='SepalWidthCm'>
```



[16]:
```
sns.boxplot(data['PetalLengthCm'])
```

```
C:\Users\ADMIN\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variable as a keyword arg: x. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(
```

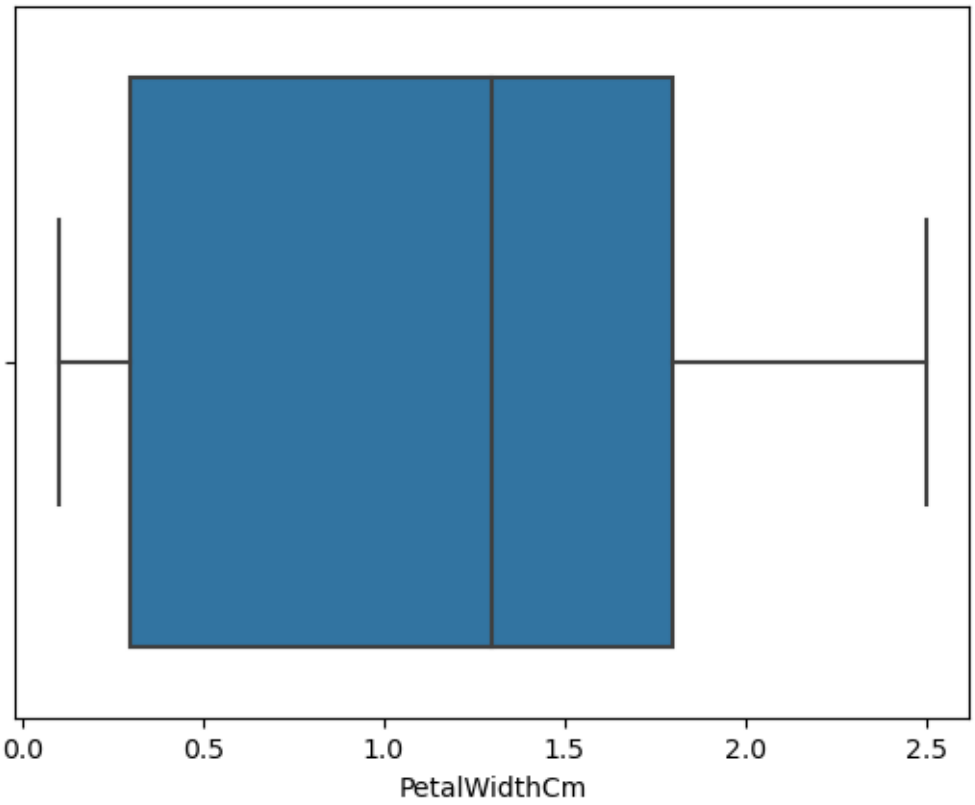
[16]:
```
<AxesSubplot:xlabel='PetalLengthCm'>
```



[17]:
```
sns.boxplot(data['PetalWidthCm'])
```

```
C:\Users\ADMIN\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variable as a keyword arg: x. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(
```

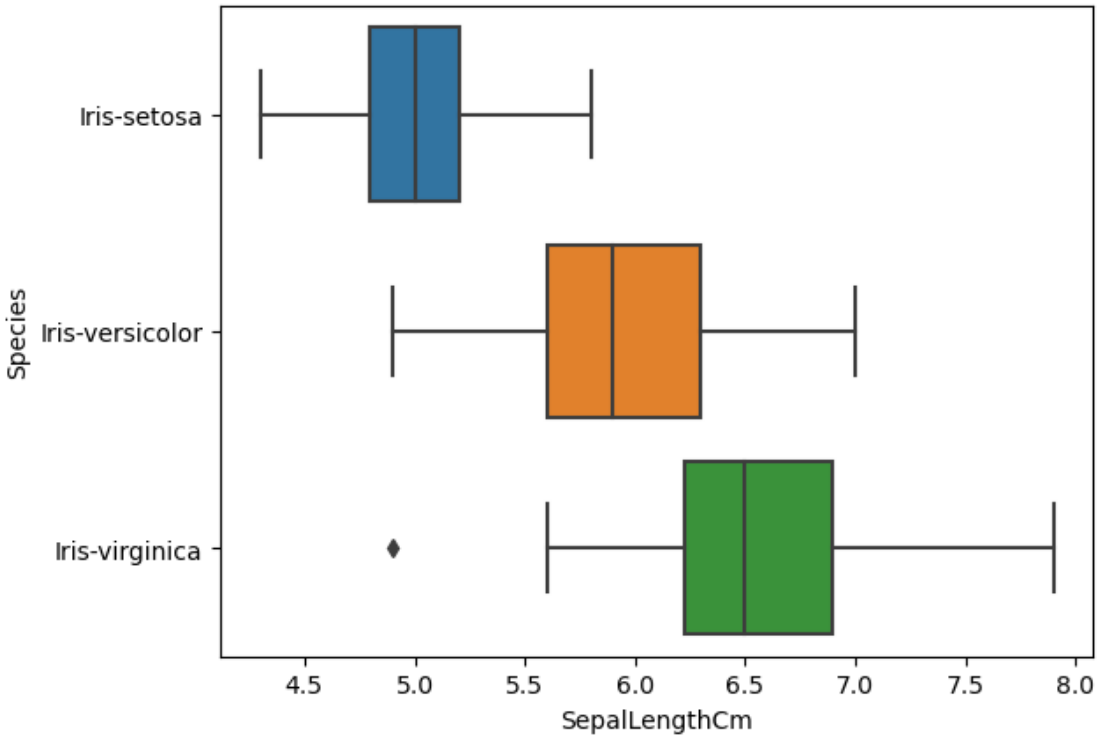
[17]:
```
<AxesSubplot:xlabel='PetalWidthCm'>
```



0.4 4. Compare Distributions and Identify Outliers

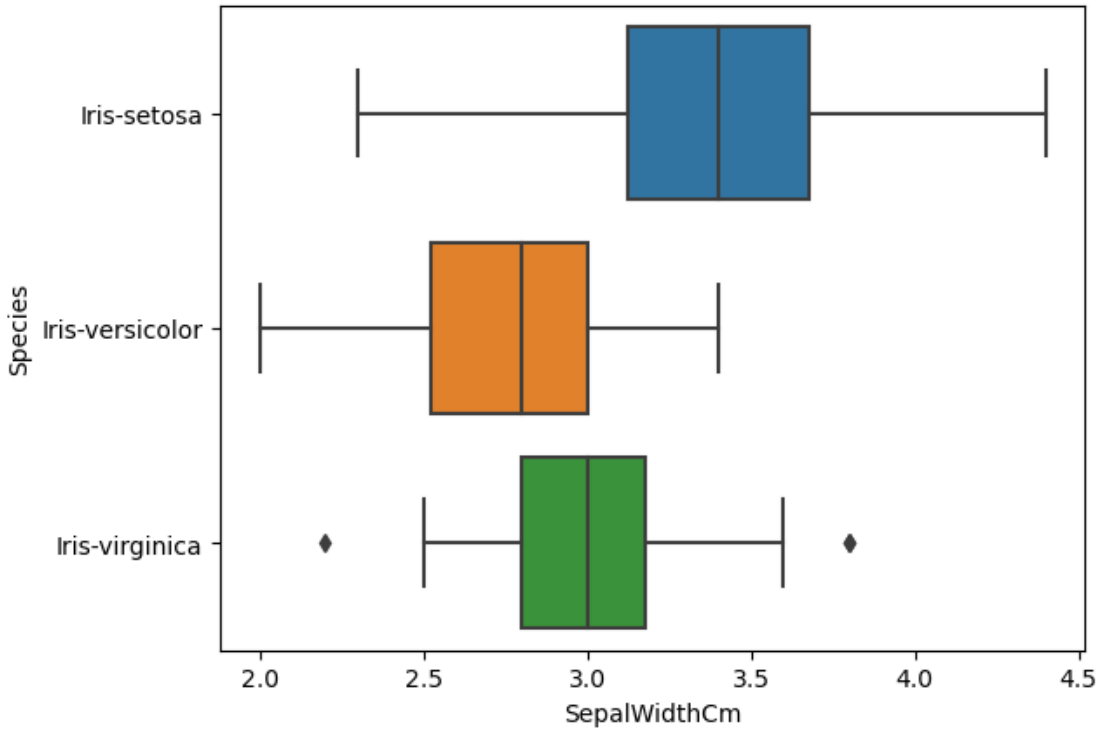
[18]:
```
sns.boxplot(x='SepalLengthCm',y='Species',data=data)
```

[18]:
```
<AxesSubplot:xlabel='SepalLengthCm', ylabel='Species'>
```



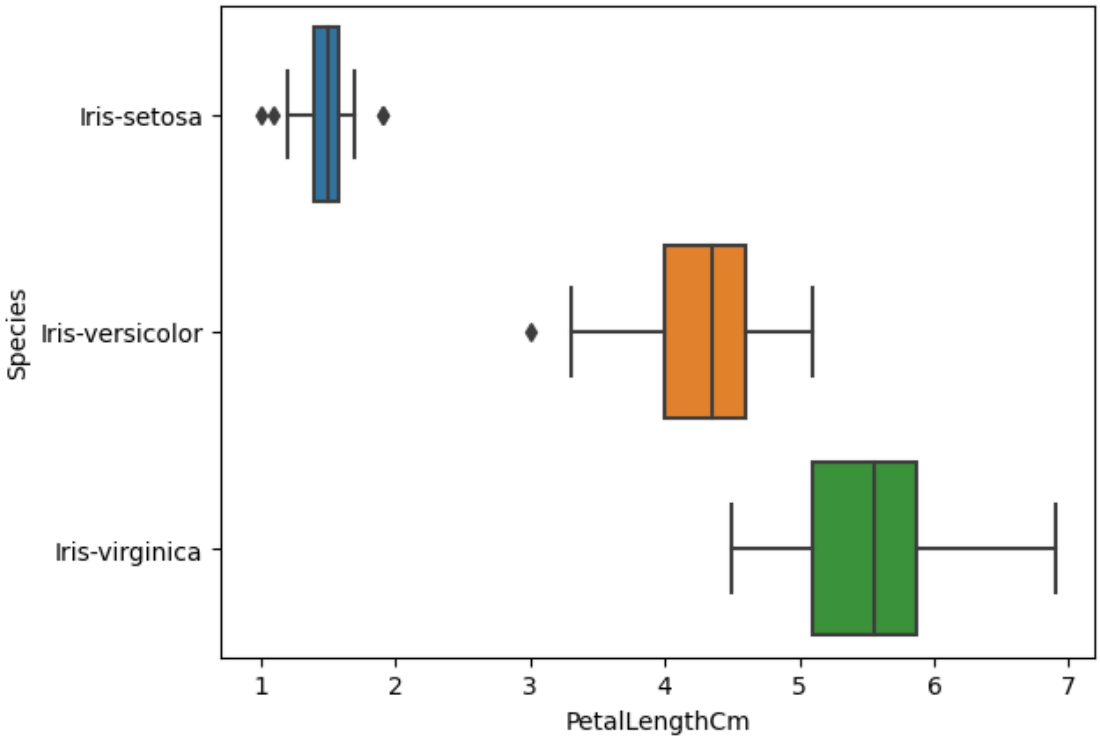
[19]:
```
sns.boxplot(x='SepalWidthCm',y='Species',data=data)
```

[19]: <AxesSubplot:xlabel='SepalWidthCm', ylabel='Species'>



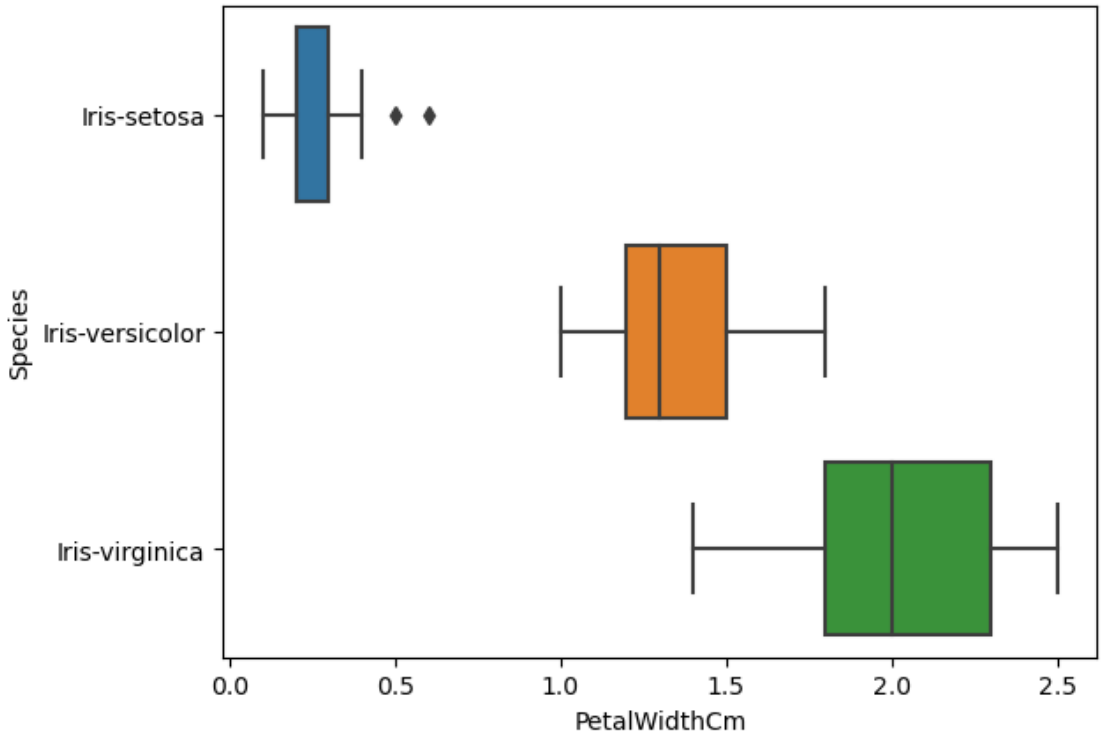
[20]:
```
sns.boxplot(x='PetalLengthCm',y='Species',data=data)
```

[20]:
```
<AxesSubplot:xlabel='PetalLengthCm', ylabel='Species'>
```



[21]:
```
sns.boxplot(x='PetalWidthCm',y='Species',data=data)
```

[21]:
```
<AxesSubplot:xlabel='PetalWidthCm', ylabel='Species'>
```


Iris-setosa
Iris-versicolor
Iris-virginica
Species
0.0
0.5
1.0
1.5
2.0
2.5
PetalWidthCm

[ ]: