PANIMALAR INSTITUTE OF TECHNOLOGY

(A CHRISTIAN MINORITY INSTITUTION)
JAISAKTHI EDUCATIONAL TRUST
BANGALORE TRUNK ROAD, VARADHARAJAPURAM,
NASARATHPET, POONAMALLEE, CHENNAI 600 123

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

AD8412 – DATA ANALYTICS LABORATORY

ACADEMIC YEAR: 2021 – 2022 (EVEN SEMESTER)

Name of the Student : _____

Register Number : _____

Roll Number : _____

Year & Semester : _____

PANIMALAR INSTITUTE OF TECHNOLOGY

REGISTER NUMBER: | |

Certified that this is a bonafide record of practical work done by _____ of II Year / III Semester of B.Tech Artificial Intelligence and Data Science in AD8412 – DATA ANALYTICS LABORATORY during the academic year 2021 - 22.

STAFF IN-CHARGE **HEAD OF THE DEPARTMENT**

Submitted for the Anna University practical examination held on _____ at Panimalar Institute of Technology, Chennai – 600 123.

INTERNAL EXAMINER **EXTERNAL EXAMINER**

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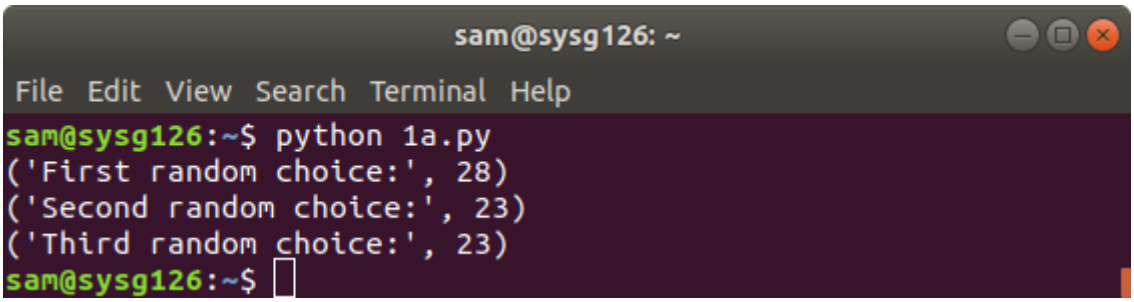
EX.NO: 01

PROGRAM

1 A) Picking Random Items in a List using 'random.choice()'

```
bmi_list = [29, 18, 20, 22, 19, 25, 30, 28,22, 21, 18, 19, 20, 20, 22, 23]
import random
print("First random choice:", random.choice(bmi_list))
print("Second random choice:", random.choice(bmi_list))
print("Third random choice:", random.choice(bmi_list))
```

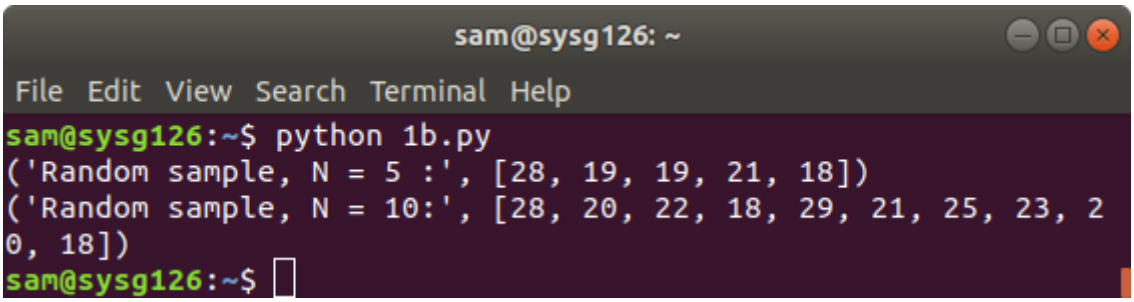
OUTPUT:



1 B) Picking Random Items in a List using 'random.sample()'

```
print("Random sample, N = 5 :", random.sample(bmi_list, 5))

print("Random sample, N = 10:", random.sample(bmi_list, 10))
```

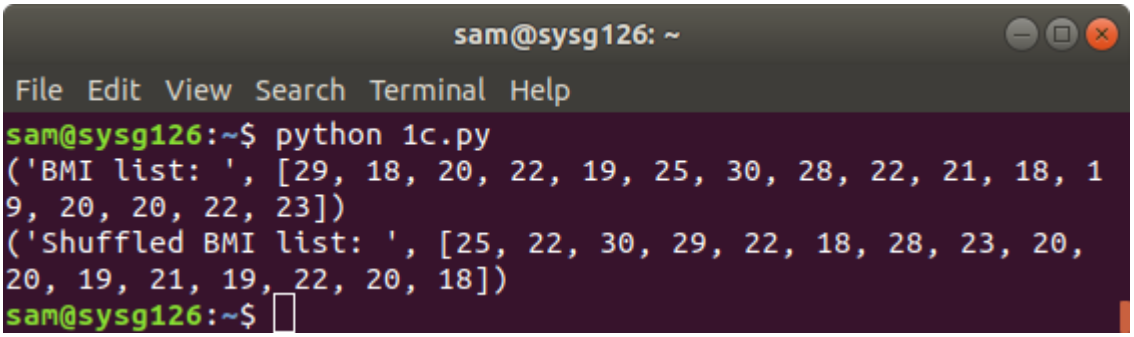
OUTPUT:



1 C) Randomly Shuffling Items in a List using 'random.shuffle()'

```
print("BMI list: ", bmi_list)
random.shuffle(bmi_list)
print("Shuffled BMI list: ", bmi_list)
```

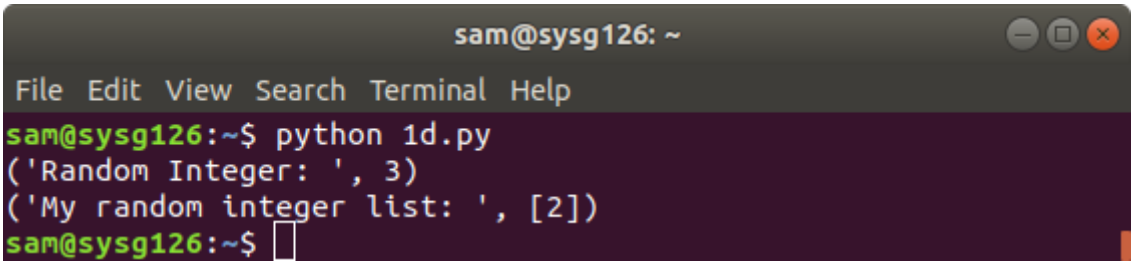
OUTPUT:



1 D) Generating Random Integers using 'random.randint()'

```
print("Random Integer: ", random.randint(1,5))
random_ints_list = []
fori in range(1,50):
    n = random.randint(1,5)
random_ints_list.append(n)
print("My random integer list: ", random_ints_list)
```

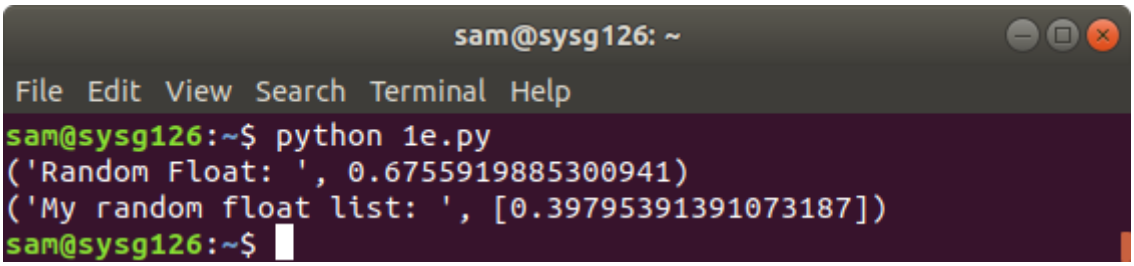
OUTPUT:



1 E) Generating Random Floating Point Values

```
print("Random Float: ", random.random())
random_float_list = []
fori in range(1,5):
    n = random.random()
random_float_list.append(n)
print("My random float list: ", random_float_list)
```

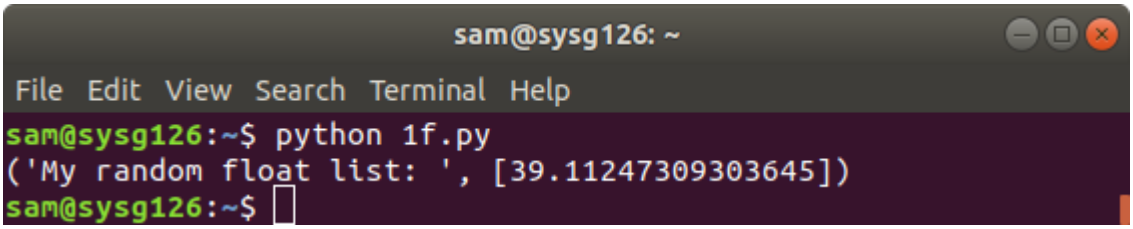
OUTPUT:



Scale the random float numbers by multiplying our random number by 500

```
random_float_list = []
fori in range(1,5):
    n = random.random()*500
random_float_list.append(n)
print("My random float list: ", random_float_list)
```

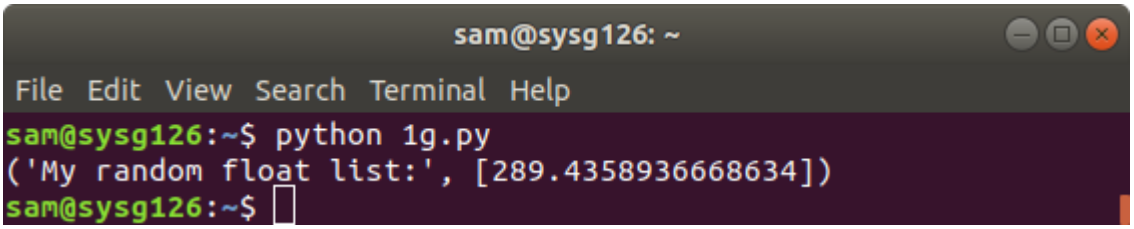
OUTPUT:



Add a lower bound as well add a conditional statement before appending and generate random numbers between 100 and 500

```
random_float_list = []
fori in range(1,10):
    n = random.random()*500
if n>=100.0:
random_float_list.append(n)
print("My random float list: ", random_float_list)
```

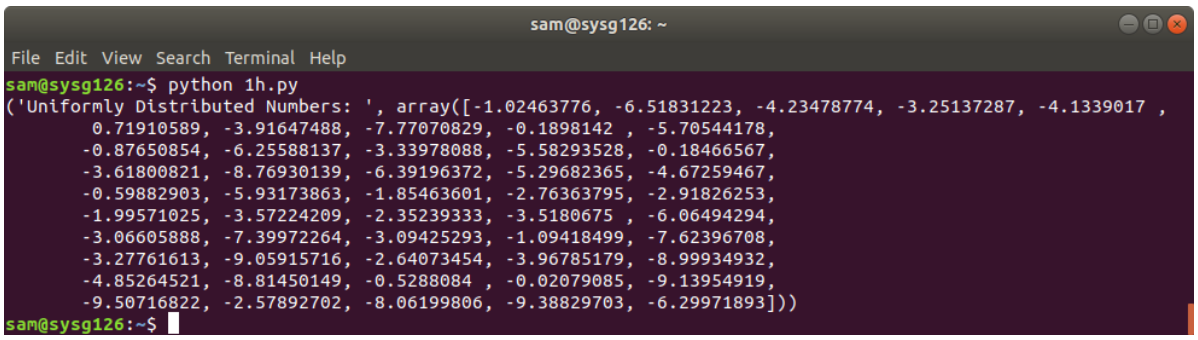
OUTPUT:



1F) Computing Uniformly Distributed Numbers with 'random.uniform()'

```
import numpy as np
uniform_list = np.random.uniform(-10,1,50)
print("Uniformly Distributed Numbers: ", uniform_list)
```

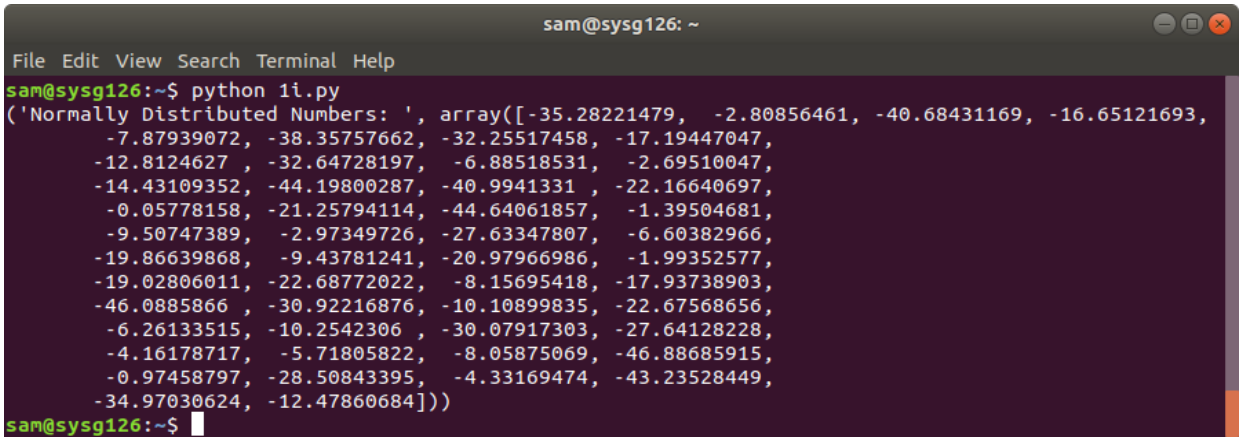
OUTPUT:



1 G) Computing Normally Distributed Numbers with ‘random.gauss()’

```
normal_list = np.random.uniform(-50,0,50)
print("Normally Distributed Numbers: ", normal_list)
```

OUTPUT:



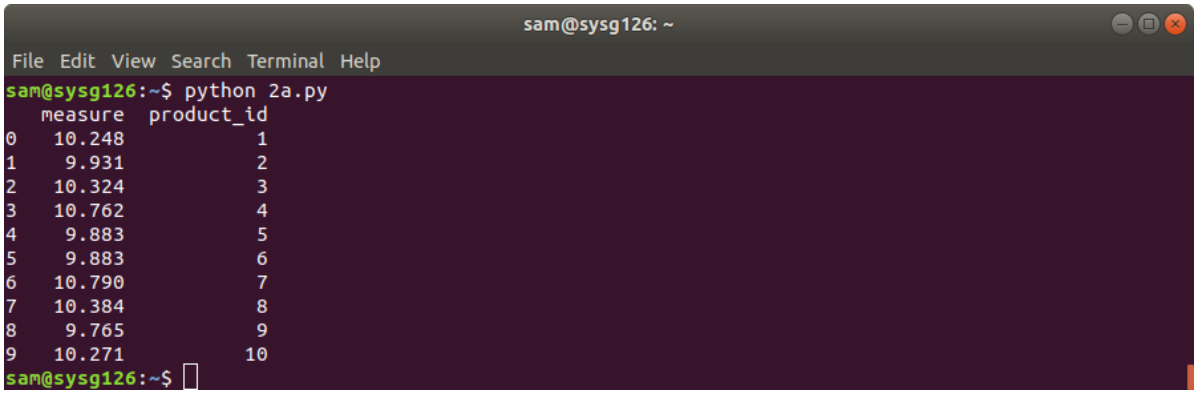
EX.NO 02

PROGRAM

2 A) Create Sample:

```
import numpy as np
import pandas as pd
np.random.seed(42)
number_of_products=10
data={'product_id':np.arange(1,number_of_products+1).tolist(),'measure':np.round(np
.random.normal(loc=10,scale=0.5,size=number_of_products),3)}
df=pd.DataFrame(data)
real_mean=round(df['measure'].mean(),3)
df
print(data)
```

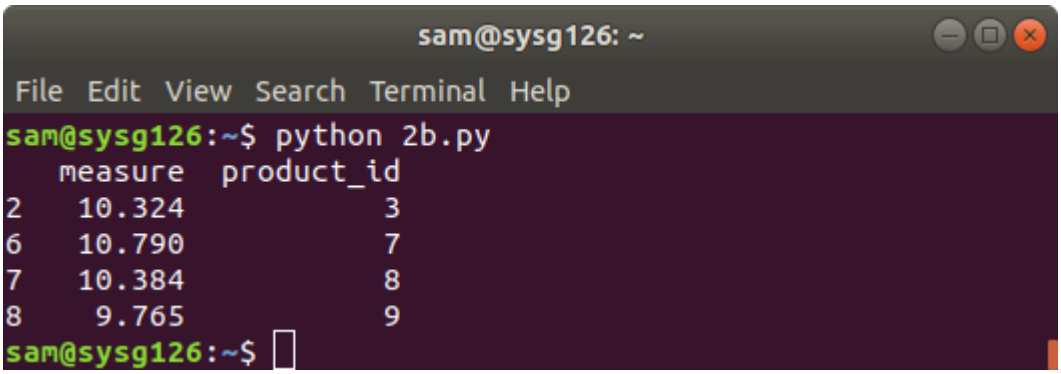
OUTPUT:



2 B) Implement Simple Random Sampling:

```
import numpy as np
import pandas as pd
np.random.seed(42)
number_of_products=10
data={'product_id':np.arange(1,number_of_products+1).tolist(),'measure':np.round(np
.random.normal(loc=10,scale=0.5,size=number_of_products),3)}
df=pd.DataFrame(data)
simple_random_sample=df.sample(n=4).sort_values(by='product_id')
simple_random_mean=round(simple_random_sample['measure'].mean(),3)
simple_random_sample
print(simple_random_sample)
```

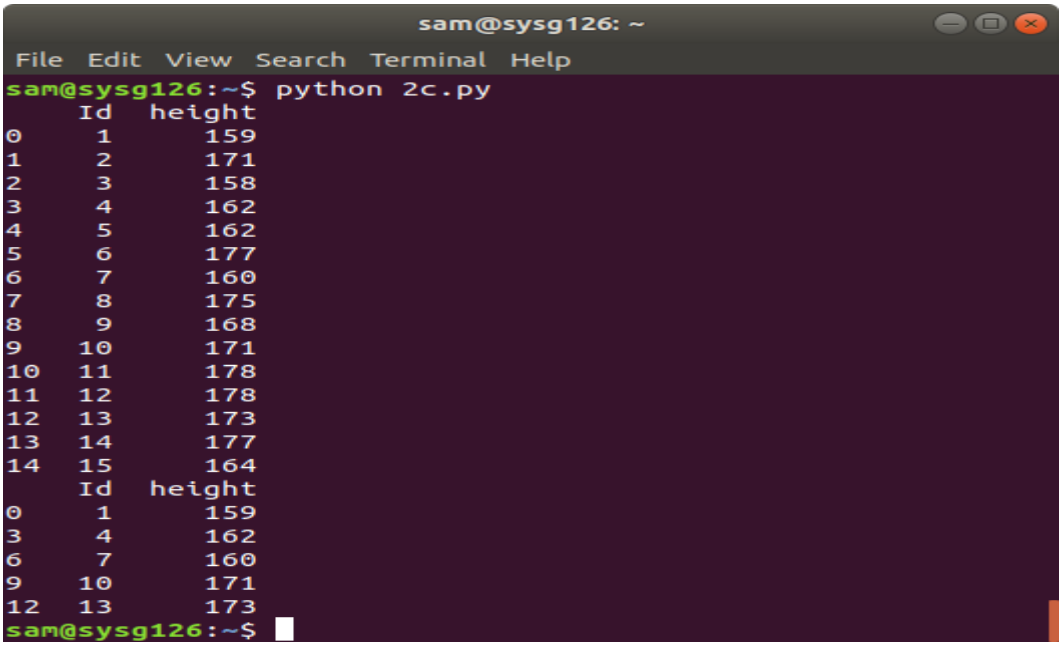
OUTPUT:



2 C) Implement Systematic Sampling:

```
import numpy as np
import pandas as pd
number_of_students = 15
data = {'Id': np.arange(1, number_of_students+1).tolist(),
        'height': [159, 171, 158, 162, 162, 177, 160, 175,
                   168, 171, 178, 178, 173, 177, 164]}
df = pd.DataFrame(data)
print(df)
def systematic_sampling(df, step):
    indexes = np.arange(0, len(df), step=step)
   systematic_sample = df.iloc[indexes]
   return systematic_sample
systematic_sample = systematic_sampling(df, 3)
print(systematic_sample)
```

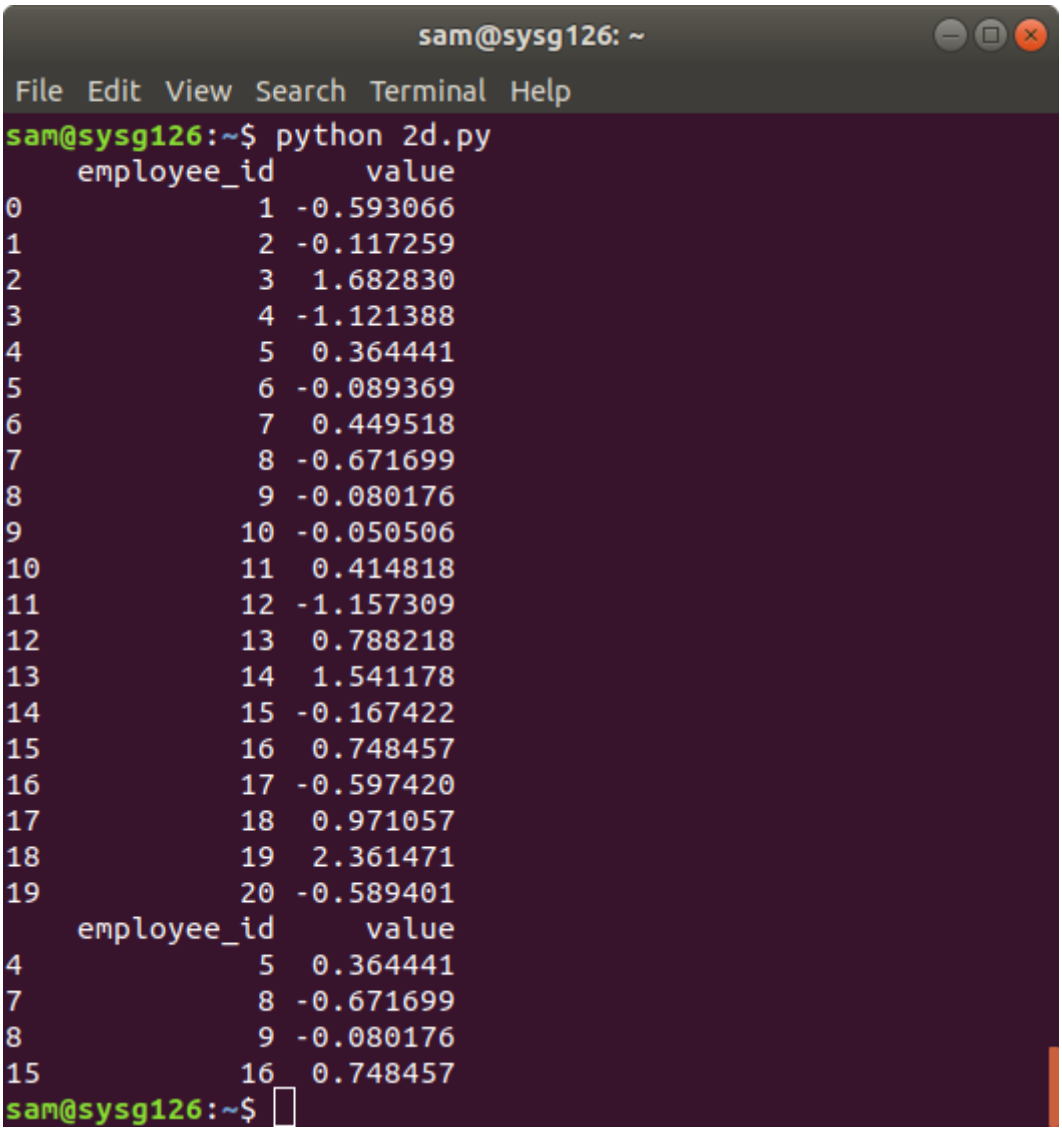
OUTPUT:



2 D) Implement Cluster Sampling:

```
import numpy as np
import pandas as pd
dic_data={"employee_id":np.arange(1,21),'value':np.random.randn(20)}
df=pd.DataFrame(dic_data)
print(df)
samples=df.sample(4).sort_values(by='employee_id')
print(samples)
```

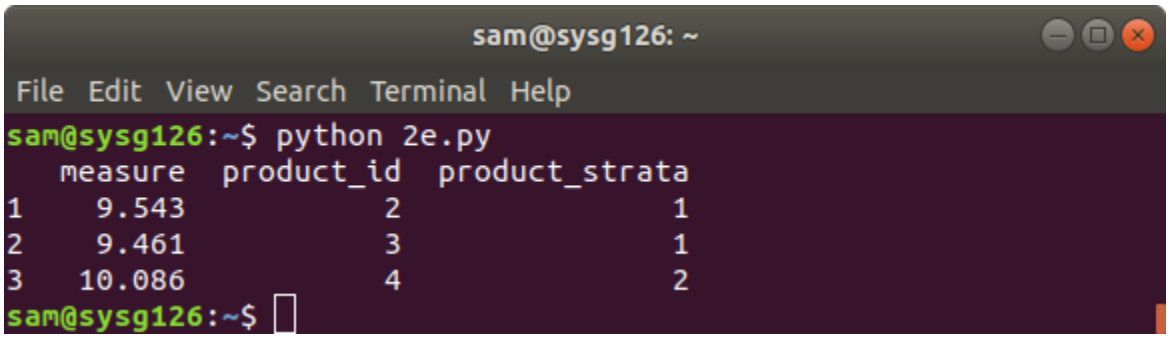
OUTPUT:



2 E) Implement Stratified Random Sampling:

```
import pandas as pd
import numpy as np
number_of_products=6
data = {'product_id':np.arange(1, number_of_products+1).tolist(),
      'product_strata':np.repeat([1,2], number_of_products/2).tolist(),
      'measure':np.round(np.random.normal(loc=10, scale=0.5, size=number_of_products),3)}
df = pd.DataFrame(data)
df
from sklearn.model_selection import StratifiedShuffleSplit
from sklearn.model_selection import train_test_split
split = StratifiedShuffleSplit(n_splits=1, test_size=0.4)
for x, y in split.split(df, df['product_strata']):
    stratified_random_sample = df.iloc[y].sort_values(by='product_id')
stratified_random_sample
stratified_random_sample.groupby('product_strata').mean().drop(['product_id'],axis=1)
print(stratified_random_sample)
```

OUTPUT:



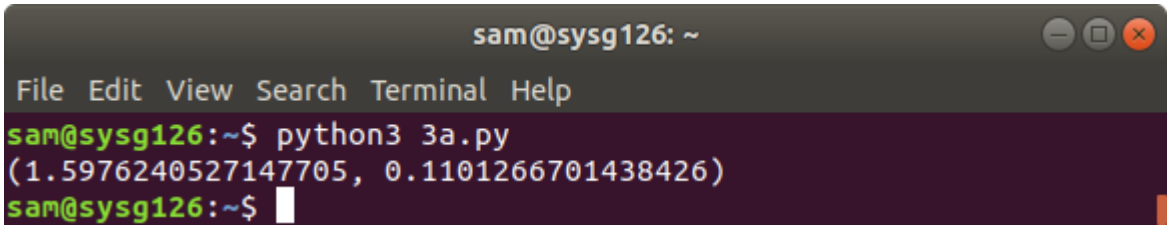
EX.NO 03

PROGRAM:

3 A) One Sample Z-Test in Python:

```
from statsmodels.stats.weightstats import ztest as ztest
data = [88, 92, 94, 94, 96, 97, 97, 97, 99, 99,
        105, 109, 109, 109, 110, 112, 112, 113, 114, 115]
ztest=ztest(data, value=100)
print(ztest)
```

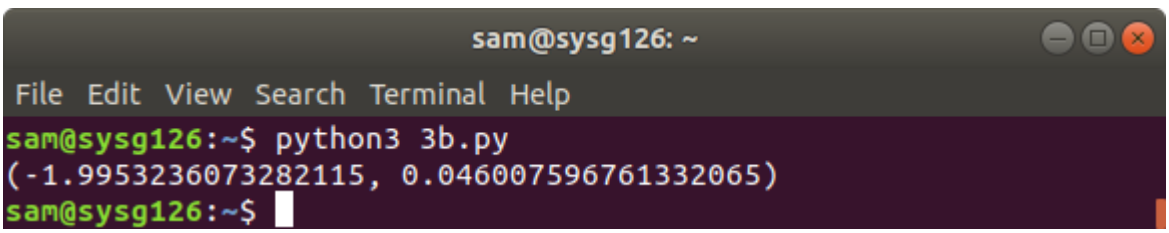
OUTPUT:



3 B) Two Sample Z-Test in Python:

```
from statsmodels.stats.weightstats import ztest as ztest
cityA = [82, 84, 85, 89, 91, 91, 92, 94, 99, 99,
        105, 109, 109, 109, 110, 112, 112, 113, 114, 114]
cityB = [90, 91, 91, 91, 95, 95, 99, 99, 108, 109,
        109, 114, 115, 116, 117, 117, 128, 129, 130, 133]
ztest=ztest(cityA, cityB, value=0)
print(ztest)
```

OUTPUT:



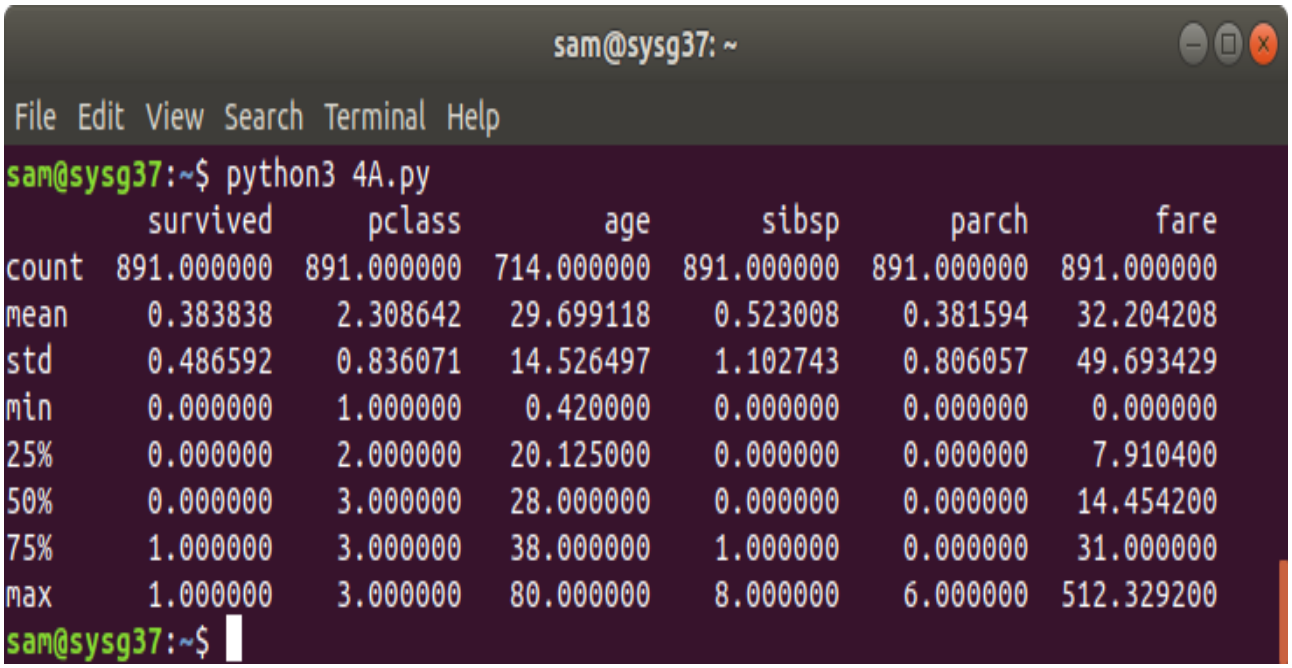
EX.NO 04

PROGRAM:

4 A) verview Of Data Set:

```
import pandas as pd
import numpy as np
import numpy.random
import seaborn as sb
titanic_trian_data=sb.load_dataset('titanic')
 titanic_train_data.describe()
```

OUTPUT:

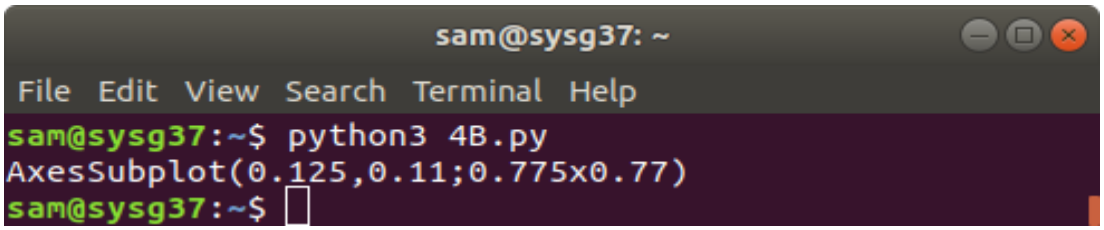


	survived	pclass	age	sibsp	parch	fare
count	891.000000	891.000000	714.000000	891.000000	891.000000	891.000000
mean	0.383838	2.308642	29.699118	0.523008	0.381594	32.204208
std	0.486592	0.836071	14.526497	1.102743	0.806057	49.693429
min	0.000000	1.000000	0.420000	0.000000	0.000000	0.000000
25%	0.000000	2.000000	20.125000	0.000000	0.000000	7.910400
50%	0.000000	3.000000	28.000000	0.000000	0.000000	14.454200
75%	1.000000	3.000000	38.000000	1.000000	0.000000	31.000000
max	1.000000	3.000000	80.000000	8.000000	6.000000	512.329200

4 B) Titanic Train Data:

```
import pandas as pd
import numpy as np
import seaborn as sb
titanic_train_data=sb.load_dataset('titanic')
temp=titanic_train_data[titanic_train_data['age'].notna()].age
print(sb.histplot(temp))
```

OUTPUT:



4 C) Survived Data:

```
survived_data = titanic_train_data(titanic_train_data['Survived']==1]
                survived_data[survived_data['Age'].notna ()].head()
```

OUTPUT:

```
sam@sysg7:~$ python3 4c.py
   survived  pclass     sex   age  sibsp  parch     fare embarked   class    who  adult_male deck  embark_town alive  alone
1         1       1  female  38.0      1      0  71.2833        C   First  woman       False    C    Cherbourg   yes  False
2         1       3  female  26.0      0      0   7.9250        S   Third  woman       False  NaN  Southampton   yes   True
3         1       1  female  35.0      1      0  53.1000        S   First  woman       False    C  Southampton   yes  False
8         1       3  female  27.0      0      2  11.1333        S   Third  woman       False  NaN  Southampton   yes  False
9         1       2  female  14.0      1      0  30.0708        C  Second  child       False  NaN    Cherbourg   yes  False
sam@sysg7:~$
```

4D) Sample List

```
sample_list = []
                for i in range (60):
                sample_list_temp = np. random. Choice (survived_data[survived_data['Age'] .notna()].Age,60) .mean()
                sample_list.append(sample_list_temp)
                sns.distplot (sample_list)
```

OUTPUT:

```
sam@sysg7:~$ python3 4d.py
AxesSubplot(0.125,0.11;0.775x0.77)
sam@sysg7:~$
```

4 E) Z test

```
                from statsmodels.stats.weightstats import ztest
                from statsmodels.stats.weightstats import zconfint

        ztest Score, p_value= ztest (sample_list, value = mean_hØ, alternative='larger")
        print('p_value',p_value)
        print('ztest Score',ztest Score)
        if (p_value < 0.05): #The smaller the p-value, the stronger the evidence to reject the HØ
        print ()
        print("Reject HØ with", (1-p_value) *100, '% level of confidence');
        print ()
else:
       print("Fail to reject HØ");
       print()
```

OUTPUT:

```
sam@sysg7:~$ python3 4e.py
p_value 0.026519184595012825
ztest Score 1.9346083940075893

Reject HØ with 97.34808154049873 % level of confidence

sam@sysg7:~$ python3 4e.py
p_value 0.40016283889959 97
ztest Score 0.2529256372170385
Fail to reject HØ
```

4 F) survived male data

sns.distplot (survived_male_data[survived_male_data.Age.notna ()1.Age)

OUTPUT:

```
sam@sysg7:~$ python3 4f.py
   survived  pclass   sex   age  sibsp  parch     fare embarked  class    who  adult_male deck  embark_town alive  alone
0         0       3  male  22.0      1      0   7.2500        S  Third    man        True  NaN  Southampton    no  False
4         0       3  male  35.0      0      0   8.0500        S  Third    man        True  NaN  Southampton    no   True
5         0       3  male   NaN      0      0   8.4583        Q  Third    man        True  NaN   Queenstown    no   True
6         0       1  male  54.0      0      0  51.8625        S  First    man        True    E  Southampton    no   True
7         0       3  male   2.0      3      1  21.0750        S  Third  child       False  NaN  Southampton    no  False
sam@sysg7:~$
```

4 G) Sample List male Using For Range (60)

```
sample_list_male = []
        for i in range (60):
            sample_list_temp = np . random. Choice
( survived_male_data[survived_male_data.Age.notna()]. Age,60). Mean ()
            sample_list_male.append(sample_list_temp)
        sns.distplot (sample_list_male)
```

OUTPUT:

```
sam@sysg7:~$ python3 4g.py
AxesSubplot(0.125,0.11;0.775x0.77)
sam@sysg7:~$
```

4 H) survived_female_data

sns.distplot (survived_female_data[survived_female_data.Age.notna()]. Age)

OUTPUT:

```
sam@sysg7:~$ python3 4h.py
   survived  pclass     sex   age  sibsp  parch     fare embarked   class    who  adult_male deck  embark_town alive  alone
1         1       1  female  38.0      1      0  71.2833        C   First  woman       False    C    Cherbourg   yes  False
2         1       3  female  26.0      0      0   7.9250        S   Third  woman       False  NaN  Southampton   yes   True
3         1       1  female  35.0      1      0  53.1000        S   First  woman       False    C  Southampton   yes  False
8         1       3  female  27.0      0      2  11.1333        S   Third  woman       False  NaN  Southampton   yes  False
9         1       2  female  14.0      1      0  30.0708        C  Second  child       False  NaN    Cherbourg   yes  False
sam@sysg7:~$
```

4 I) Sample List Female Using For Range (60)

```
sample_list_female = [ ]
        for i in range(60):
        sample_list_temp = np . random . choice
( survived_female_data[survived_female_date.Age . notna ()] . Age,60). Mean()
        sample_list_female.append(sample_list_temp)
        sns.distplot (sample_list_female)
```

OUTPUT:

```
sam@sysg7:~$ python3 4i.py
AxesSubplot(0.125,0.11;0.775x0.77)
sam@sysg7:~$
```

4 J) Z test

```
        from statsmodels.stats.weightstats import ztest
        from statsmodels.stats.weightstats import zconfint


    Ztest_Score, p_value =  ztest(x1=sample_list_male, x2 sample_list_female, value = 0,
alternatives two-sided"]
     print('p_value,p_value)
     print('ztest Score',ztest Score)
    if (p_value < 0.05): #The smaller the p-value, the stronger the evidence to reject the HØ
    print()
   print("Reject HØ with", (1-p_value)*100,' %level of confidence');
   print()
else:
  print("Fail to reject HØ ");
  print()
 lower, upper = zconfint (x1=sample_list_male, value = 0,alpha=0.05, alternative = 'two-
sided")
 print("with 95% considence interval we can say thta, Passenger Mean age is between,
lower,"and", upper)
 lower, upper = zconfint(x1=sample_list_female, value = 0,alpha 0.05, alternative="two-
sided")
 print("With 95% considence interval we can say thta, Passenger Mean age is between",
lower, "and", upper)
```

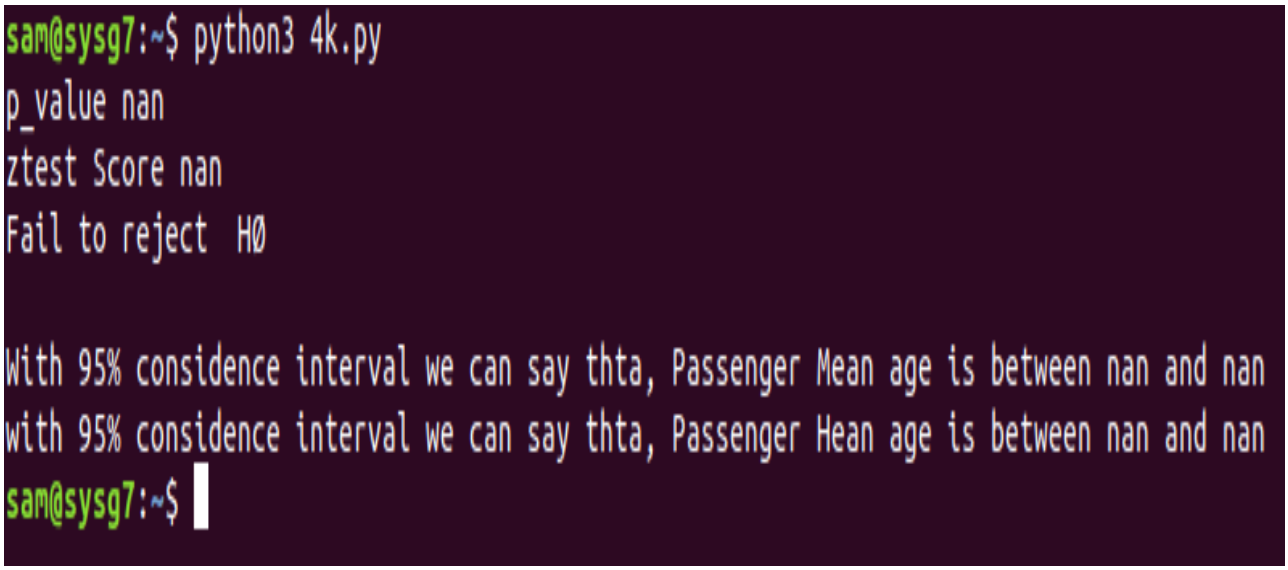
OUTPUT:

```
sam@sysg7:~$ python3 4j.py
p_value nan
ztest Score nan
Fail to reject HØ

with 95% considence interval we can say thta, Passenger Mean age is between nan and nan
With 95% considence interval we can say thta, Passenger Mean age is between nan and nan
sam@sysg7:~$
```

4 K) z test

```
from statsmodels.stats.weightstats import ztest
from statsmodels.stats.weightstats import zconfint


ztest_score,p_value=ztest(x1=sample_list_male,x2=sample_list_female,value=0,
alternative='larger')
 print('p_value,p_value)
 print('ztest Score',ztest Score)
 if (p_value < 0.05): #The smaller the p-value, the stronger the evidence to reject
the HO
 print()
 print("Reject  HØ with", (1-p_value)*100,'%level of confidence');
 print()
else:
 print("Fail to reject  HØ'');
 print()
lower, upper = zconfint(x1=sample_list_male, value = 0,alpha=0.05,
alternative='two-sided')
print("With 95% considence interval we can say thta, Passenger Mean age is
between", lower,"and", upper)
lower, upper = zconfint (x1=sample_list_female, value = 0,alpha=0.05,
alternatives=' two-sided')
print("with 95% considence interval we can say thta, Passenger Hean age is
between", lower, "and", upper)
```

OUTPUT:



4 L) One Proportion Z-Test

```
from statsmodels.stats.weightstats import ztest
from statsmodels.stats.weightstats import zconfint
from statsmodels.stats.proportion import proportions_ztest
from statsmodels.stats.proportion import proportion_confint

p = Ø.5Ø
ztestScore,p_value=proportions_ztest(count=153,nobs=survived_data.Age_range.count(),val
ue=p, alternative ‘large’

print("Below is the calculation using Library")
print('p_value,p_value)
print('ztest Score’,ztest Score)
  if (p_value < 0.05): #The smaller the p-value, the stronger the evidence to reject the HØ
  print("Reject HØ with", (1-p_value)*100, '%level of confidence');
  print()
else:
print("Fail to reject HØ ");
print()
z_score= ((153/290)-0.5)/(math.sqrt((0.5+0.5)/714))
print("z_score,z_score)
lower,upper=proportion_confint(count=153,nobs=survived_data.Age_range.count(),
method="normal)
print (lower *100, "% to”, upper*100, “% of passengers who survived lie in the range of 20-
40 age ")
```

OUTPUT:

```
sam@sysg7:~$ python3 4l.py
Below is the calculation using Library
p_value 0.17335611403977724
ztest Score 0.9409856206480031
Fail to reject HØ

z_score 0.7371249222558574
47.01273352614269 % to”, upper*100, “% of passengers who survived lie in the range of 20-40 age
sam@sysg7:~$
```

4 M) One Proportion Z-Test

```
from statsmodels.stats.weightstats import ztest
from statsmodels.stats.weightstats import zconfint
from statsmodels.stats.proportion import proportions_ztest
from statsmodels.stats.proportion import proportion_confint
P = Ø.5 Ø

Ztest_ Score,p_value= proportions_ztest (count=385, nobs=titanic_train_data.
Age_range.count(),value=p,alternative='large

print("Below is the calculation using Library")
print('p_value.p_value)
print( ztest Scoreztest Score)
  if (p_value < 0.05): #The smaller the p-value, the stronger the evidence to reject the H Ø
print("Reject H Ø with''. (1-p_value)*100,'% level of confidence");
print()
else:
      print("Fail to reject H Ø ");
      print()
z score = (0.539-0.5)/(math.sqrt((0.5*0.5)/714))
print("score ,z_score)
Lower, upper = proportion_confint (count=385, nobs =titanic_train_data.Age_range.count(),
method="normal")
print (lower*100, "% to, upper*100,''% of passengers lie in range of 20-40 age ")
```

OUTPUT:

```
sam@sysg7:~$ python3 4m.py
Below is the calculation using Library
p_value 0.017766864459442252
ztest Score 2.1022231945651932
Reject H Ø with''. (1-p_value)*100,'% level of confidence

score 2.084220717678434
50.26537584422187 % to 57.57776141068008 % of passengers lie in range of 20-40 age
sam@sysg7:~$
```

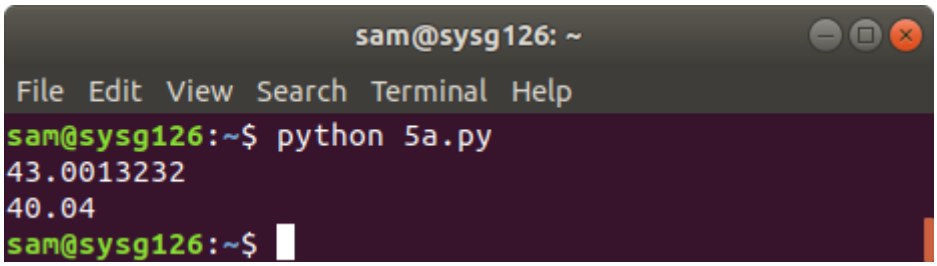
EX.NO 05

PROGRAM:

5 A) ONE-SAMPLE T-TEST:

```
import numpy as np
from scipy import stats
population_ages1=stats.poisson.rvs(loc=18,mu=35,size=1500000)
population_ages2=stats.poisson.rvs(loc=18,mu=10,size=1000000)
population_ages=np.concatenate((population_ages1,population_ages2))
minnesota_ages1=stats.poisson.rvs(loc=18,mu=30,size=30)
minnesota_ages2=stats.poisson.rvs(loc=18,mu=10,size=20)
minnesota_ages=np.concatenate((minnesota_ages1,minnesota_ages2))
print(population_ages.mean())
print(minnesota_ages.mean())
```

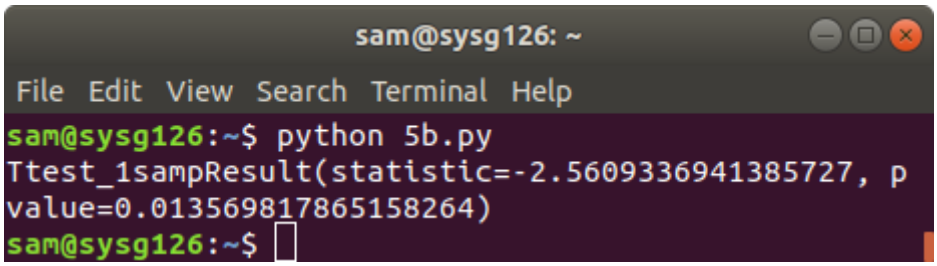
OUTPUT:



5 B)

```
import numpy as np
from scipy import stats
population_ages1=stats.poisson.rvs(loc=18,mu=35,size=1500000)
population_ages2=stats.poisson.rvs(loc=18,mu=10,size=1000000)
population_ages=np.concatenate((population_ages1,population_ages2))
minnesota_ages1=stats.poisson.rvs(loc=18,mu=30,size=30)
minnesota_ages2=stats.poisson.rvs(loc=18,mu=10,size=20)
minnesota_ages=np.concatenate((minnesota_ages1,minnesota_ages2))
sa=stats.ttest_1samp(a=minnesota_ages,popmean=population_ages.mean())
print(sa)
```

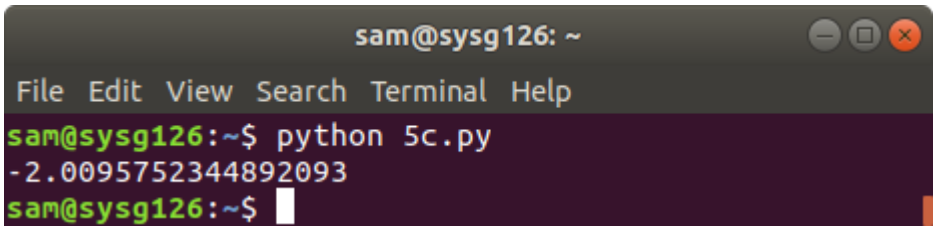
OUTPUT:



5 C)

```
import numpy as np
from scipy import stats
population_ages1=stats.poisson.rvs(loc=18,mu=35,size=1500000)
population_ages2=stats.poisson.rvs(loc=18,mu=10,size=1000000)
population_ages=np.concatenate((population_ages1,population_ages2))
minnesota_ages1=stats.poisson.rvs(loc=18,mu=30,size=30)
minnesota_ages2=stats.poisson.rvs(loc=18,mu=10,size=20)
minnesota_ages=np.concatenate((minnesota_ages1,minnesota_ages2))
sa=stats.t.ppf(q=0.025, df=49)
print(sa)
```

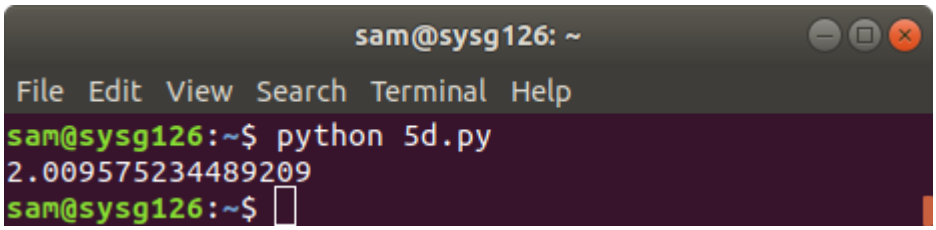
OUTPUT:



5 D)

```
import numpy as np
from scipy import stats
population_ages1=stats.poisson.rvs(loc=18,mu=35,size=1500000)
population_ages2=stats.poisson.rvs(loc=18,mu=10,size=1000000)
population_ages=np.concatenate((population_ages1,population_ages2))
minnesota_ages1=stats.poisson.rvs(loc=18,mu=30,size=30)
minnesota_ages2=stats.poisson.rvs(loc=18,mu=10,size=20)
minnesota_ages=np.concatenate((minnesota_ages1,minnesota_ages2))
sa=stats.t.ppf(q=0.975, df=49)
print(sa)
```

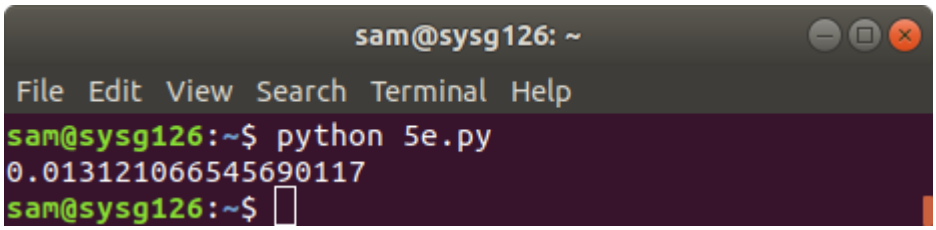
OUTPUT:



5 E)

```
import numpy as np
from scipy import stats
population_ages1=stats.poisson.rvs(loc=18,mu=35,size=1500000)
population_ages2=stats.poisson.rvs(loc=18,mu=10,size=1000000)
population_ages=np.concatenate((population_ages1,population_ages2))
minnesota_ages1=stats.poisson.rvs(loc=18,mu=30,size=30)
minnesota_ages2=stats.poisson.rvs(loc=18,mu=10,size=20)
minnesota_ages=np.concatenate((minnesota_ages1,minnesota_ages2))
sa=stats.t.cdf(x=-2.5742, df=49)*2
print(sa)
```

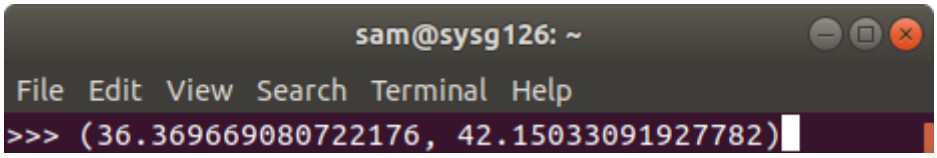
OUTPUT:



5 F)

```
import numpy as np
from scipy import stats
population_ages1=stats.poisson.rvs(loc=18,mu=35,size=1500000)
population_ages2=stats.poisson.rvs(loc=18,mu=10,size=1000000)
population_ages=np.concatenate((population_ages1,population_ages2))
minnesota_ages1=stats.poisson.rvs(loc=18,mu=30,size=30)
minnesota_ages2=stats.poisson.rvs(loc=18,mu=10,size=20)
minnesota_ages=np.concatenate((minnesota_ages1,minnesota_ages2))
sa=stats.t.interval(0.95, df=49, loc=minnesota_ages.mean(), scale=sigma)
print(sa)
```

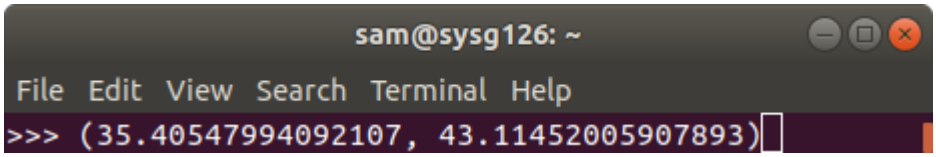
OUTPUT:



5 G)

```
import numpy as np
from scipy import stats
population_ages1=stats.poisson.rvs(loc=18,mu=35,size=1500000)
population_ages2=stats.poisson.rvs(loc=18,mu=10,size=1000000)
population_ages=np.concatenate((population_ages1,population_ages2))
minnesota_ages1=stats.poisson.rvs(loc=18,mu=30,size=30)
minnesota_ages2=stats.poisson.rvs(loc=18,mu=10,size=20)
minnesota_ages=np.concatenate((minnesota_ages1,minnesota_ages2))
sa=stats.t.interval(alpha=0.99, df=49, loc=minnesota_ages.mean(), scale=sigma)
print(sa)
```

OUTPUT:



EX.NO 06

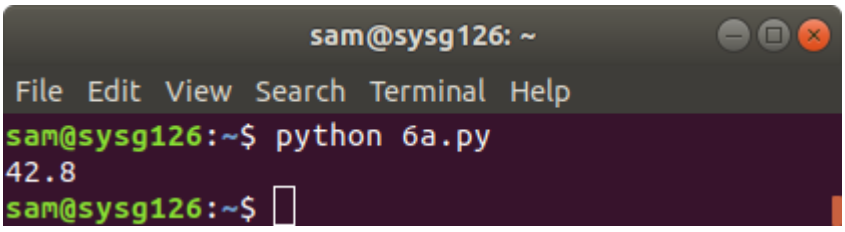
PROGRAM

6 A) Two-Sample T-Test:

```
import pandas as pd
import numpy as np
from scipy import stats
from scipy.stats import norm
import matplotlib.pyplot as plt
np.random.seed(12)
wisconsin_ages1 = stats.poisson.rvs(loc=18, mu=33, size=30)
wisconsin_ages2 = stats.poisson.rvs(loc=18, mu=13, size=20)
wisconsin_ages = np.concatenate((wisconsin_ages1, wisconsin_ages2))
print(wisconsin_ages.mean() )
stats.ttest_ind(a= minnesota_ages,
        b= wisconsin_ages,
equal_var=False)    # Assume samples have equal variance?
```

Ttest_indResult(statistic=-1.7083870793286842, pvalue=0.09073104343957748)

OUTPUT:

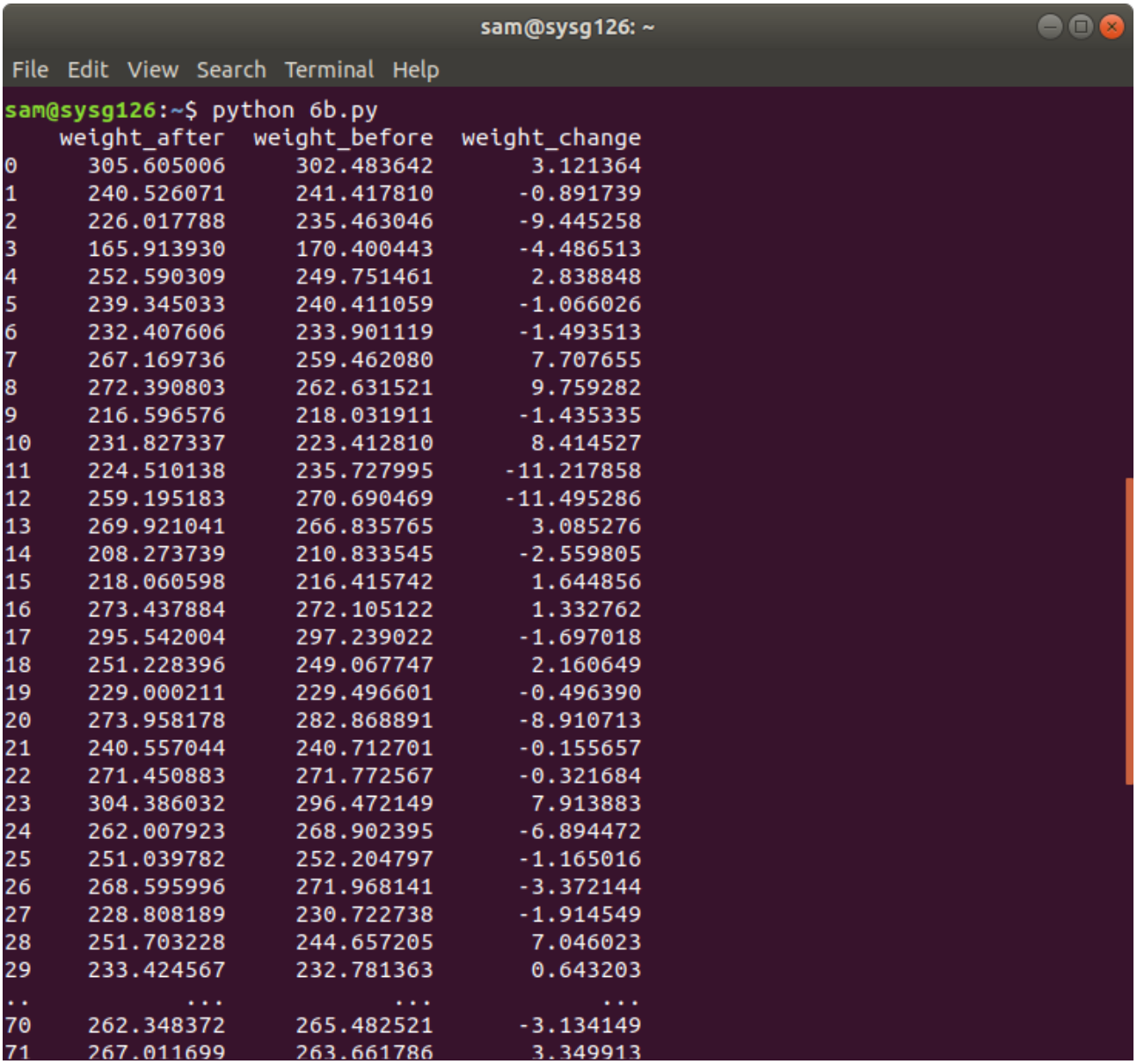


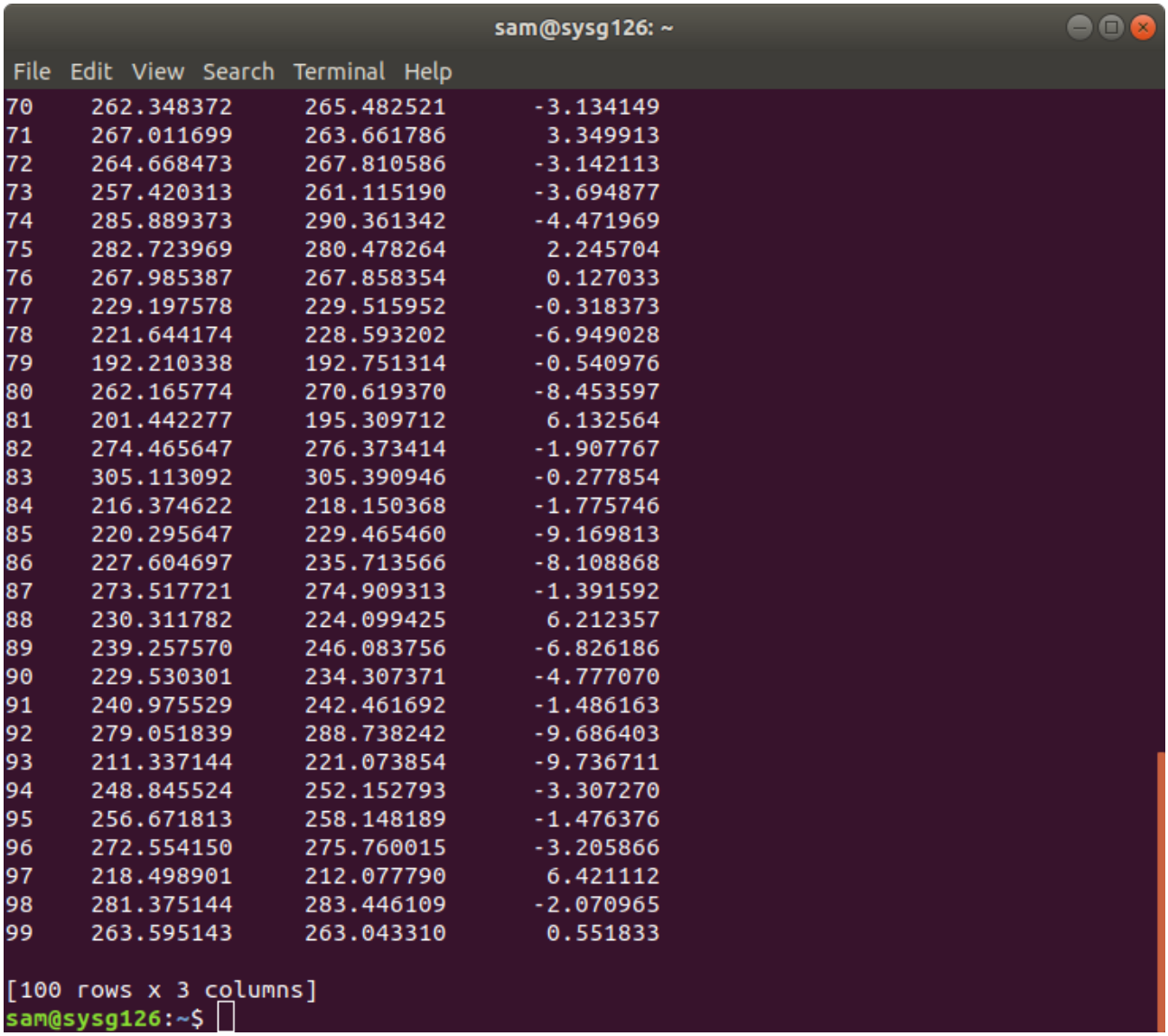
6 B) Paired T-Test:

```
np.random.seed(11)

before= stats.norm.rvs(scale=30, loc=250, size=100)
```

```
        after = before + stats.norm.rvs(scale=5, loc=-1.25, size=100)

        weight_df = pd.DataFrame({"weight_before":before,
                                  "weight_after":after,
                                  "weight_change":after-before})

weight_df.describe()
        stats.ttest_rel(a = before, b = after)
Ttest_relResult(statistic=2.5720175998568284, pvalue=0.011596444318439857)
```

OUTPUT:

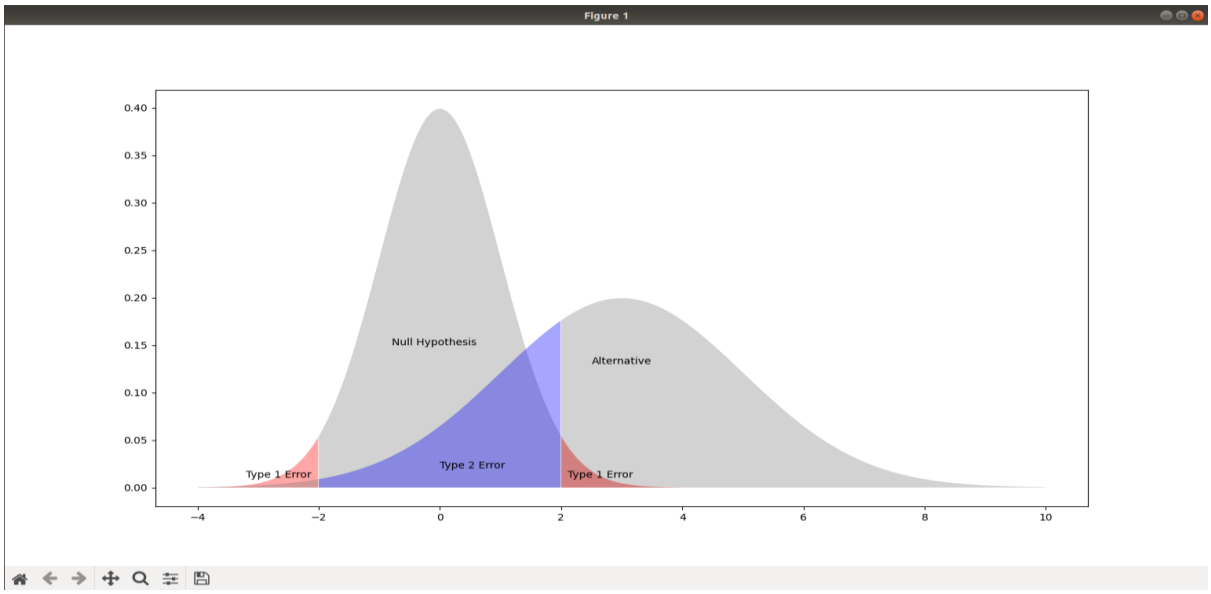

sam@sysg126: ~
File Edit View Search Terminal Help
sam@sysg126:~$ python 6b.py
weight_after weight_before weight_change
0 305.605006 302.483642 3.121364
1 240.526071 241.417810 -0.891739
2 226.017788 235.463046 -9.445258
3 165.913930 170.400443 -4.486513
4 252.590309 249.751461 2.838848
5 239.345033 240.411059 -1.066026
6 232.407606 233.901119 -1.493513
7 267.169736 259.462080 7.707655
8 272.390803 262.631521 9.759282
9 216.596576 218.031911 -1.435335
10 231.827337 223.412810 8.414527
11 224.510138 235.727995 -11.217858
12 259.195183 270.690469 -11.495286
13 269.921041 266.835765 3.085276
14 208.273739 210.833545 -2.559805
15 218.060598 216.415742 1.644856
16 273.437884 272.105122 1.332762
17 295.542004 297.239022 -1.697018
18 251.228396 249.067747 2.160649
19 229.000211 229.496601 -0.496390
20 273.958178 282.868891 -8.910713
21 240.557044 240.712701 -0.155657
22 271.450883 271.772567 -0.321684
23 304.386032 296.472149 7.913883
24 262.007923 268.902395 -6.894472
25 251.039782 252.204797 -1.165016
26 268.595996 271.968141 -3.372144
27 228.808189 230.722738 -1.914549
28 251.703228 244.657205 7.046023
29 233.424567 232.781363 0.643203
.. ..
70 262.348372 265.482521 -3.134149
71 267.011699 263.661786 3.349913


sam@sysg126: ~
File Edit View Search Terminal Help
70 262.348372 265.482521 -3.134149
71 267.011699 263.661786 3.349913
72 264.668473 267.810586 -3.142113
73 257.420313 261.115190 -3.694877
74 285.889373 290.361342 -4.471969
75 282.723969 280.478264 2.245704
76 267.985387 267.858354 0.127033
77 229.197578 229.515952 -0.318373
78 221.644174 228.593202 -6.949028
79 192.210338 192.751314 -0.540976
80 262.165774 270.619370 -8.453597
81 201.442277 195.309712 6.132564
82 274.465647 276.373414 -1.907767
83 305.113092 305.390946 -0.277854
84 216.374622 218.150368 -1.775746
85 220.295647 229.465460 -9.169813
86 227.604697 235.713566 -8.108868
87 273.517721 274.909313 -1.391592
88 230.311782 224.099425 6.212357
89 239.257570 246.083756 -6.826186
90 229.530301 234.307371 -4.777070
91 240.975529 242.461692 -1.486163
92 279.051839 288.738242 -9.686403
93 211.337144 221.073854 -9.736711
94 248.845524 252.152793 -3.307270
95 256.671813 258.148189 -1.476376
96 272.554150 275.760015 -3.205866
97 218.498901 212.077790 6.421112
98 281.375144 283.446109 -2.070965
99 263.595143 263.043310 0.551833
[100 rows x 3 columns]
sam@sysg126:~$

6 C) Type I and Type II Error:

```
import pandas as pd
import numpy as np
from scipy import stats
from scipy.stats import norm
import matplotlib.pyplot as plt

plt.figure(figsize=(12,10))
plt.fill_between(x=np.arange(-4,-2,0.01),y1= stats.norm.pdf(np.arange(-4,-2,0.01))
,facecolor='red',alpha=0.35)
plt.fill_between(x=np.arange(-2,2,0.01),y1= stats.norm.pdf(np.arange(-2,2,0.01))
,facecolor='grey',alpha=0.35)
plt.fill_between(x=np.arange(2,4,0.01),y1= stats.norm.pdf(np.arange(2,4,0.01))
,facecolor='red',alpha=0.5)
plt.fill_between(x=np.arange(-4,-2,0.01),y1= stats.norm.pdf(np.arange(-4,-2,0.01),loc=3,
scale=2) ,facecolor='grey',alpha=0.35)
plt.fill_between(x=np.arange(-2,2,0.01),y1= stats.norm.pdf(np.arange(-2,2,0.01),loc=3,
scale=2) ,facecolor='blue',alpha=0.35)
plt.fill_between(x=np.arange(2,10,0.01),y1= stats.norm.pdf(np.arange(2,10,0.01),loc=3,
scale=2),facecolor='grey',alpha=0.35)
plt.text(x=-0.8, y=0.15, s= "Null Hypothesis")
plt.text(x=2.5, y=0.13, s= "Alternative")
plt.text(x=2.1, y=0.01, s= "Type 1 Error")
plt.text(x=-3.2, y=0.01, s= "Type 1 Error")
plt.text(x=0, y=0.02, s= "Type 2 Error")
plt.show()
```

OUTPUT:

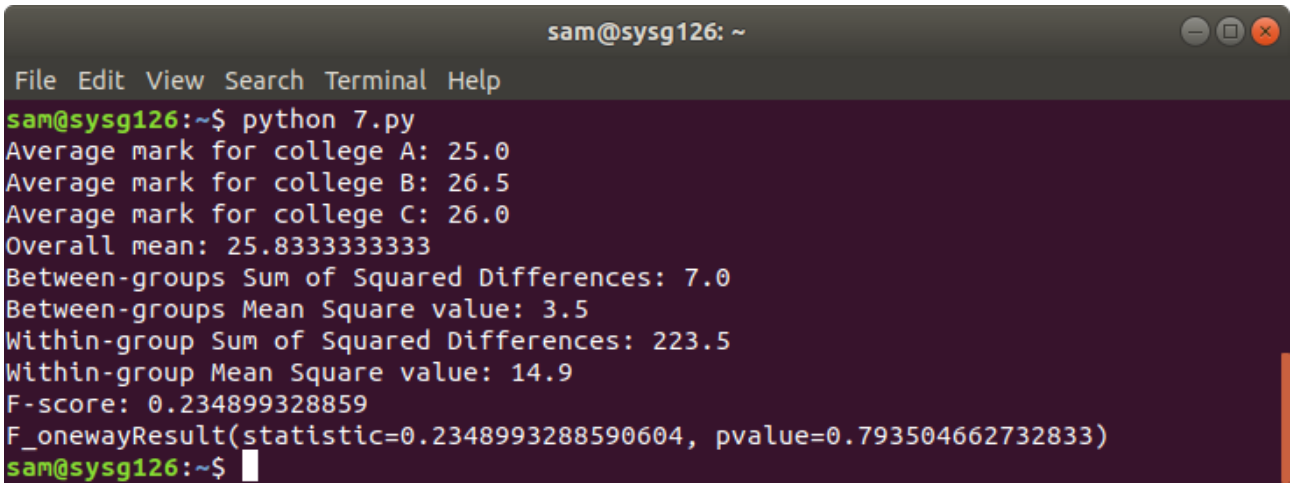


EX.NO 07

PROGRAM:

```
import pandas as pd
import numpy as np
import scipy.stats as stats
a=[25,25,27,30,23,20]
b=[30,30,21,24,26,28]
c=[18,30,29,29,24,26]
list_of_tuples = list(zip(a, b,c))
df = pd.DataFrame(list_of_tuples, columns = ['A', 'B', 'C'])
df
m1=np.mean(a)
m2=np.mean(b)
m3=np.mean(c)
print('Average mark for college A: {}'.format(m1))
print('Average mark for college B: {}'.format(m2))
print('Average mark for college C: {}'.format(m3))
m=(m1+m2+m3)/3
print('Overall mean: {}'.format(m))
SSb=6*((m1-m)**2+(m2-m)**2+(m3-m)**2)
print('Between-groups Sum of Squared Differences: {}'.format(SSb))
MSb=SSb/2
print('Between-groups Mean Square value: {}'.format(MSb))
err_a=list(a-m1)
err_b=list(b-m2)
err_c=list(c-m3)
err=err_a+err_b+err_c
ssw=[]
for i in err:
   ssw.append(i**2)
SSw=np.sum(ssw)
print('Within-group Sum of Squared Differences: {}'.format(SSw))
MSw=SSw/15
print('Within-group Mean Square value: {}'.format(MSw))
F=MSb/MSw
print('F-score: {}'.format(F))
print(stats.f_oneway(a,b,c))
```

OUTPUT:

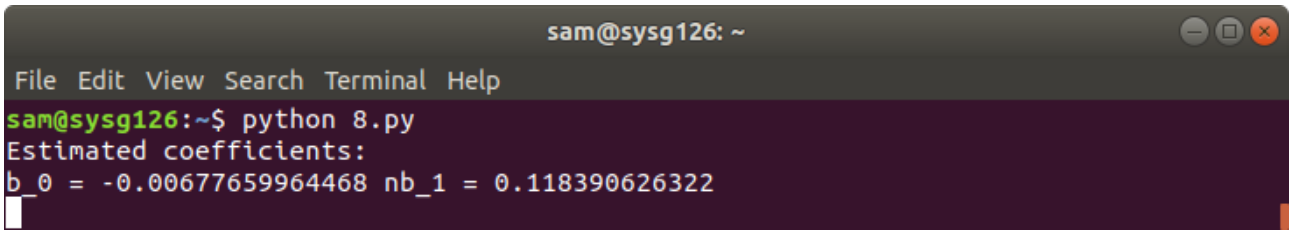

sam@sysg126: ~
File Edit View Search Terminal Help
sam@sysg126:~$ python 7.py
Average mark for college A: 25.0
Average mark for college B: 26.5
Average mark for college C: 26.0
Overall mean: 25.8333333333
Between-groups Sum of Squared Differences: 7.0
Between-groups Mean Square value: 3.5
Within-group Sum of Squared Differences: 223.5
Within-group Mean Square value: 14.9
F-score: 0.234899328859
F_onewayResult(statistic=0.2348993288590604, pvalue=0.793504662732833)
sam@sysg126:~$

EX.NO 08

PROGRAM:

```
import numpy as np
import matplotlib.pyplot as plt

def estimate_coef(x, y):
    n = np.size(x)
    m_x, m_y = np.mean(x), np.mean(y)
    SS_xy = np.sum(y*x - n*m_y*m_x)
    SS_xx = np.sum(x*x - n*m_x*m_x)
    b_1 = SS_xy / SS_xx
    b_0 = m_y - b_1*m_x
    return(b_0, b_1)
def plot_regression_line(x, y, b):
      plt.scatter(x, y, color = "m",marker = "o", s = 30)
      y_pred = b[0] + b[1]*x
      plt.plot(x, y_pred, color = "g")
      plt.xlabel('x')
      plt.ylabel('y')
      plt.show()
x = np.array([25, 23, 25, 31, 32, 25, 36, 27, 28, 29])
y = np.array([3.2, 3, 3.5, 3, 3.6, 3.7, 3.3, 3.6, 3.2, 3.1])
b = estimate_coef(x, y)
print("Estimated coefficients:\nb_0 = {} nb_1 = {}".format(b[0], b[1]))
plot_regression_line(x, y, b)
```

OUTPUT:


sam@sysg126: ~
File Edit View Search Terminal Help
sam@sysg126:~$ python 8.py
Estimated coefficients:
b_0 = -0.00677659964468 nb_1 = 0.118390626322

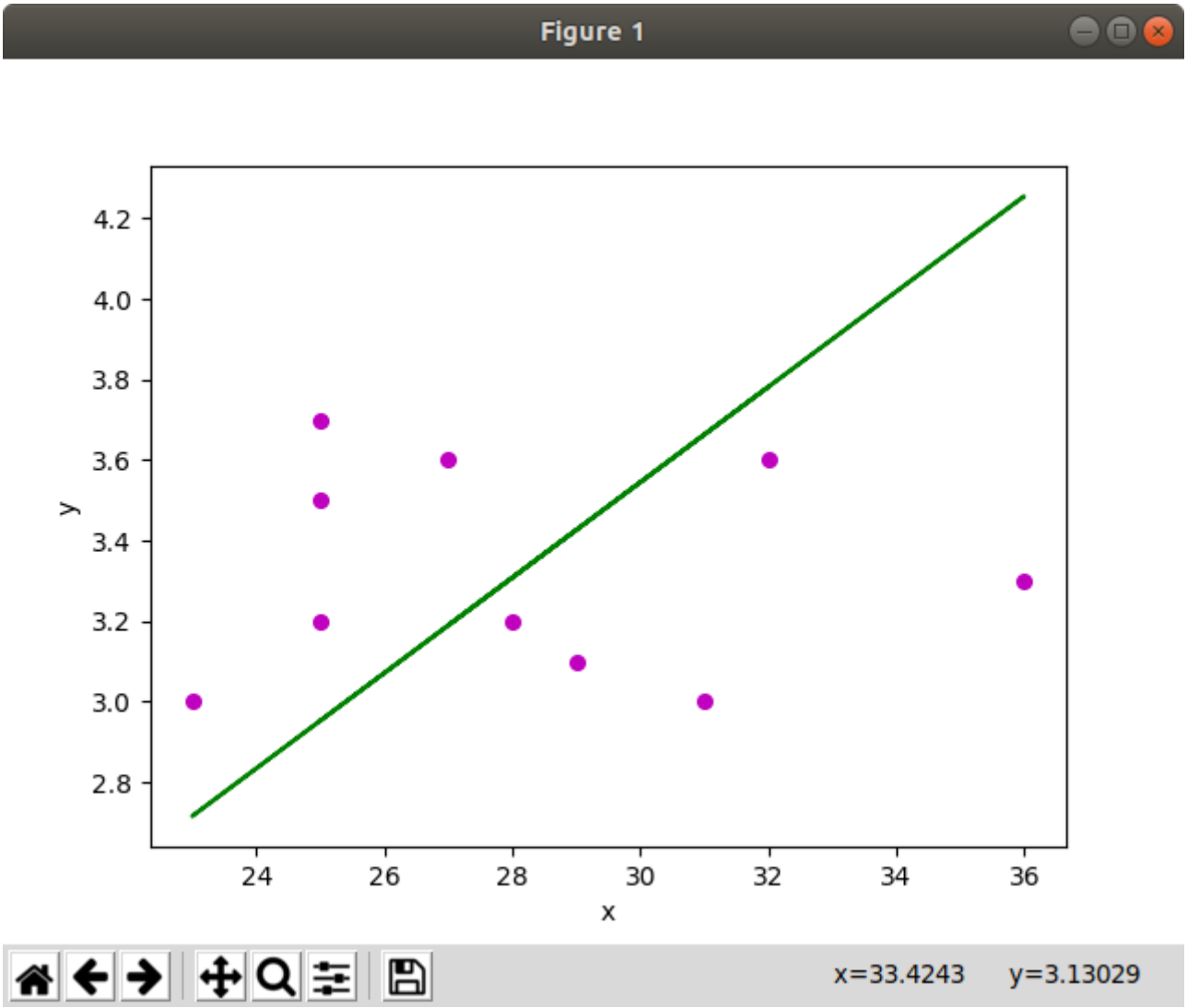


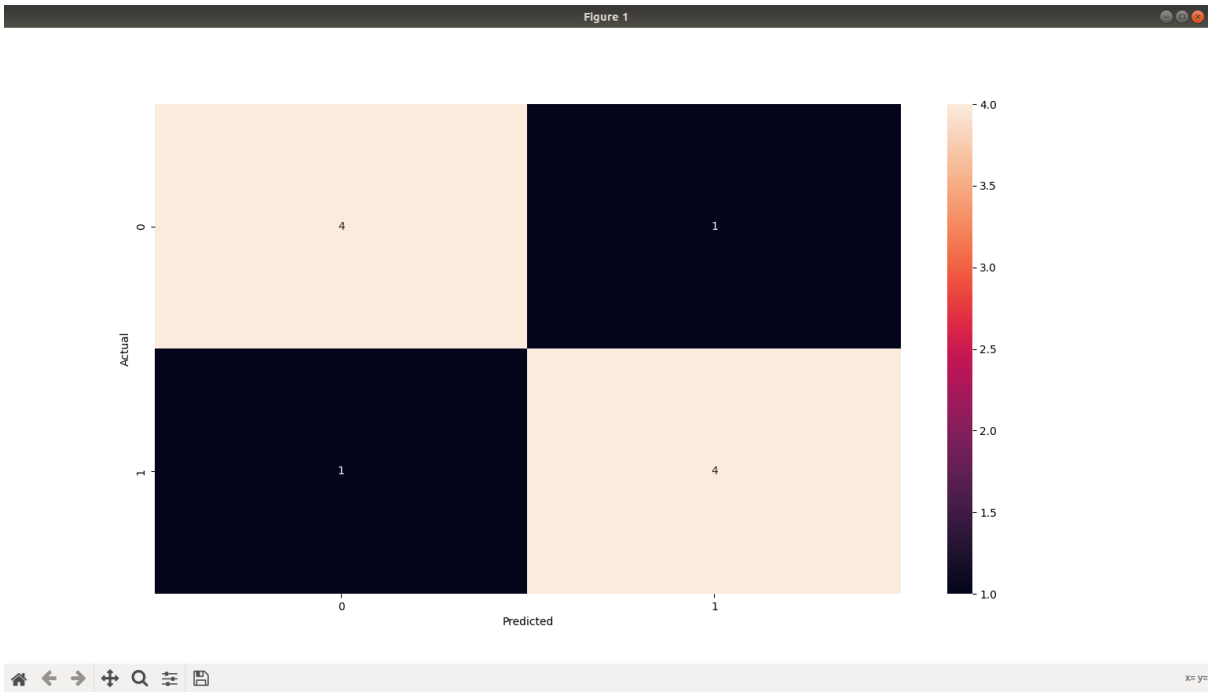
Figure 1
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
y
24
26
28
30
32
34
36
x
x=33.4243
y=3.13029

EX.NO 09

PROGRAM

```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn import metrics
import seaborn as sn
import matplotlib.pyplot as plt
candidates = {'gmat':[780,750,690,710,680,730,690,720,740,690,610,690,710,680,770,610,580,650,540,590,620,600,550,550,570,670,660,580,650,660,640,620,660,660,680,650,670,580,590,690],
'gpa':[4,3.9,3.3,3.7,3.9,3.7,2.3,3.3,3.3,3.3,1.7,2.7,3.7,3.7,3.3,3.3,3.3,2.7,3.7,2.7,2.3,3.3,2,2.3,2.7,3,3.3,3.7,2.3,3.7,3.3,3,2.7,4,3.3,3.3,3.3,2.3,2.7,3.3,1.7,3.7],
'work_experience':[3,4,3,5,4,6,1,4,5,1,3,5,6,4,3,1,4,6,2,3,2,1,4,1,2,6,4,2,6,5,1,2,4,6,5,1,2,1,4,5],
'admitted':[1,1,0,1,0,1,0,1,1,0,0,1,1,0,1,0,0,1,0,0,1,0,0,0,0,1,1,0,1,1,0,0,1,1,1,0,0,0,0,1]}
df = pd.DataFrame(candidates,columns= ['gmat', 'gpa','work_experience','admitted'])
print(df)
X = df[['gmat', 'gpa','work_experience']]
y = df['admitted']
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.25,random_state=0)
print (X_train)
print (y_train)
logistic_regression= LogisticRegression()
logistic_regression.fit(X_train,y_train)
y_pred=logistic_regression.predict(X_test)
confusion_matrix = pd.crosstab(y_test, y_pred, rownames=['Actual'], colnames=['Predicted'])
sn.heatmap(confusion_matrix, annot=True)
print('Accuracy: ',metrics.accuracy_score(y_test, y_pred))
print (X_test)
print (y_pred)
print('confusion_matrix:', confusion_matrix, sep ='\n', end ='\n\n')
plt.show()
```

OUTPUT:



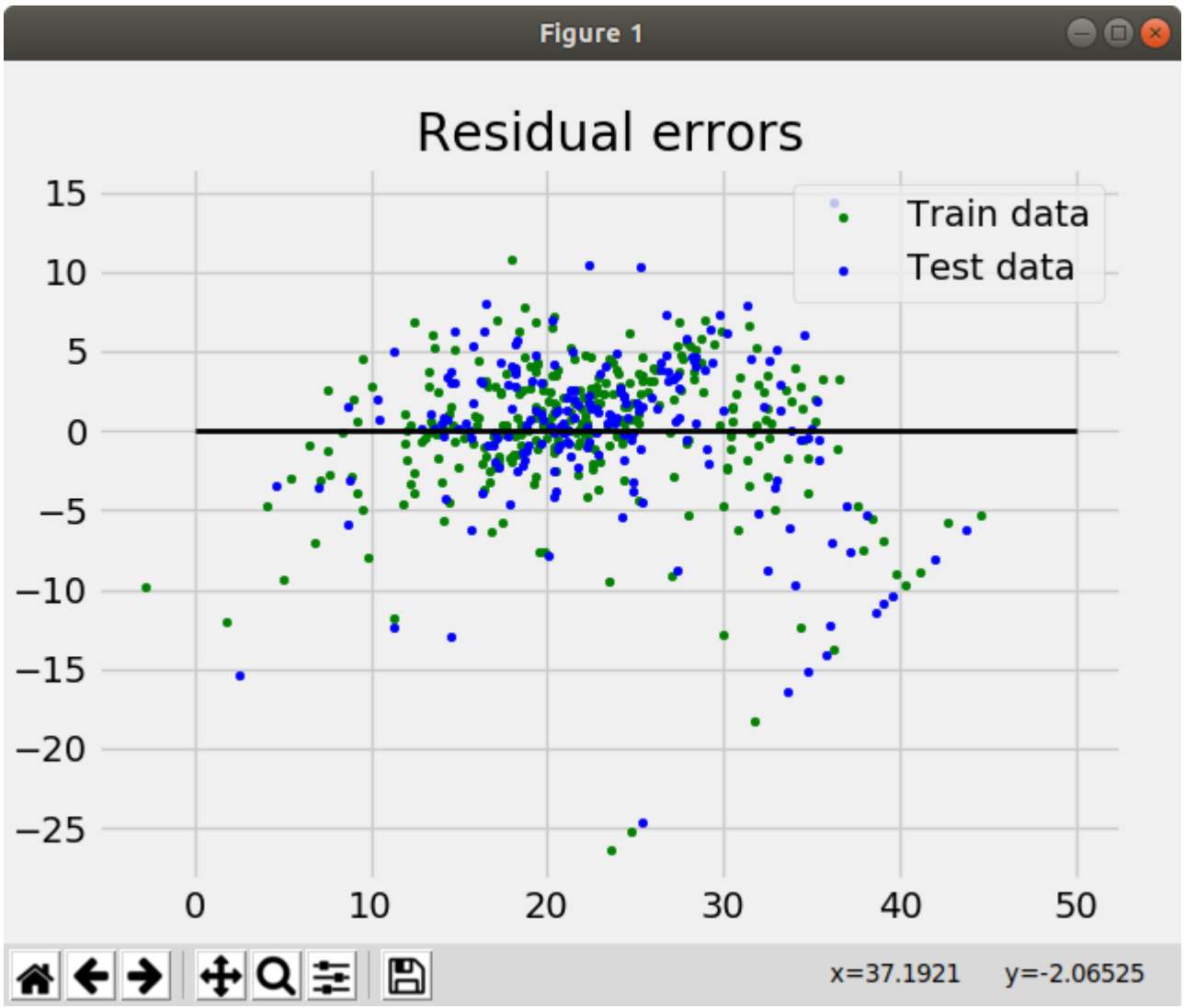
EX.NO 10

PROGRAM:

```
import matplotlib.pyplot as plt
import numpy as np
from sklearn import datasets, linear_model, metrics
boston = datasets.load_boston(return_X_y=False)
X = boston.data
y = boston.target
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.4,random_state=1)
reg = linear_model.LinearRegression()
reg.fit(X_train, y_train)
print('Coefficients: ', reg.coef_)
print('Variance score: {}'.format(reg.score(X_test, y_test)))
plt.style.use('fivethirtyeight')
plt.scatter(reg.predict(X_train), reg.predict(X_train) - y_train,
color = "green", s = 10, label = 'Train data')
plt.scatter(reg.predict(X_test), reg.predict(X_test) - y_test,
color = "blue", s = 10, label = 'Test data')
plt.hlines(y = 0, xmin = 0, xmax = 50, linewidth = 2)
plt.legend(loc = 'upper right')
plt.title("Residual errors")
plt.show()
```

OUTPUT:

```
sam@sysg126: ~
File  Edit  View  Search  Terminal  Help
sam@sysg126:~$ python 10.py
('Coefficients: ', array([-8.95714048e-02,  6.73132853e-02,  5.04649248e-02,  2.
18579583e+00,
       -1.72053975e+01,  3.63606995e+00,  2.05579939e-03, -1.36602886e+00,
        2.89576718e-01, -1.22700072e-02, -8.34881849e-01,  9.40360790e-03,
       -5.04008320e-01]))
Variance score: 0.720905667266
```



EX. NO. 11

PROGRAM

11 A)

```
from dateutil.parser import parse
import matplotlib as mpl
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
import pandas as pd
plt.rcParams.update({'figure.figsize': (10, 7), 'figure.dpi': 120})
df = pd.read_csv('https://raw.githubusercontent.com/selva86/datasets/master/a10.csv',
parse_dates=['date'])
df.head()
df =
pd.read_csv('https://raw.githubusercontent.com/selva86/datasets/master/MarketArrivals.csv')
df = df.loc[df.market=='MUMBAI', :]
df.head().
import matplotlib.pyplot as plt
df = pd.read_csv('https://raw.githubusercontent.com/selva86/datasets/master/a10.csv',
parse_dates=['date'], index_col='date')
def plot_df(df, x, y, title="", xlabel='Date', ylabel='Value', dpi=100):
    plt.figure(figsize=(16,5), dpi=dpi)
    plt.plot(x, y, color='tab:red')
    plt.gca().set(title=title, xlabel=xlabel, ylabel=ylabel)
    plt.show()
plot_df(df, x=df.index, y=df.value, title='Monthly anti-diabetic drug sales in Australia from
1992 to 2008.')
```

OUTPUT

	date	value
0	1991-07-01	3.526591
1	1991-08-01	3.180891
2	1991-09-01	3.252221
3	1991-10-01	3.611003
4	1991-11-01	3.565869

11 B)

```
df =
pd.read_csv('https://raw.githubusercontent.com/selva86/datasets/master/MarketArrivals.csv')
df = df.loc[df.market=='MUMBAI', :]
df.head()
```

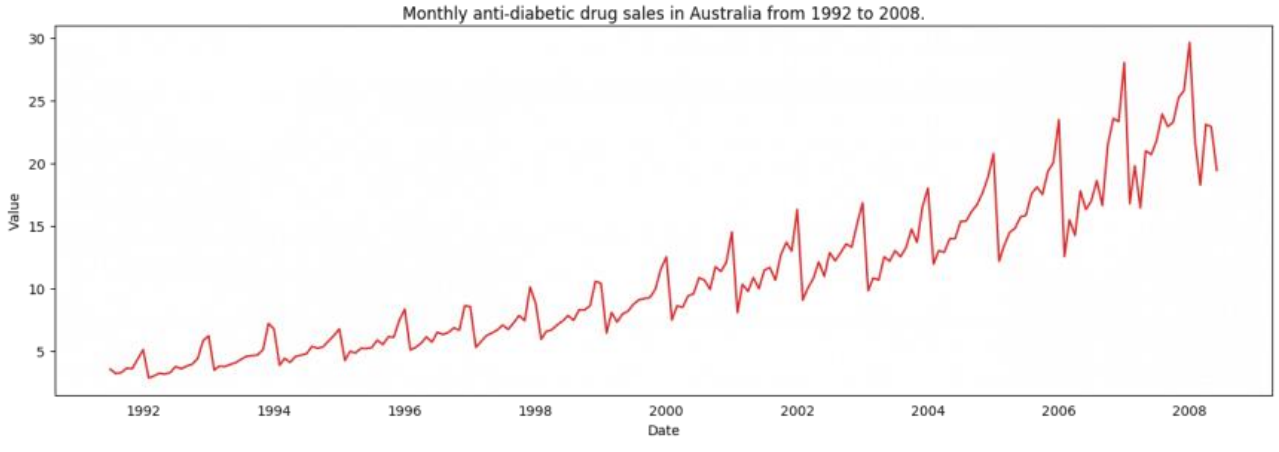
OUTPUT:

	market	month	year	quantity	priceMin	priceMax	priceMod	state	city	date
6654	MUMBAI	January	2004	267100	719	971	849	MS	MUMBAI	January-2004
6655	MUMBAI	January	2005	275845	261	513	387	MS	MUMBAI	January-2005
6656	MUMBAI	January	2006	228000	315	488	402	MS	MUMBAI	January-2006
6657	MUMBAI	January	2007	205200	866	1136	997	MS	MUMBAI	January-2007
6658	MUMBAI	January	2008	267550	348	550	448	MS	MUMBAI	January-2008

11 C)

```
import matplotlib.pyplot as plt
df = pd.read_csv('https://raw.githubusercontent.com/selva86/datasets/master/a10.csv',
parse_dates=['date'], index_col='date')

def plot_df(df, x, y, title="", xlabel='Date', ylabel='Value', dpi=100):
    plt.figure(figsize=(16,5), dpi=dpi)
    plt.plot(x, y, color='tab:red')
    plt.gca().set(title=title, xlabel=xlabel, ylabel=ylabel)
    plt.show()

plot_df(df, x=df.index, y=df.value, title='Monthly anti-diabetic drug sales in Australia from
1992 to 2008.')
df = pd.read_csv('datasets/AirPassengers.csv', parse_dates=['date'])
x = df['date'].values
y1 = df['value'].values
```

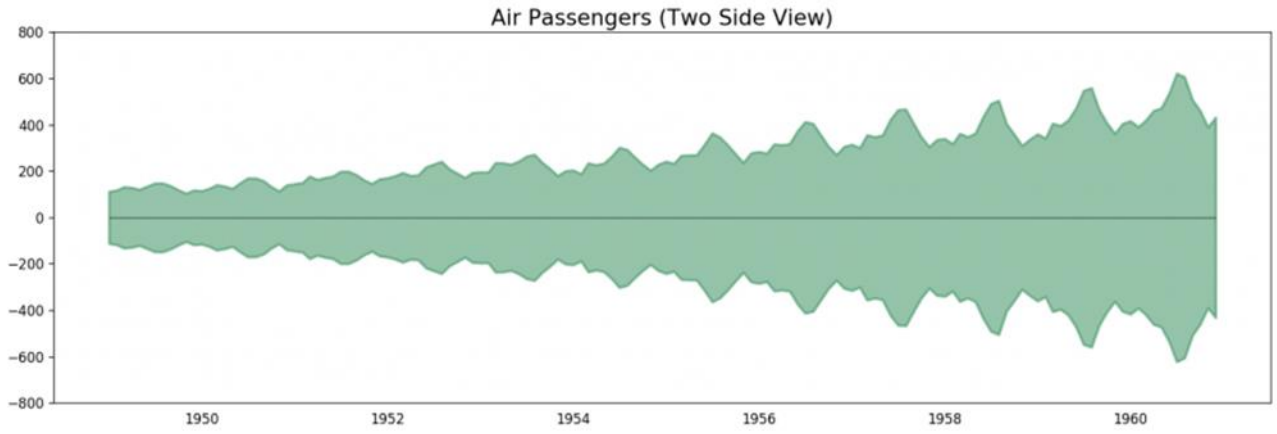
OUTPUT:



11 D) PLOT

```
fig, ax = plt.subplots(1, 1, figsize=(16,5), dpi= 120)
plt.fill_between(x, y1=y1, y2=-y1, alpha=0.5, linewidth=2, color='seagreen')
plt.ylim(-800, 800)
plt.title('Air Passengers (Two Side View)', fontsize=16)
plt.hlines(y=0, xmin=np.min(df.date), xmax=np.max(df.date), linewidth=.5)
plt.show()
```

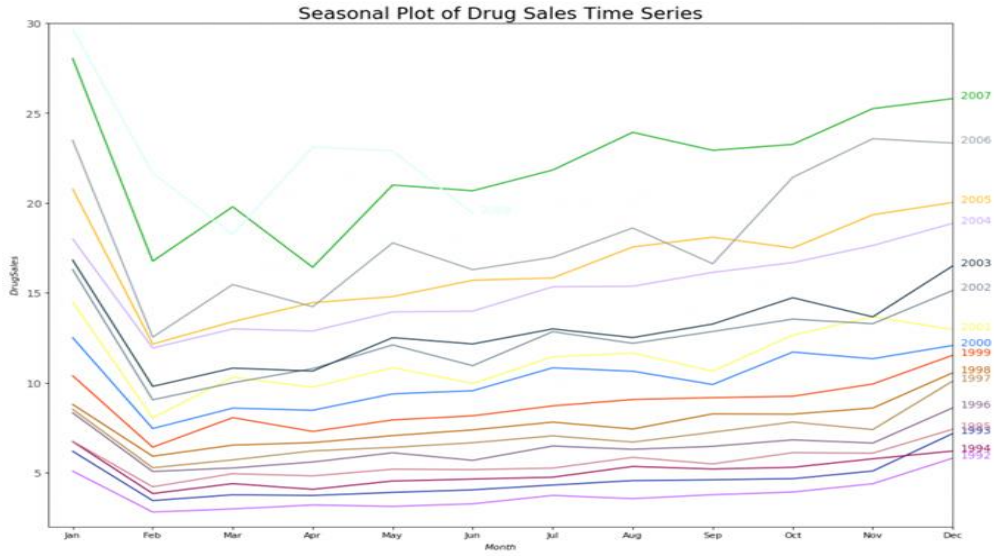
OUTPUT:



11 E)

```
df = pd.read_csv('https://raw.githubusercontent.com/selva86/datasets/master/a10.csv',
parse_dates=['date'], index_col='date')
df.reset_index(inplace=True)
df['year'] = [d.year for d in df.date]
df['month'] = [d.strftime('%b') for d in df.date]
years = df['year'].unique()
np.random.seed(100)
mycolors = np.random.choice(list(mpl.colors.XKCD_COLORS.keys()), len(years),
replace=False)
plt.figure(figsize=(16,12), dpi= 80)
for i, y in enumerate(years):
    if i > 0:
        plt.plot('month', 'value', data=df.loc[df.year==y, :], color=mycolors[i], label=y)
        plt.text(df.loc[df.year==y, :].shape[0]-.9, df.loc[df.year==y, 'value'][-1:].values[0], y,
fontsize=12, color=mycolors[i])
plt.gca().set(xlim=(-0.3, 11), ylim=(2, 30), ylabel='$Drug Sales$', xlabel='$Month$')
plt.yticks(fontsize=12, alpha=.7)
plt.title("Seasonal Plot of Drug Sales Time Series", fontsize=20)
plt.show()
```

OUTPUT:



11 F)

```
df = pd.read_csv('https://raw.githubusercontent.com/selva86/datasets/master/a10.csv',
parse_dates=['date'], index_col='date')
df.reset_index(inplace=True)
df['year'] = [d.year for d in df.date]
df['month'] = [d.strftime('%b') for d in df.date]
years = df['year'].unique()
fig, axes = plt.subplots(1, 2, figsize=(20,7), dpi= 80)
sns.boxplot(x='year', y='value', data=df, ax=axes[0])
sns.boxplot(x='month', y='value', data=df.loc[~df.year.isin([1991, 2008]), :])
axes[0].set_title('Year-wise Box Plot\n(The Trend)', fontsize=18);
axes[1].set_title('Month-wise Box Plot\n(The Seasonality)', fontsize=18)
plt.show()
```

OUTPUT: