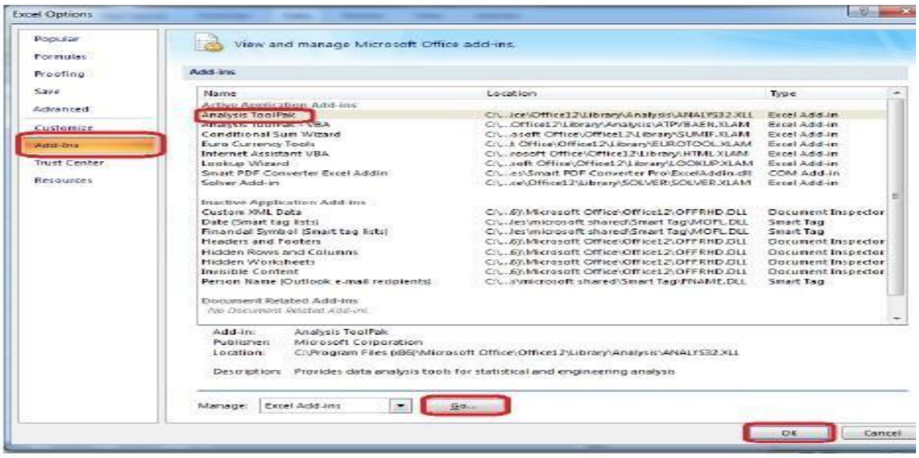
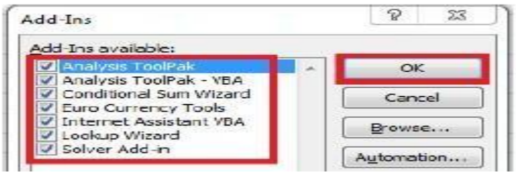
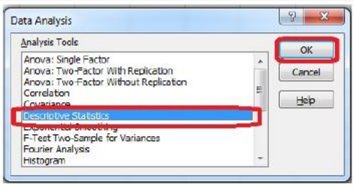
Practical 1

A.Write a program for obtaining descriptive statistics of data Using excel

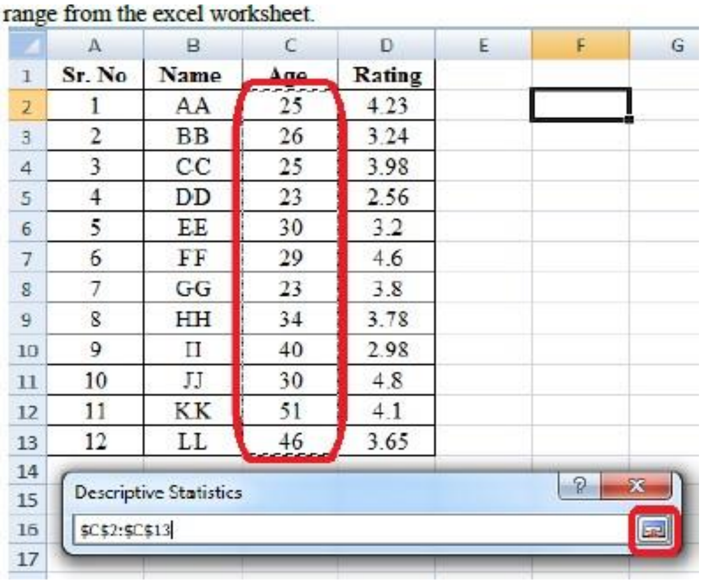
Go to File Menu → Options → Add-Ins→ Select Analysis ToolPak→ Press OK



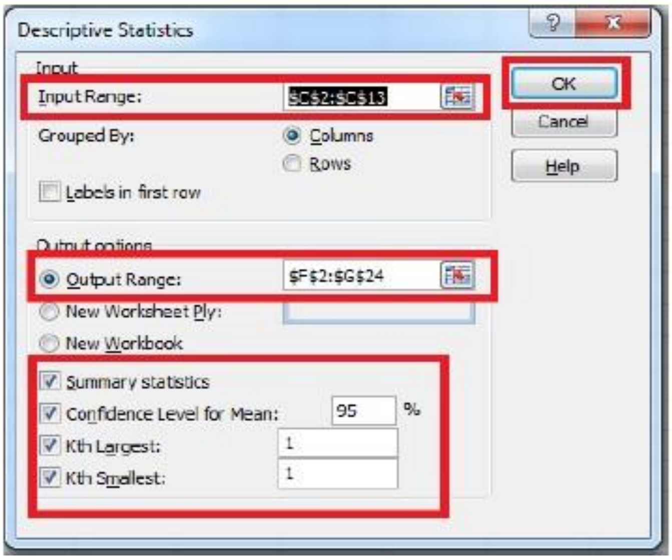




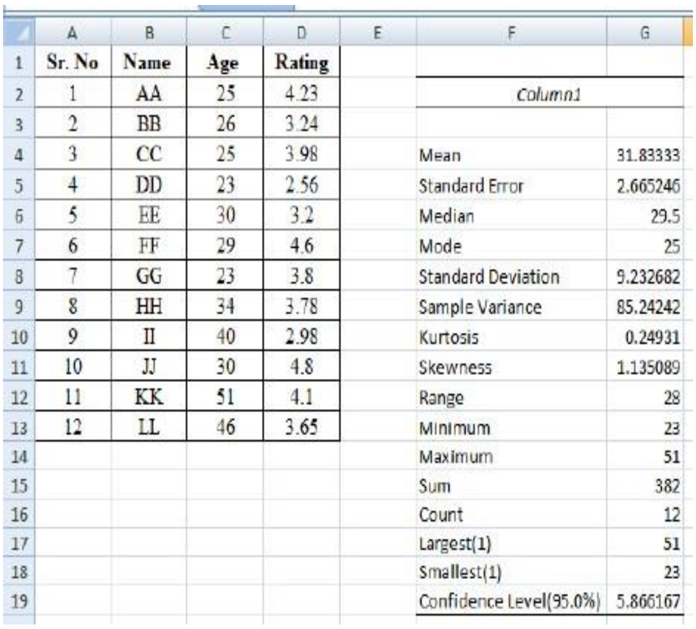
Select the data range from the excel worksheet.



	A	B	C	D	E	F	G
1	Sr. No	Name	Age	Rating			
2	1	AA	25	4.23			
3	2	BB	26	3.24			
4	3	CC	25	3.98			
5	4	DD	23	2.56			
6	5	EE	30	3.2			
7	6	FF	29	4.6			
8	7	GG	23	3.8			
9	8	HH	34	3.78			
10	9	II	40	2.98			
11	10	JJ	30	4.8			
12	11	KK	51	4.1			
13	12	LL	46	3.65			



Output:



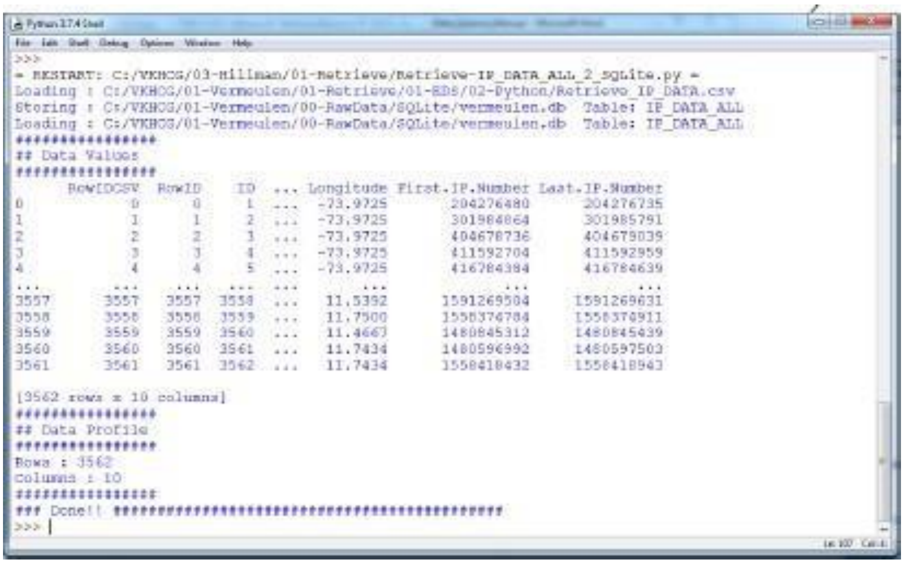
	A	B	C	D	E	F	G
1	Sr. No	Name	Age	Rating			
2	1	AA	25	4.23		Column1	
3	2	BB	26	3.24			
4	3	CC	25	3.98		Mean	31.83333
5	4	DD	23	2.56		Standard Error	2.665246
6	5	EE	30	3.2		Median	29.5
7	6	FF	29	4.6		Mode	25
8	7	GG	23	3.8		Standard Deviation	9.232682
9	8	HH	34	3.78		Sample Variance	85.24242
10	9	II	40	2.98		Kurtosis	0.24931
11	10	JJ	30	4.8		Skewness	1.135089
12	11	KK	51	4.1		Range	28
13	12	LL	46	3.65		Minimum	23
14						Maximum	51
15						Sum	382
16						Count	12
17						Largest(1)	51
18						Smallest(1)	23
19						Confidence Level(95.0%)	5.866167

B. Import data from different data sources (from Excel, csv, mysql, sql server, oracle to R/Python/Excel)

SQLite:

code

```
import sqlite3 as sq import
pandas as pd
Base='C:/VKHCG'
sDatabaseName=Base + '/01-Vermeulen/00-RawData/SQLite/vermeulen.db' conn =
sq.connect(sDatabaseName)
sFileName='C:/VKHCG/01-Vermeulen/01-Retrieve/01-EDS/02-Python/Retrieve_IP_DATA.csv'
print('Loading :',sFileName)
IP_DATA_ALL_FIX=pd.read_csv(sFileName,header=0,low_memory=False)
IP_DATA_ALL_FIX.index.names = ['RowIDCSV'] sTable='IP_DATA_ALL'
print('Storing :',sDatabaseName,' Table:',sTable)
IP_DATA_ALL_FIX.to_sql(sTable, conn, if_exists="replace")
print('Loading :',sDatabaseName,' Table:',sTable)
TestData=pd.read_sql_query("select * from IP_DATA_ALL;", conn)
print('#################')
print('## Data Values')       print('#################')
print(TestData)               print('#################')
print('## Data Profile')      print('#################')
print('Rows :',TestData.shape[0])
print('Columns :',TestData.shape[1])       print('#################')
print('### Done!! ############################################')
```



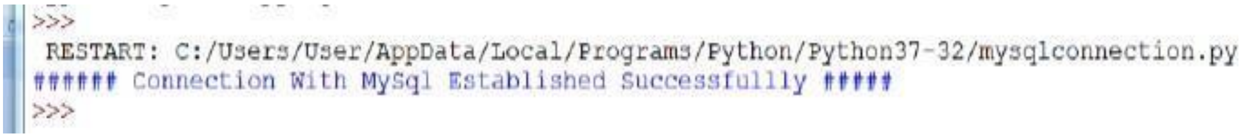
MySQL:

Open MySql. Create a database “DataScience”. Create a python file and add the following code:

Connection With MySQL

```
Import mysql.connector
conn = mysql.connector.connect(host='localhost', database='DataScience',
```

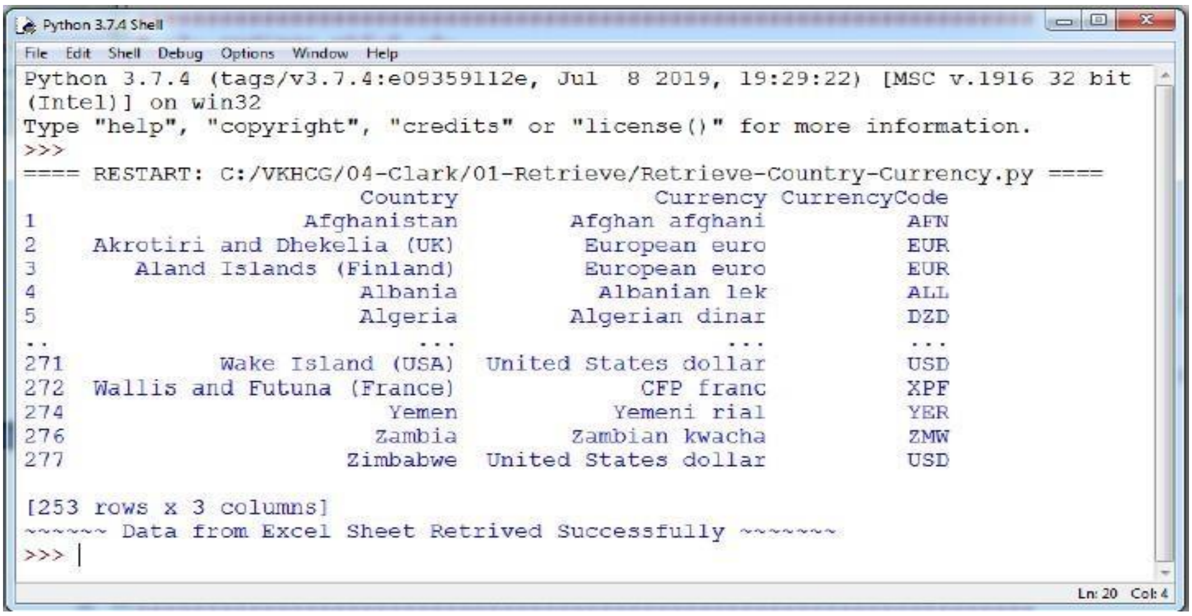
```
user='root', password='root')
conn.connect
if(conn.is_co nnected):
        print('###### Connection With MySql Established Successfullly ### ')
else:
        print('Not Connected -- Check Connection Properites')
```



```
>>>
 RESTART: C:/Users/User/AppData/Local/Programs/Python/Python37-32/mysqlconnection.py
###### Connection With MySql Established Successfullly #####
>>>
```

Microsoft Excel

```
import os
import pandas as pd

sFileDir=Base + '/01-Vermeulen/01-Retrieve/01-EDS/02Python' #ifnot os.path.exists(sFileDir):
#os.makedirs(sFileDir)
CurrencyRawData = pd.read_excel('C:/VKHCG/01-Vermeulen/00
RawData/Country_Currency.xlsx') sColumns = ['Country or territory', 'Currency', 'ISO-4217']
CurrencyData = CurrencyRawData[sColumns]
CurrencyData.rename(columns={'Country or territory': 'Country','ISO-4217': 'CurrencyCode'},
inplace=True)
CurrencyData.dropna(subset=['Currency'],inplace=True)
CurrencyData['Country'] = CurrencyData['Country'].map(lambda x: x.strip())
CurrencyData['Currency'] = CurrencyData['Currency'].map(lambda x: x.strip())
CurrencyData['CurrencyCode'] = CurrencyData['CurrencyCode'].map(lambda x: x.strip())
print(CurrencyData)
print('~~~~~~ Data from Excel Sheet Retrived Successfully ~~~~~~~ ')
sFileName=sFileDir + '/Retrieve-CountryCurrency.csv'CurrencyData.to_csv(sFileName,
index = False)
```

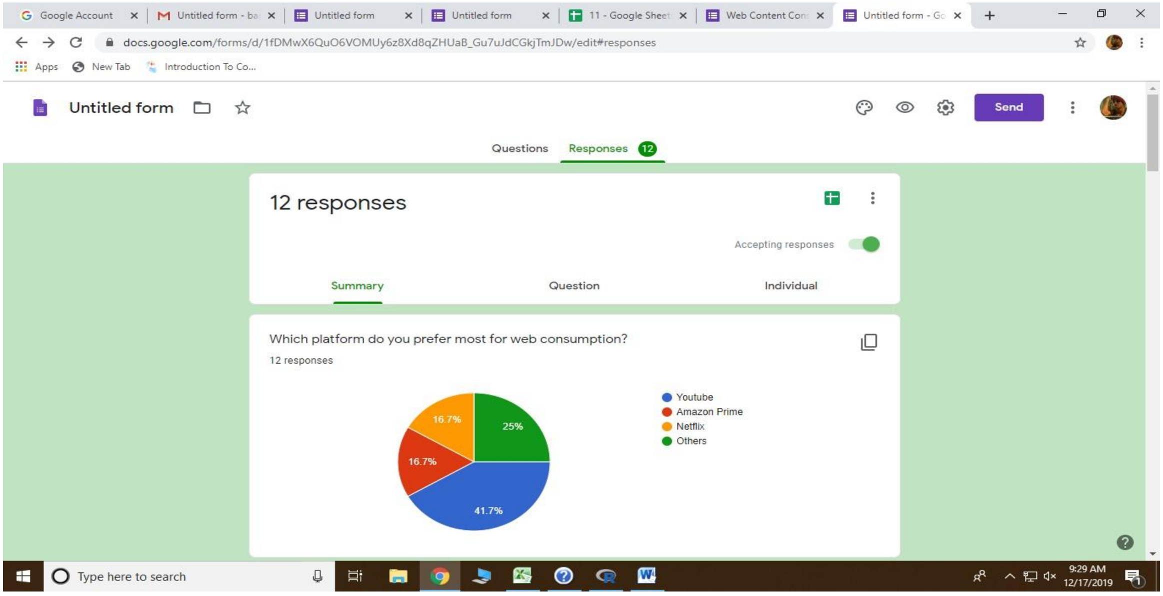


```
Python 3.7.4 Shell
File Edit Shell Debug Options Window Help
Python 3.7.4 (tags/v3.7.4:e09359112e, Jul  8 2019, 19:29:22) [MSC v.1916 32 bit
(Intel)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
==== RESTART: C:/VKHCG/04-Clark/01-Retrieve/Retrieve-Country-Currency.py ====
                         Country              Currency CurrencyCode
1                    Afghanistan        Afghan afghani          AFN
2    Akrotiri and Dhekelia (UK)          European euro          EUR
3       Aland Islands (Finland)          European euro          EUR
4                        Albania          Albanian lek          ALL
5                        Algeria        Algerian dinar          DZD
..                           ...                   ...          ...
271            Wake Island (USA)  United States dollar          USD
272  Wallis and Futuna (France)              CFP franc          XPF
274                        Yemen           Yemeni rial          YER
276                       Zambia        Zambian kwacha          ZMW
277                     Zimbabwe  United States dollar          USD

[253 rows x 3 columns]
~~~~~~ Data from Excel Sheet Retrived Successfully ~~~~~~~
>>> |
Ln: 20  Col: 4
```

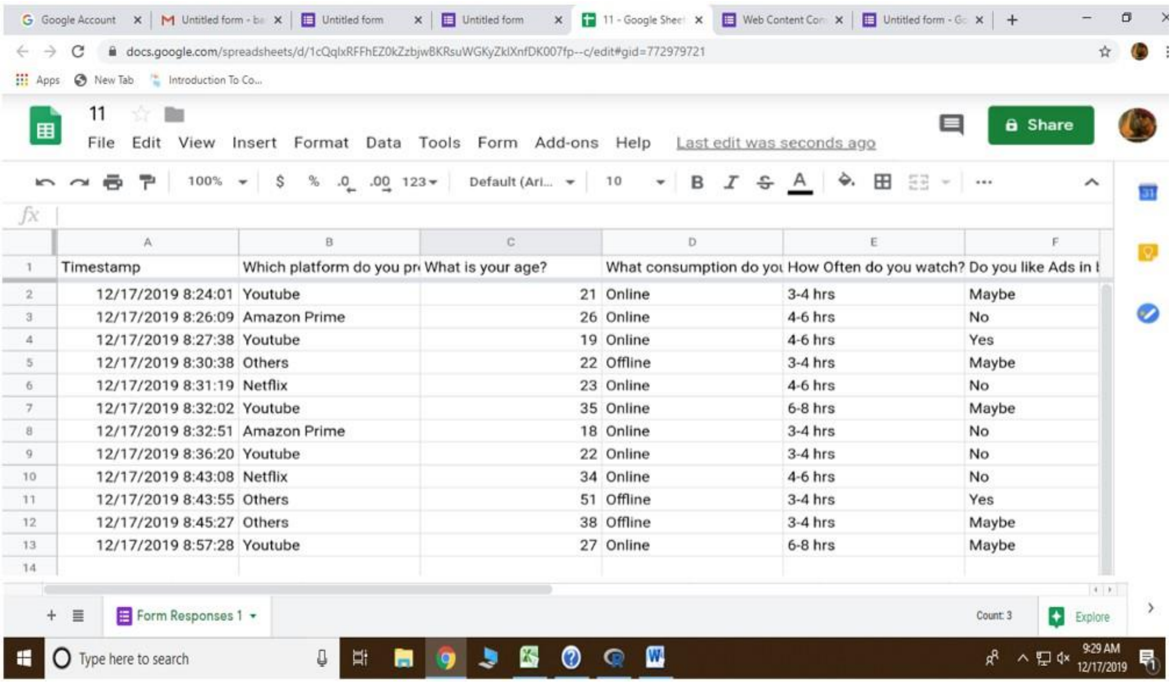
Practical 2

A. Design a survey form for a given case study, collect the primary data and analyse it

Step 1: Create a Google form and take the survey for minimum 10 responses. By clicking on + sign create spreadsheet

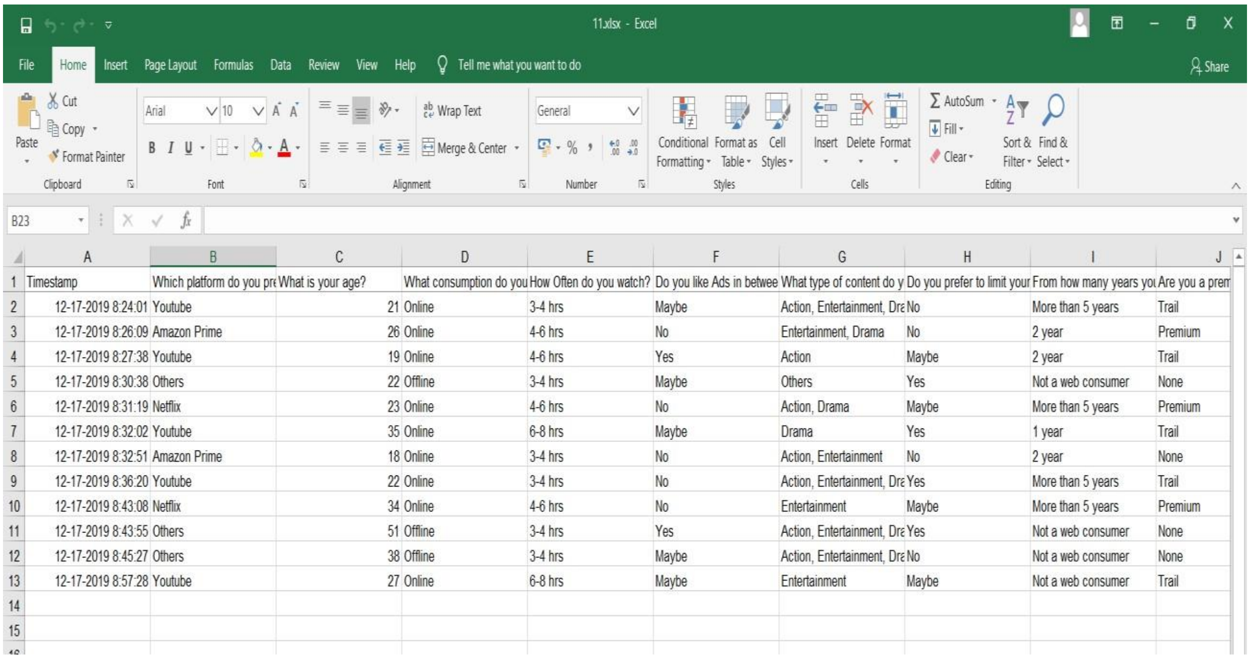


Step 2: Go to file and download the Excel file



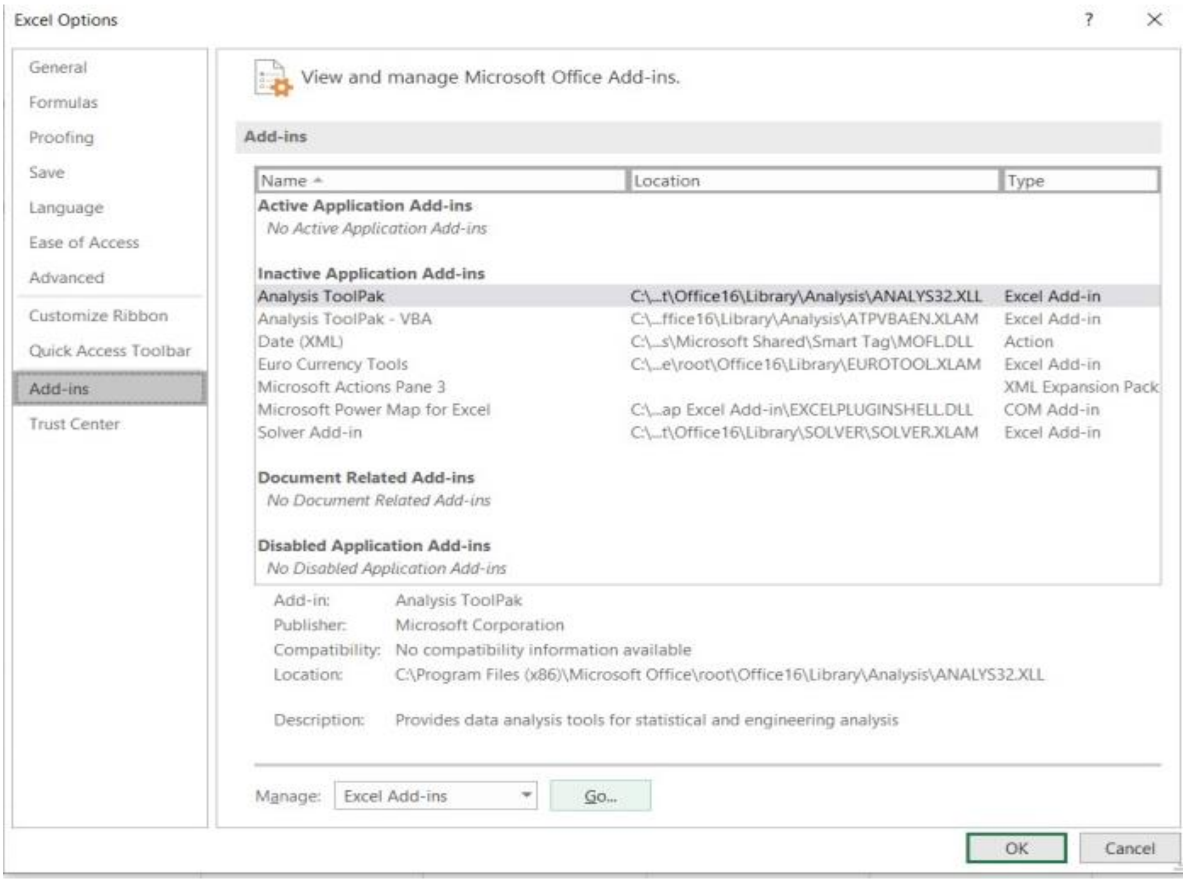
Timestamp	Which platform do you pr	What is your age?	What consumption do you	How Often do you watch?	Do you like Ads in t
12/17/2019 8:24:01	Youtube	21	Online	3-4 hrs	Maybe
12/17/2019 8:26:09	Amazon Prime	26	Online	4-6 hrs	No
12/17/2019 8:27:38	Youtube	19	Online	4-6 hrs	Yes
12/17/2019 8:30:38	Others	22	Offline	3-4 hrs	Maybe
12/17/2019 8:31:19	Netflix	23	Online	4-6 hrs	No
12/17/2019 8:32:02	Youtube	35	Online	6-8 hrs	Maybe
12/17/2019 8:32:51	Amazon Prime	18	Online	3-4 hrs	No
12/17/2019 8:36:20	Youtube	22	Online	3-4 hrs	No
12/17/2019 8:43:08	Netflix	34	Online	4-6 hrs	No
12/17/2019 8:43:55	Others	51	Offline	3-4 hrs	Yes
12/17/2019 8:45:27	Others	38	Offline	3-4 hrs	Maybe
12/17/2019 8:57:28	Youtube	27	Online	6-8 hrs	Maybe

Step 3: Now open the downloaded excel file

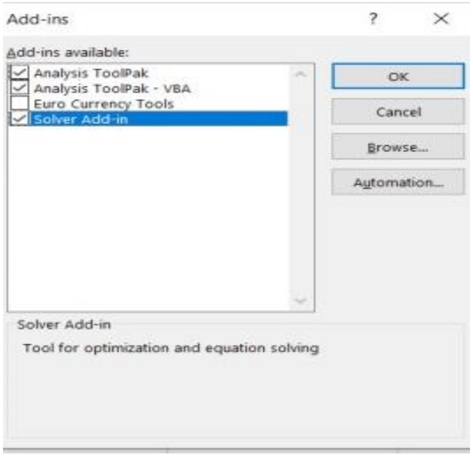


	A	B	C	D	E	F	G	H	I	J
1	Timestamp	Which platform do you pre	What is your age?	What consumption do you	How Often do you watch?	Do you like Ads in betwee	What type of content do y	Do you prefer to limit your	From how many years you	Are you a prem
2	12-17-2019 8:24:01	Youtube	21	Online	3-4 hrs	Maybe	Action, Entertainment, Dra	No	More than 5 years	Trail
3	12-17-2019 8:26:09	Amazon Prime	26	Online	4-6 hrs	No	Entertainment, Drama	No	2 year	Premium
4	12-17-2019 8:27:38	Youtube	19	Online	4-6 hrs	Yes	Action	Maybe	2 year	Trail
5	12-17-2019 8:30:38	Others	22	Offline	3-4 hrs	Maybe	Others	Yes	Not a web consumer	None
6	12-17-2019 8:31:19	Netflix	23	Online	4-6 hrs	No	Action, Drama	Maybe	More than 5 years	Premium
7	12-17-2019 8:32:02	Youtube	35	Online	6-8 hrs	Maybe	Drama	Yes	1 year	Trail
8	12-17-2019 8:32:51	Amazon Prime	18	Online	3-4 hrs	No	Action, Entertainment	No	2 year	None
9	12-17-2019 8:36:20	Youtube	22	Online	3-4 hrs	No	Action, Entertainment, Dra	Yes	More than 5 years	Trail
10	12-17-2019 8:43:08	Netflix	34	Online	4-6 hrs	No	Entertainment	Maybe	More than 5 years	Premium
11	12-17-2019 8:43:55	Others	51	Offline	3-4 hrs	Yes	Action, Entertainment, Dra	Yes	Not a web consumer	None
12	12-17-2019 8:45:27	Others	38	Offline	3-4 hrs	Maybe	Action, Entertainment, Dra	No	Not a web consumer	None
13	12-17-2019 8:57:28	Youtube	27	Online	6-8 hrs	Maybe	Entertainment	Maybe	Not a web consumer	Trail

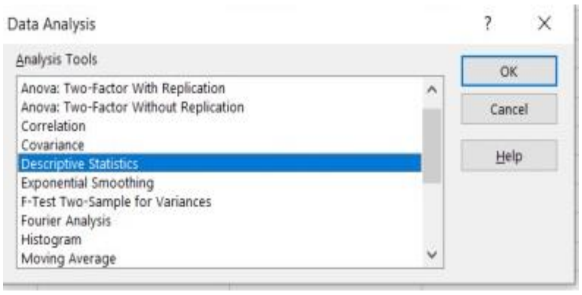
Step 4: Go to file click option >> Click Add ins >> Select Analysis ToolPak then click Go



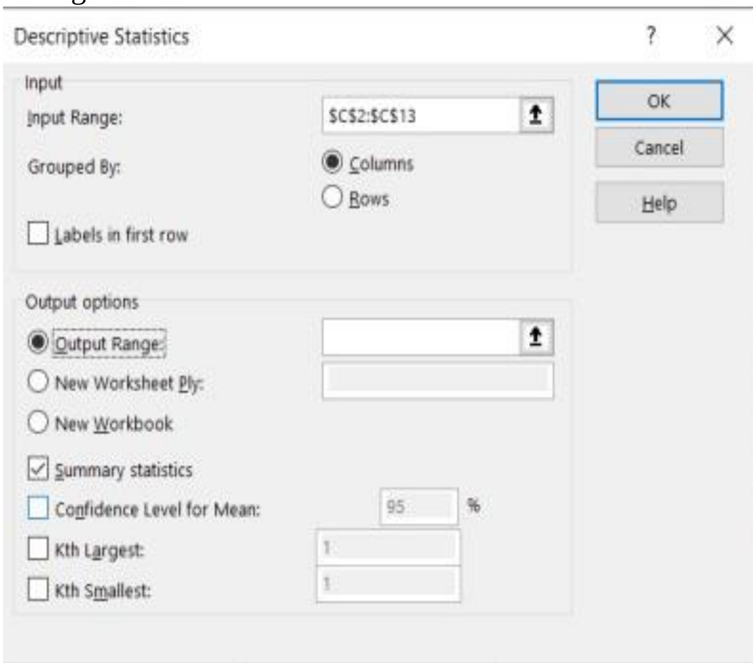
Step 5: Check mark all except Euro Currency tools then click ok



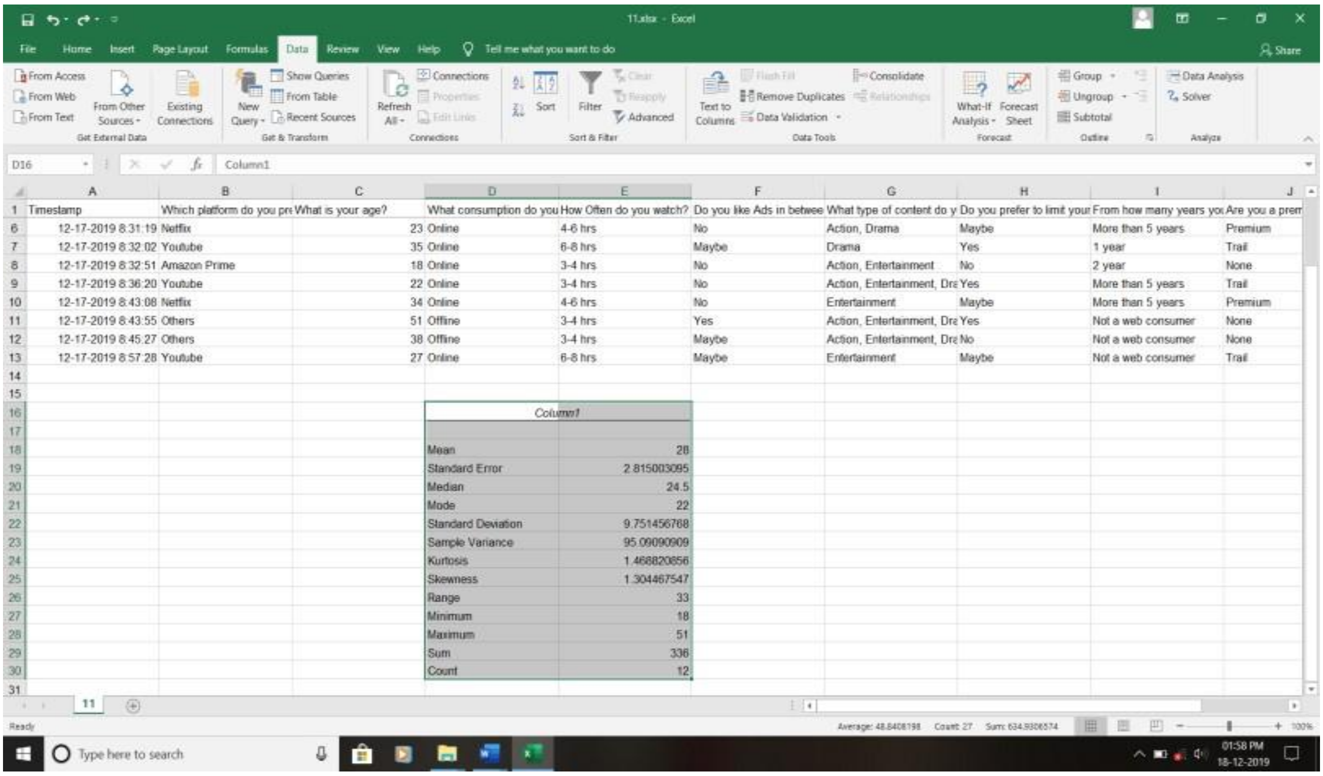
Step 6: Go to Data >> Click Data Analysis >> Select Descriptive Statistics then ok



Step 7: Click on input range icon and select the numbers in one column



Step 8: Then check mark on summary statistics and then click output range icon and select one empty cell and then click ok

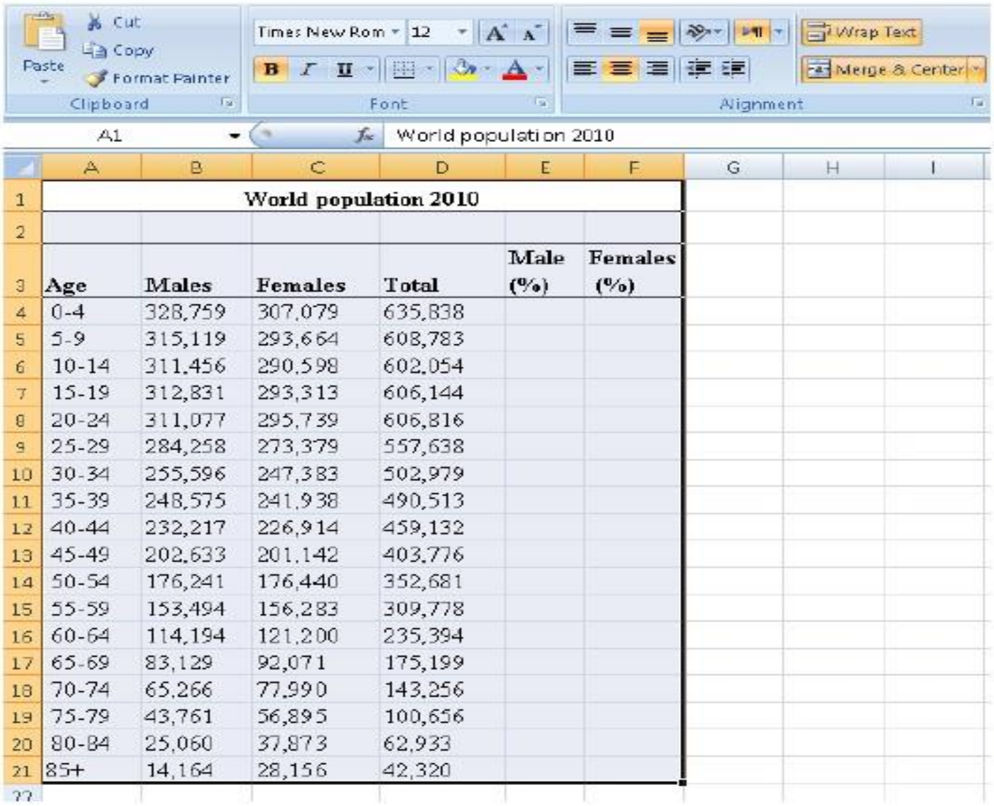


	A	B	C	D	E	F	G	H	I	J
1	Timestamp	Which platform do you pr	What is your age?	What consumption do you	How Often do you watch?	Do you like Ads in betwee	What type of content do y	Do you prefer to limit your	From how many years yo	Are you a prem
6	12-17-2019 8:31:19	Netflix	23	Online	4-6 hrs	No	Action, Drama	Maybe	More than 5 years	Premium
7	12-17-2019 8:32:02	Youtube	35	Online	6-8 hrs	Maybe	Drama	Yes	1 year	Trail
8	12-17-2019 8:32:51	Amazon Prime	18	Online	3-4 hrs	No	Action, Entertainment	No	2 year	None
9	12-17-2019 8:36:20	Youtube	22	Online	3-4 hrs	No	Action, Entertainment, Dra	Yes	More than 5 years	Trail
10	12-17-2019 8:43:08	Netflix	34	Online	4-6 hrs	No	Entertainment	Maybe	More than 5 years	Premium
11	12-17-2019 8:43:55	Others	51	Offline	3-4 hrs	Yes	Action, Entertainment, Dra	Yes	Not a web consumer	None
12	12-17-2019 8:45:27	Others	38	Offline	3-4 hrs	Maybe	Action, Entertainment, Dra	No	Not a web consumer	None
13	12-17-2019 8:57:28	Youtube	27	Online	6-8 hrs	Maybe	Entertainment	Maybe	Not a web consumer	Trail

Column1	
Mean	28
Standard Error	2.815003095
Median	24.5
Mode	22
Standard Deviation	9.751456768
Sample Variance	95.09090909
Kurtosis	1.468820856
Skewness	1.304467547
Range	33
Minimum	18
Maximum	51
Sum	336
Count	12

B . Perform analysis of given secondary data.

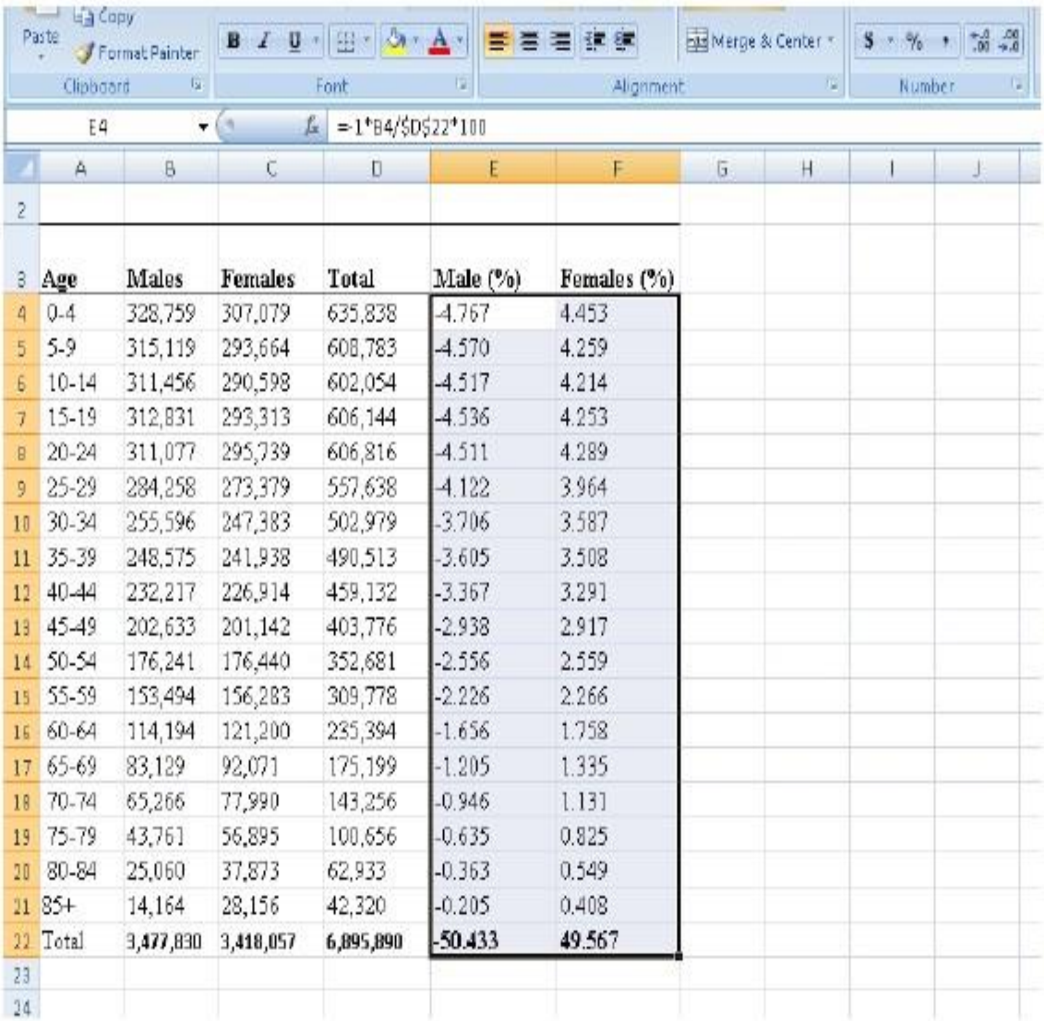
Analyze the given Population Census Data for Planning and Decision Making by using the size and composition of populations



World population 2010					
Age	Males	Females	Total	Male (%)	Females (%)
0-4	328,759	307,079	635,838		
5-9	315,119	293,664	608,783		
10-14	311,456	290,598	602,054		
15-19	312,831	293,313	606,144		
20-24	311,077	295,739	606,816		
25-29	284,258	273,379	557,638		
30-34	255,596	247,383	502,979		
35-39	248,575	241,938	490,513		
40-44	232,217	226,914	459,132		
45-49	202,633	201,142	403,776		
50-54	176,241	176,440	352,681		
55-59	153,494	156,283	309,778		
60-64	114,194	121,200	235,394		
65-69	83,129	92,071	175,199		
70-74	65,266	77,990	143,256		
75-79	43,761	56,895	100,656		
80-84	25,060	37,873	62,933		
85+	14,164	28,156	42,320		

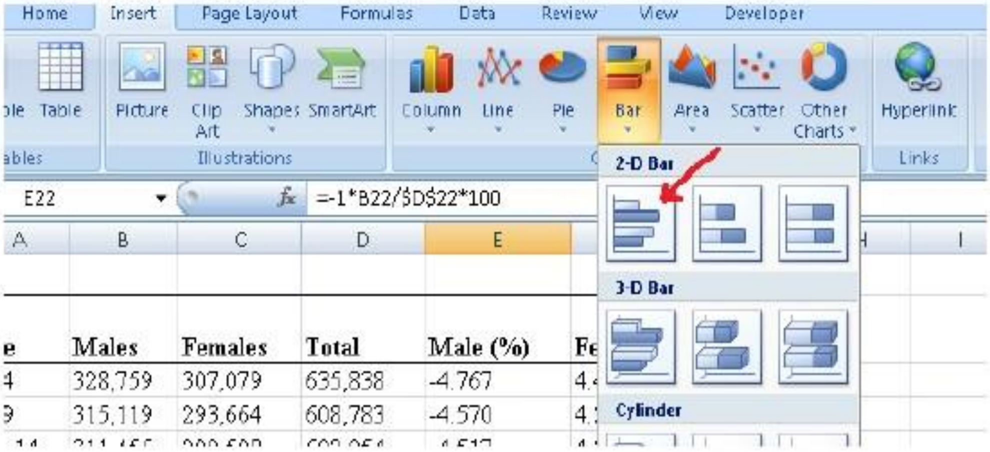
1. Put the cursor in cell **B22** and click on the **AutoSum** and then click **Enter**. This will calculate the total population. Then copy the formula in cell **D22** across the row **22.**
2. To calculate the percent of males in cell **E4**, enter the formula **=-1*100*B4/$D$22** .And copy the formula in cell **E4** down to cell **E21.**

3. To calculate the percent of females in cell **F4**, enter the formula =**100*C4/$D$22**. Copy the formula in cell **F4** down to cell **F21.**



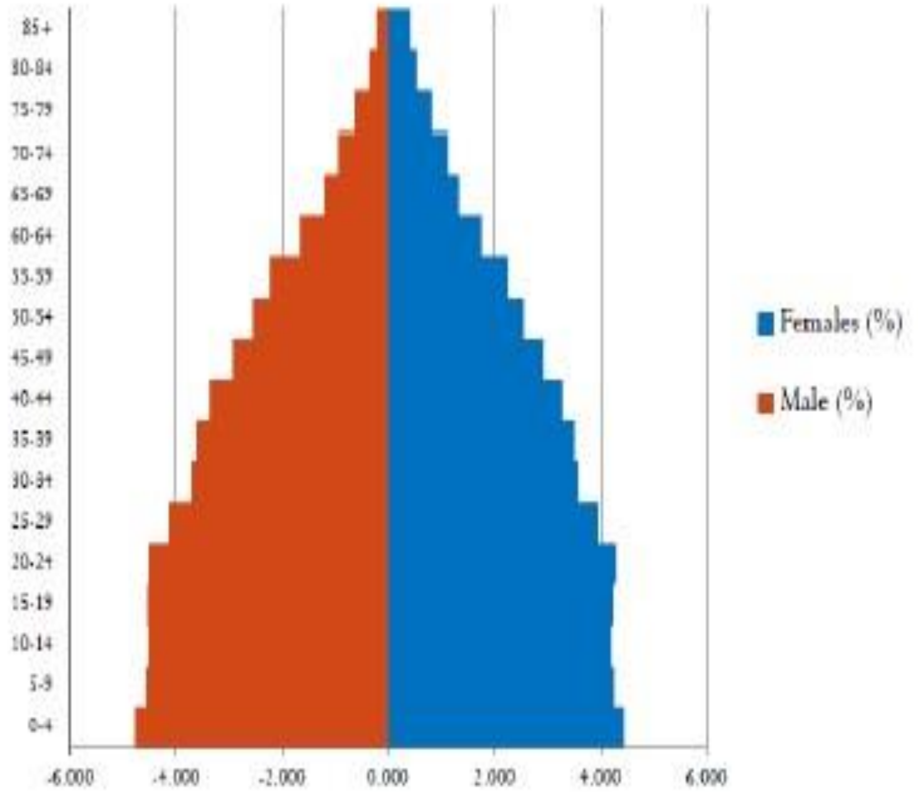
Age	Males	Females	Total	Male (%)	Females (%)
0-4	328,759	307,079	635,838	-4.767	4.453
5-9	315,119	293,664	608,783	-4.570	4.259
10-14	311,456	290,598	602,054	-4.517	4.214
15-19	312,831	293,313	606,144	-4.536	4.253
20-24	311,077	295,739	606,816	-4.511	4.289
25-29	284,258	273,379	557,638	-4.122	3.964
30-34	255,596	247,383	502,979	-3.706	3.587
35-39	248,575	241,938	490,513	-3.605	3.508
40-44	232,217	226,914	459,132	-3.367	3.291
45-49	202,633	201,142	403,776	-2.938	2.917
50-54	176,241	176,440	352,681	-2.556	2.559
55-59	153,494	156,283	309,778	-2.226	2.266
60-64	114,194	121,200	235,394	-1.656	1.758
65-69	83,129	92,071	175,199	-1.205	1.335
70-74	65,266	77,990	143,256	-0.946	1.131
75-79	43,761	56,895	100,656	-0.635	0.825
80-84	25,060	37,873	62,933	-0.363	0.549
85+	14,164	28,156	42,320	-0.205	0.408
Total	3,477,830	3,418,057	6,895,890	-50.433	49.567

To build the population pyramid, we need to choose a horizontal bar chart with two series of data (% male and % female) and the age labels in column A as the **Category X-axis** labels. Highlight the range **A3:A21**, hold down the CTRL key and highlight the range **E3:F21**
Under **inset** tab, under horizontal bar charts select **clustered bar chart**



Put the tip of your mouse arrow on the **Y-axis** (vertical axis) so it says "Category Axis", right click and chose **Format Axis**

Choose **Axis options** tab and set the major and minor tick mark type to **None**, Axis labels to **Low**, and click **OK**.
Click on any of the bars in your pyramid, click right and select "format data series".
Set the **Overlap** to **100** and **Gap Width** to **0**. Click **OK**.



Practical 3

A. Perform testing of hypothesis using one sample t-test. One sample t-test :

Program Code:

```
fromscipy.stats import ttest_1samp
import numpy as np
ages = np.genfromtxt('ages.csv')
print(ages)
ages_mean = np.mean(ages)
print(ages_mean)
tset, pval = ttest_1samp(ages, 30)
print('p-values - ',pval)

if pval< 0.05: # alpha value is 0.05
    print(" we are rejecting null hypothesis")
else:
    print("we are accepting null hypothesis")
```

output

```
In [4]: runfile('K:/Research In Computing/Practical Material/Programs/
Practical_05/Prac_3A.py', wdir='K:/Research In Computing/Practical Material/
Programs/Practical_05')
[20. 30. 25. 13. 16. 17. 34. 35. 38. 42. 43. 45. 48. 49. 50. 51. 54. 55.
 56. 59. 61. 62. 18. 22. 29. 30. 31. 39. 52. 53. 67. 36. 47. 54. 40. 40.
 35. 22. 59. 58. 30. 43. 22. 45. 21. 59. 51. 47. 25. 58. 50. 23. 24. 45.
 37. 59. 28. 28. 48. 42. 54. 36. 36. 24. 26. 24. 50. 48. 34. 44. 56. 55.
 35. 33. 39. 53. 34. 28. 56. 24. 21. 29. 28. 58. 35. 57. 26. 25. 59. 56.
 22. 57. 48. 33. 23. 26. 57. 32. 53. 31. 35. 44. 54. 25. 31. 58. 26. 32.
 26. 50. 41. 49. 26. 33. 34. 24. 43. 42. 51. 36. 38. 38. 40. 38. 56. 39.
 23. 33. 53. 30. 38.]
39.47328244274809
p-values -  5.362905195437013e-14
 we are rejecting null hypothesis
```

B. Write a program for t-test comparing two means for independent samples.

Two Sample t Test

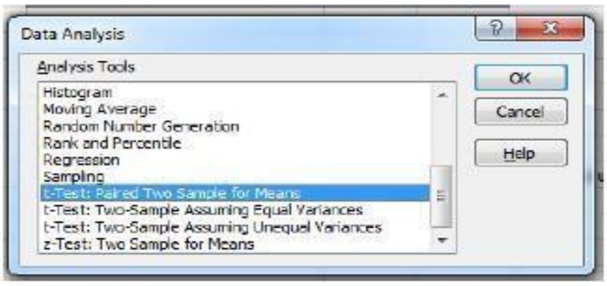
Example: A college Principal informed classroom teachers that some of their students showed unusual potential for intellectual gains. One months later the students identified to teachers a shaving protentional for unusual intellectual gains showed significantly greater gains performance on a test said to measure IQ than did students who were not so identified. Below are the data for the students:

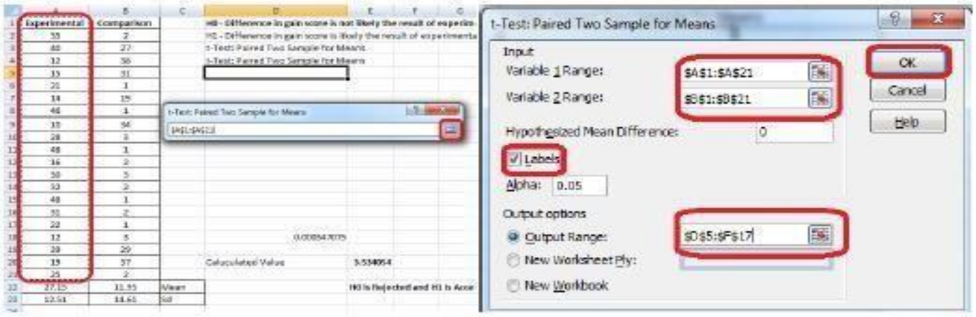
Experimental	Comparison	
35	2	
40	27	
12	38	
15	31	
21	1	
14	19	
46	1	
10	34	
28	3	
48	1	
16	2	
30	3	
32	2	
48	1	
31	2	
22	1	
12	3	
39	29	
19	37	
25	2	
27.15	11.95	Mean
12.51	14.61	Sd

Experimental Data
To calculate Standard Mean go to cell A22 and type =SUM(A2:A21)/20
To calculate Standard Deviation go to cell A23 and type =STDEV(A2:A21)

Comparison Data
To calculate Standard Mean go to cell B22 and type =SUM(B2:B21)/20
To calculate Standard Deviation go to cell B23 and type =STDEV(B2:B21)

To find T-Test Statistics go to data → Data Analysis



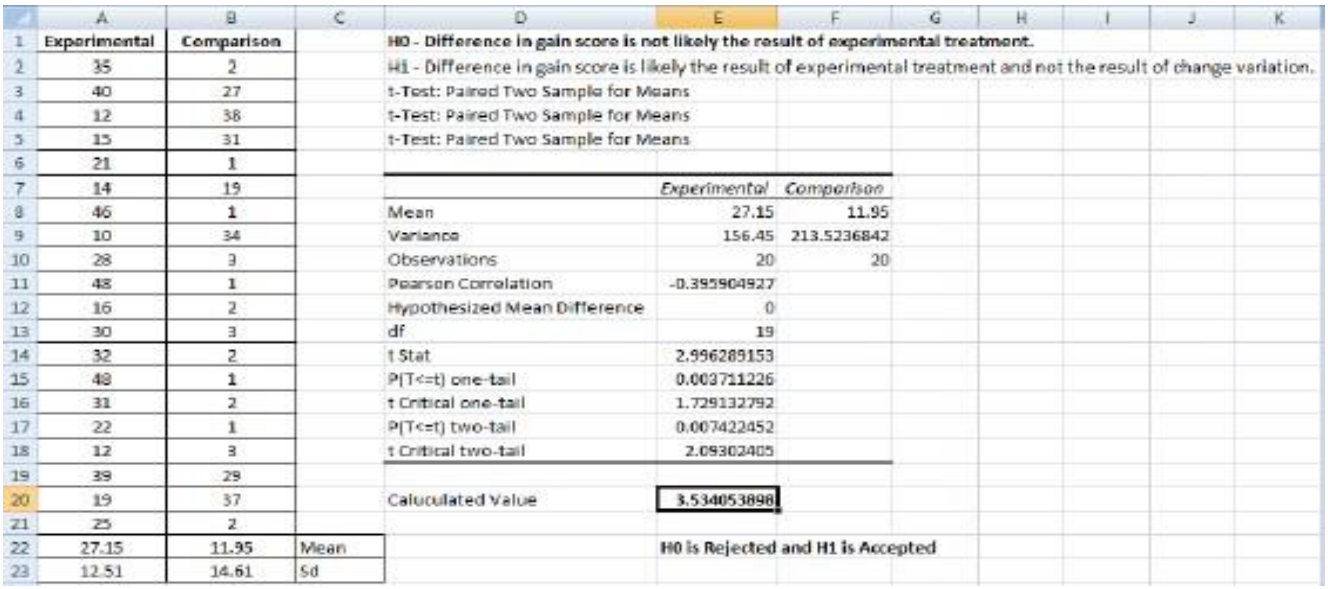


To caluculate the T-Test square value go to cell E20 and type
=(A22-B22)/SQRT((A23*A23)/COUNT(A2:A21)+(B23*B23)/COUNT(A2:A21))

Now go to cell E20 and type
=IF(E20<E12,"H0 is Accepted", "H0 is Rejected and H1 is Accepted")

Our calculated value is larger than the tabled value at alpha = .01, so we reject the null hypothesisand accept the alternative hypothesis, namely, that the difference in gain scores is likely the resultof the experimental treatment and not the result of chance variation.

OUTPUT:



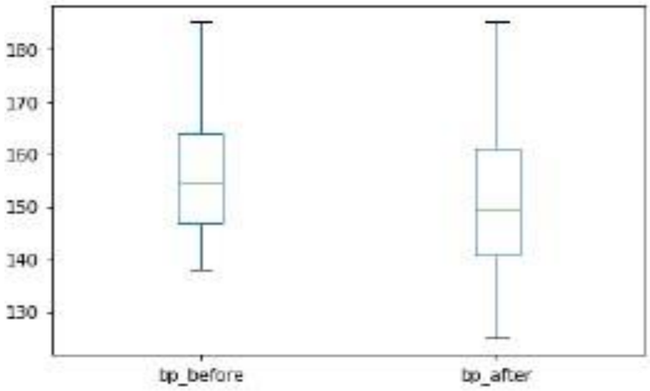
	A	B	C	D	E	F
1	Experimental	Comparison		H0 - Difference in gain score is not likely the result of experimental treatment.		
2	35	2		H1 - Difference in gain score is likely the result of experimental treatment and not the result of change variation.		
3	40	27		t-Test: Paired Two Sample for Means		
4	12	38		t-Test: Paired Two Sample for Means		
5	15	31		t-Test: Paired Two Sample for Means		
6	21	1				
7	14	19			Experimental	Comparison
8	46	1		Mean	27.15	11.95
9	10	34		Variance	156.45	213.5236842
10	28	3		Observations	20	20
11	48	1		Pearson Correlation	-0.395904927	
12	16	2		Hypothesized Mean Difference	0	
13	30	3		df	19	
14	32	2		t Stat	2.996289153	
15	48	1		P(T<=t) one-tail	0.003711226	
16	31	2		t Critical one-tail	1.729132792	
17	22	1		P(T<=t) two-tail	0.007422452	
18	12	3		t Critical two-tail	2.09302405	
19	39	29				
20	19	37		Caluculated Value	3.534053898	
21	25	2				
22	27.15	11.95	Mean		H0 is Rejected and H1 is Accepted	
23	12.51	14.61	Sd			

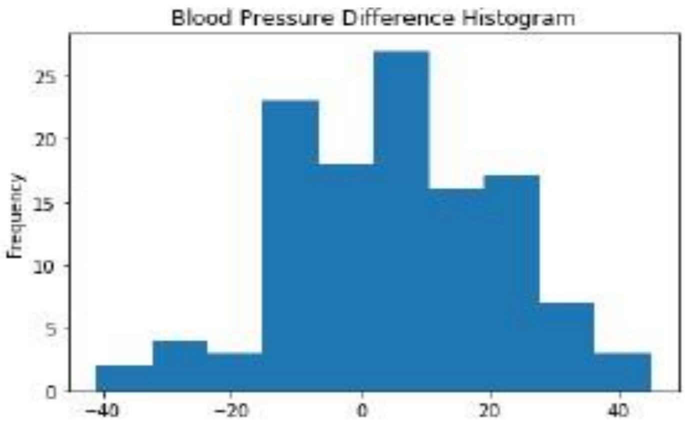
C. Perform testing of hypothesis using paired t-test.

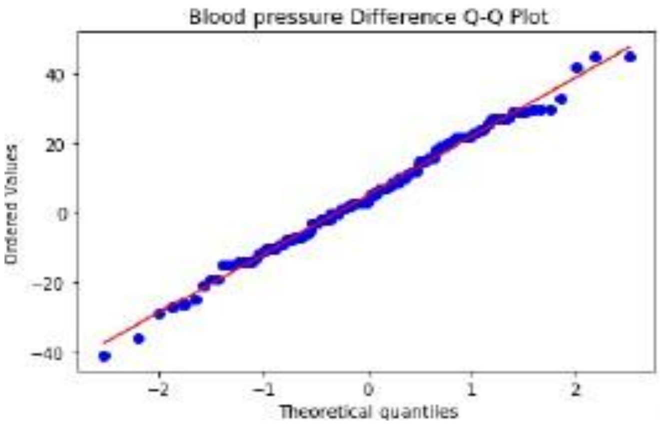
code

```
from scipy import stats
import matplotlib.pyplot as plt
import pandas as pd
df = pd.read_csv("blood_pressure.csv")
print(df[['bp_before','bp_after']].describe())

#First let's check for any significant outliers in each of the variables.
df[['bp_before', 'bp_after']].plot(kind='box')
plt.savefig('boxplot_outliers.png')  # This saves the plot as a png file

# make a histogram to differences between the two scores.
df['bp_difference'] = df['bp_before'] - df['bp_after']
df['bp_difference'].plot(kind='hist', title= 'Blood Pressure Difference Histogram')

#Again, this saves the plot as a png file
plt.savefig('blood pressure difference histogram.png')
stats.probplot(df['bp_difference'], plot= plt)
plt.title('Blood pressure Difference Q-Q Plot')
plt.savefig('blood pressure difference qq plot.png')
stats.shapiro(df['bp_difference'])
stats.ttest_rel(df['bp_before'], df['bp_after'])
```

Output:








```
In [21]: runfile('K:/Research In Computing/Practical
Material/Programs/Practical_03/Practical_03C.py', wdir='K:/
Research In Computing/Practical Material/Programs/
Practical_03')
       bp_before    bp_after
count  120.000000  120.000000
mean   156.450000  151.358333
std     11.389845   14.177622
min    138.000000  125.000000
25%    147.000000  140.750000
50%    154.500000  149.500000
75%    164.000000  161.000000
max    185.000000  185.000000
0.0011297914644840823
Ttest_relResult(statistic=3.3371870510833657,
pvalue=0.0011297914644840823)
reject null hypothesis
```

Practical 4

A. Perform testing of hypothesis using chi-squared goodness- of-fit test.

Problem

Ansystem administrator needs to upgrade the computers for his division. He wants to know what sort of computer system his workers prefer. He gives three choices: Windows, Mac, or Linux. Test the hypothesis or theory that an equal percentage of the population prefers each type of computer system .

System	O	Ei	$\sum \frac{(O_i - E_i)^2}{Ei}$
Windows	20	33.33%	
Mac	60	33.33%	
Linux	20	33.33%	

H0 : The population distribution of the variable is the same as the proposed distribution HA : The distributions are different

To calculate the Chi –Squred value for Windows go to cell D2 and type =((B2- C2)*(B2C2))/C2

To calculate the Chi –Squred value for Mac go to cell D3 and type =((B3-C3)*(B3- C3))/C3

To calculate the Chi –Squred value for Mac go to cell D3 and type =((B4-C4)*(B4- C4))/C4

Go to Cell D5 for and type=SUM(D2:D4)

To get the table value for Chi-Square for α = 0.05 and dof = 2, go to cell D7 and type =CHIINV(0.05,2)

At cell D8 type =IF(D5>D7, "H0 Accepted","H0 Rejected")

output

	A	B	C	D	E	F
1	System	O	Ei	$\sum \frac{(O_i - E_i)^2}{Ei}$		
2	Windows	20	33.33	5.333333		H_0 : The population distribution of the variable is the same as the proposed distribution
3	Mac	60	33.33	21.33333		H1 - : The distributions are different
4	Linux	20	33.33	5.333333		
5	Total	100	100	32		
6						
7			Table Value	5.991465		
8			H0 Accepted			

B. Perform testing of hypothesis using chi-squared test of independence.

In a study to understatnd the permormacne of M. Sc. IT Part -1 class, a college selects a random sample of 100 students. Each student was asked his grade obtained in B. Sc. IT. The sample is as given below

Sr. No	Roll No	Student's Name	Gen	Grade
1	1	Gaborone	m	O
2	2	Francistown	m	O
3	5	Niamey	m	O
4	13	Maxixe	m	O
5	16	Tema	m	O
6	17	Kumasi	m	O
7	34	Blida	m	O
8	35	Oran	m	O
9	38	Saefda	m	O
10	42	Constantine	m	O
11	43	Annaba	m	O
12	45	Bejaefa	m	O
13	48	Medea	m	O
14	49	Djelfa	m	O
15	50	Tipaza	m	O
16	51	Bechar	m	O
17	54	Mostaganem	m	O
18	55	Tiaret	m	O
19	56	Bouira	m	O
20	59	Tebessa	m	O
21	61	El Harrach	m	O
22	62	Mila	m	O
23	65	Fouka	m	O
24	66	El Eulma	m	O
25	68	SidiBel Abbes	m	O
26	69	Jijel	m	O
27	70	Guelma	m	O
28	85	Khemis El Khechna	m	O
29	87	Bordj El Kiffan	m	O
30	88	Lakhdaria	m	O
31	6	Maputo	m	D
32	12	Lichinga	m	D
33	15	Ressano Garcia	m	D
34	19	Accra	m	D
35	27	Wa	m	D
36	28	Navrongo	m	D
37	37	Mascara	m	D
38	44	Batna	m	D
39	57	El Biar	m	D
40	60	Boufarik	m	D
41	63	OuedRhiou	m	D
42	64	Souk Ahras	m	D
43	71	Dar El Befda	m	D
44	86	Birtouta	m	D
45	18	Takoradi	m	C
46	22	Cape Coast	m	C
47	29	Kwabeng	m	C
48	30	Algiers	m	C
49	31	Laghouat	m	C
50	39	Relizane	m	C
51	52	Setif	m	C
52	53	Biskra	m	C
53	67	Kolea	m	C
54	100	AefnFakroun	m	C
55	26	Nima	m	B
56	32	TiziOuzou	m	B
57	33	Chlef	m	B
62	3	Maun	f	O
63	7	Tete	f	O
64	9	Chimoio	f	O
65	11	Pemba	f	O
66	14	Chibuto	f	O
67	25	Mampong	f	O
68	36	Tlemcen	f	O
69	40	Adrar	f	O
70	41	Tindouf	f	O
71	46	Skikda	f	O
72	47	Ouargla	f	O
73	10	Matola	f	D
74	20	Legon	f	D
75	21	Sunyani	f	D
76	72	Teenas	f	D
77	73	Kouba	f	D
78	75	HussenDey	f	D
79	77	Khenchela	f	D
80	82	HassiBahbah	f	D
81	84	Baraki	f	D
82	91	Boudouaou	f	D
83	95	Tadjenanet	f	D
84	4	Molepolole	f	C
85	8	Quelimane	f	C
86	23	Bolgatanga	f	C
87	58	Mohammadia	f	C
88	83	Merouana	f	C
89	24	Ashaiman	f	B
90	76	N'gaous	f	B
91	90	Bab El Oued	f	B
92	92	BordjMenael	f	B
93	93	Ksar El Boukhari	f	B
94	74	Reghaa	f	A
95	78	Cheria	f	A
96	79	Mouzaa	f	A
97	80	Meskiana	f	A
98	81	Miliana	f	A
99	94	Sig	f	A
100	99	Kadiria	f	A

54	100	AefnFakroun	m	C
55	26	Nima	m	B
56	32	TiziOuzou	m	B
57	33	Chlef	m	B

Null Hypothesis - H0 : The performance of girls students is same as boys students.

Alternate Hypothesis - H1 : The performance of boys and girls students are different. Open Excel Workbook

	O	A	B	C	D	Total	$\sum \frac{(O_i - E_i)^2}{Ei}$
Girls	11	7	5	5	11	**39**	6.075
Boys	30	4	3	10	14	**61**	6.075
Total	41	11	8	15	25	**100**	**12.150**
Ei	**20.5**	**5.5**	**4**	**7.5**	**12.5**	**50**	

Prepare a contingency table as shown above. To calculate
Girls Students with ‘O’ Grade
Go to Cell N6 and type =COUNTIF($J$2:$K$40,"O")

To calculate Girls Students with ‘A’ Grade
Go to Cell O6 and type =COUNTIF($J$2:$K$40,"A")

To calculate Girls Students with ‘B’ Grade
Go to Cell P6 and type =COUNTIF($J$2:$K$40,"B")

To calculate Girls Students with ‘C’ Grade
Go to Cell Q6 and type =COUNTIF($J$2:$K$40,"C")

To calculate Girls Students with ‘D’ Grade
Go to Cell R6 and type =COUNTIF($J$2:$K$40,"D")

To calculate Boys Students with ‘O’ Grade
Go to Cell N7 and type =COUNTIF($D$2:$E$62,"O")

To calculate Boys Students with ‘A’ Grade
Go to Cell O7 and type =COUNTIF($D$2:$E$62,"A")

To calculate Boys Students with ‘B’ Grade
Go to Cell P7 and type =COUNTIF($D$2:$E$62,"B") To calculate
Boys Students with ‘C’ Grade
Go to Cell Q7 and type =COUNTIF($D$2:$E$62,"C")

To calculate Boys Students with ‘D’ Grade
Go to Cell R7 and type =COUNTIF($D$2:$E$62,"D")

To calculated the expected value Ei
Go to Cell N9 and type =N8/2 Go to
Cell O9 and type =O8/2 Go to Cell P9
and type =P8/2 Go to Cell Q9 and
type =Q8/2 Go to Cell R9 and type
=R8/2

Go to Cell S6 and calculate total girl students = SUM(N6:R6) Go to Cell
S7 and calculate total girl students = SUM(N7:R7)

$$\sum \frac{(O_i - E_i)^2}{Ei}$$

Now Calculate
Go to cell **T6** and type
=SUM((N6-$N$9)^2/$N$9,(O6-$O$9)^2/$O$9,(P6-$P$9)^2/$P$9,(Q6-Q$9)^2/$Q$9,(R6$R$9)^2/$R$9)

Go to cell **T7** and type
=SUM((N7-$N$9)^2/$N$9,(O7-$O$9)^2/$O$9,(P7-$P$9)^2/$P$9,(Q7-Q$9)^2/$Q$9,(R7$R$9)^2/$R$9)

To get the table value go to cell T11 and type **=CHIINV(0.05,4)**
Go to cell O13 and type =IF(T8>=T11," H0 is Accepted", "H0 is Rejected")

M	N	O	P	Q	R	S	T
H0 : Performance of boys and girls are equal							
Frequency Table							$\frac{(O_i - E_i)^2}{Ei}$
	O	A	B	C	D	Total	
Girls	11	7	5	5	11	39	6.075
Boys	30	4	3	10	14	61	6.075
Total	41	11	8	15	25	100	12.150
Ei	20.5	5.5	4	7.5	12.5	50	
Critcal Value of α =0.05 for df = (2-1) * (5-1)							9.487729
Decesion		H0 is Accepted					

Practical 5:

Perform testing of hypothesis using Z-test. code

```
from statsmodels.stats import weightstats as stests
import pandas as pd
from scipy import stats
df = pd.read_csv("blood_pressure.csv")
df[['bp_before','bp_after']].describe()
print(df)
ztest ,pval = stests.ztest(df['bp_before'], x2=None, value=156)
print(float(pval))

if pval<0.05:
    print("reject null hypothesis")
else:
    print("accept null hypothesis")
```

output

```
In [29]: runfile('K:/Research In Computing/Practical
Material/Programs/Practical_05/Z_Test_Two_Sample.py',
wdir='K:/Research In Computing/Practical Material/Programs/
Practical_05')
     patient  gender agegrp  bp_before  bp_after
0          1    Male  30-45        143       153
1          2    Male  30-45        163       170
2          3    Male  30-45        153       168
3          4    Male  30-45        153       142
4          5    Male  30-45        146       141
..       ...     ...    ...        ...       ...
115      116  Female    60+        152       152
116      117  Female    60+        161       152
117      118  Female    60+        165       174
118      119  Female    60+        149       151
119      120  Female    60+        185       163

[120 rows x 5 columns]
0.002162306611369422
reject null hypothesis
```

Practical 6

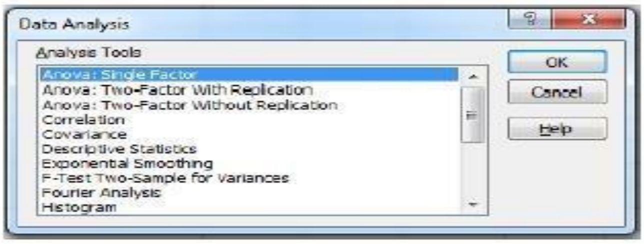
A. Perform testing of hypothesis using One-way ANOVA using Excel

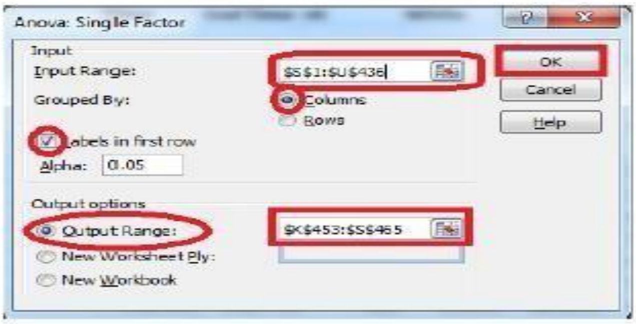
H0 - There are no significant differences between the Subject's mean SAT scores.

$\mu1 = \mu2 = \mu3 = \mu4 = \mu5$

H1 - There is a significant difference between the Subject's mean SAT scores.

To perform ANOVA go to data □Data Analysis





Input Range : $S$1:$U$436*(Select columns to be analyzed in group)*

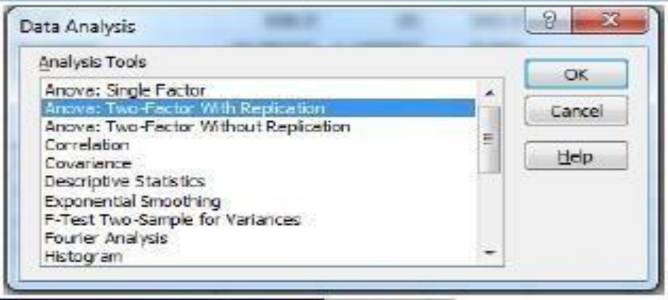
Output Range :$K$453:$S$465*(Can be any Range)*

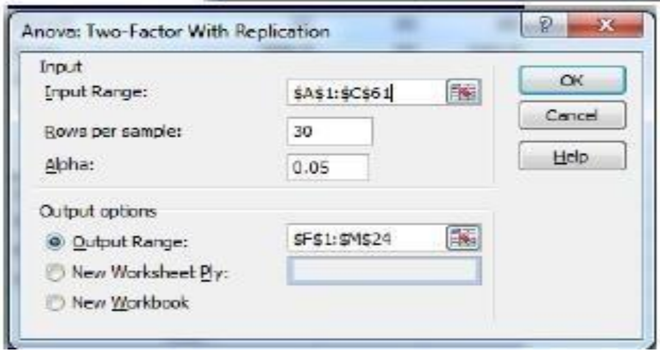
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Average Score (SAT Math)	375	162354	432.944	5177.144		
Average Score (SAT Reading)	375	159189	424.504	3829.267		
Average Score (SAT Writing)	375	156922	418.4587	4166.522		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	39700.57	2	19850.28	4.520698	0.01108	3.003745
Within Groups	4926677	1122	4390.977			
Total	4966377	1124				

Since the resulting p value is less than 0.05. The null hypothesis (H0) is rejected and conclude that there is a significant difference between the SAT scores for each subject.

B. Perform testing of hypothesis using Two-way ANOVA Using Excel:

Go to Data tab → Data Analysis





Input Range - $A$1:C

Rows Per Sample – 30 (Beacause 30 Patients are given each dose) Alpha – 0.05 Output Range - $F$1:$M$24

Output:

Anova: Two-Factor With Replication						
SUMMARY	len	dose	Total			
1						
Count	30	30	60			
Sum	508.9	35	543.9			
Average	16.96333	1.166667	9.065			
Variance	68.32723	0.402299	97.22333			
31						
Count	30	30	60			
Sum	619.9	35	654.9			
Average	20.66333	1.166667	10.915			
Variance	43.63344	0.402299	118.2854			
Total						
Count	60	60				
Sum	1128.8	70				
Average	18.81333	1.166667				
Variance	58.51202	0.39548				
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Sample	102.675	1	102.675	3.642079	0.058808	3.922879
Columns	9342.145	1	9342.145	331.3838	8.55E-36	3.922879
Interaction	102.675	1	102.675	3.642079	0.058808	3.922879
Within	3270.193	116	28.19132			
Total	12817.69	119				

P-value = 0.0588079 column in the ANOVA Source of Variation table at the bottom of the output. Because the p-values for both medicine dose and interaction are less than our significance level, these factors are statistically significant. On the other hand, the interaction effect is not significant because its p-value (0.0588) is greater than our significance level. Because the interaction effect is not significant, we can focus on only the main effects and not consider the interaction effect of the dose.

C. Perform testing of hypothesis using MANOVA

Go to http://www.real-statistics.com/free-download/

1. Download Real Statistics Resource Pack

Real Statistics Resource Pack: contains a variety of supplemental functions and data analysis tools not provided by Excel. These complement the standard Excel capabilities and make it easier for you to perform the statistical analyses described in the rest of this website.

Free Download

Real Statistics Resource Pack for Excel 2010, 2013, 2016, 2019 or 365 for Windows

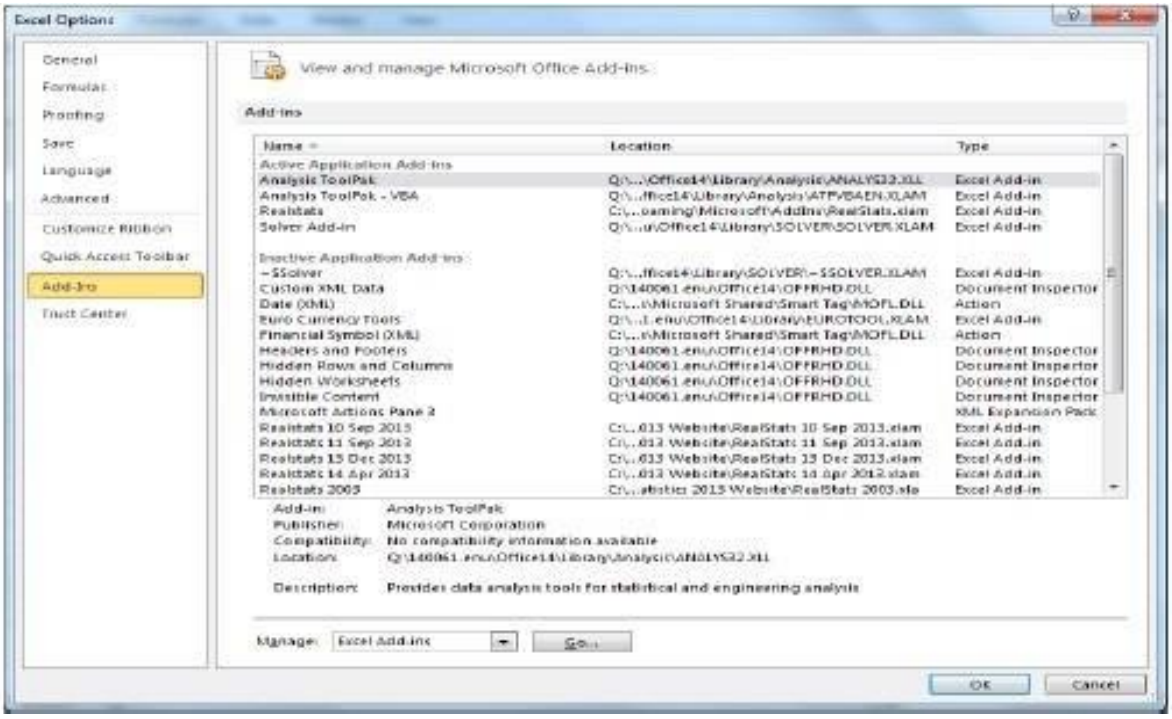
If you accept the License Agreement, click here on Real Statistics Resource Pack for Excel 2010/2013/2016/2019/365 to download the latest Excel for Windows version of the

Or

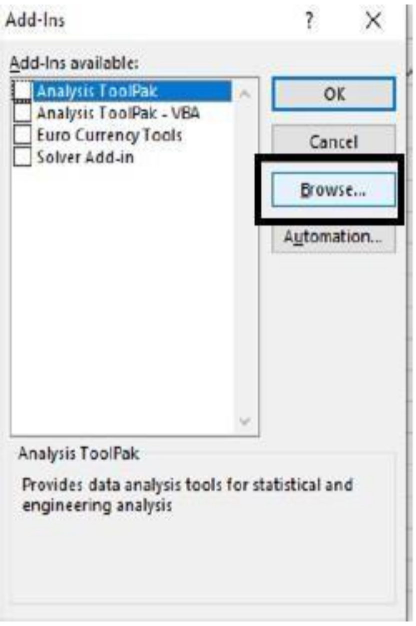
http://www.real-statistics.com/wp-content/uploads/2019/11/XRealStats.xlam

Install Add-in in excel. Select **File** > **Help |Options** > **Add-Ins** and click on the **Go** button at the bottom of the window (see Figure 1).

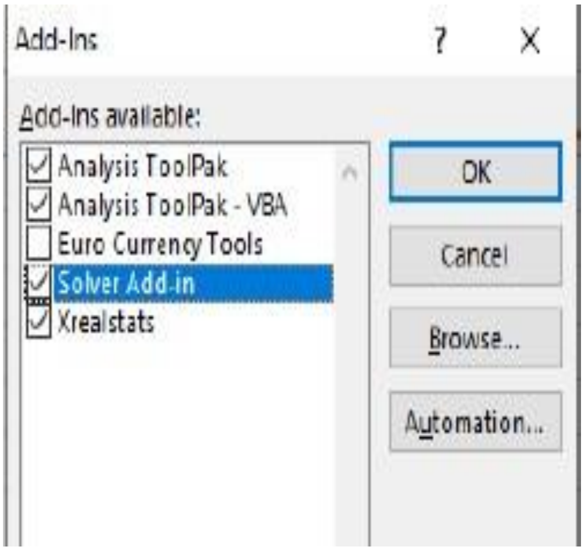
Add-ins →Analysis Pack →Go



Click on browse and select XrealStats file (previously downloaded).



Select the following Add-Ins. Click OK.

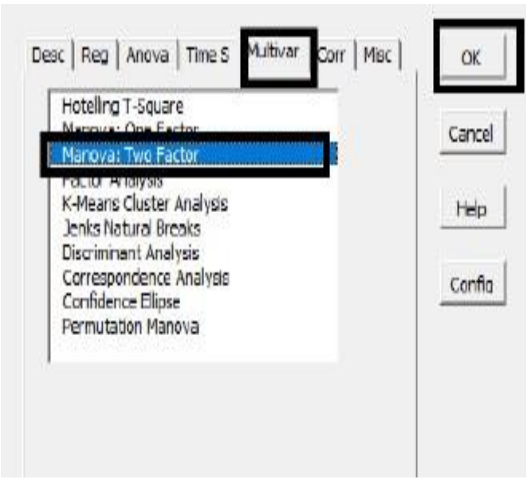


Now create an excel sheet with following data.

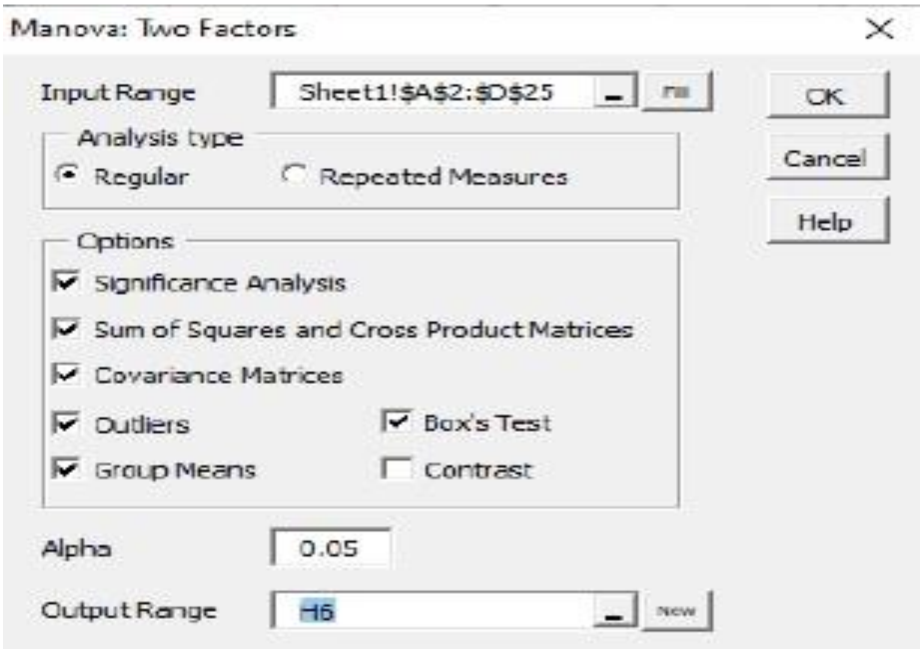
A study was conducted to see the impact of social-economic class (rich, middle, poor) and gender (male, female) on kindness and optimism using on a sample of 24 people based on the data in Figure 1.

	A	B	C	D
3	gender	economic	kindness	optimism
4	male	wealthy	5	3
5	male	wealthy	4	6
6	male	wealthy	3	4
7	male	wealthy	2	4
8	male	middle	4	6
9	male	middle	3	6
10	male	middle	5	4
11	male	middle	5	5
12	male	poor	7	5
13	male	poor	4	3
14	male	poor	3	1
15	male	poor	7	2
16	female	wealthy	2	3
17	female	wealthy	3	5
18	female	wealthy	5	3
19	female	wealthy	4	2
20	female	middle	9	8
21	female	middle	6	5
22	female	middle	7	6
23	female	middle	8	9
24	female	poor	8	9
25	female	poor	9	8
26	female	poor	3	7
27	female	poor	5	7

Press ctrl-m to open Real Statistics menu.



Select the data excluding column names. Select a cell for output.



Output

Two-Way MANOVA

fact A	*stat*	*df1*	*df2*	*F*	*p-value*	*part eta-sq*
Pillai Trac	0.190764	2	16	1.885866	0.183909	0.190764
Wilk's Lam	0.809236	2	16	1.885866	0.183909	0.190764
Hotelling	0.235733	2	16	1.885866	0.183909	0.190764
Roy's Lg R	0.235733					

fact B	*stat*	*df1*	*df2*	*F*	*p-value*	*part eta-sq*
Pillai Trac	0.340249	4	34	1.742501	0.163458	0.170125
Wilk's Lam	0.8181	4	32	1.778757	0.157443	0.1819
Hotelling	0.479878	4	30	1.799541	0.155008	0.193509
Roy's Lg R	0.448078					

SSCP Matrices

Tot	
104.9565	59.86957
59.86957	110.6087
Row (A)	
12.5247	15.41502
15.41502	18.97233
Column (B)	
31.15295	22.95885
22.95885	19.37655

Practical 7

A. Perform the Random sampling for the given data and analyse it.

	A	B	C	D	E	F	G	H	I	J	K
1	Sr. No	Roll No	Student's Name	Gender	Grade		Sr. No	Roll No	Student's Name	Gender	Grade
2	1	1	Gaborone	m	O		62	3	Maun	f	O
3	2	2	Francistown	m	O		63	7	Tete	f	O
4	3	5	Niamey	m	O		64	9	Chimoio	f	O
5	4	13	Maxixe	m	O		65	11	Pemba	f	O
6	5	16	Tema	m	O		66	14	Chibuto	f	O
7	6	17	Kumasi	m	O		67	25	Mampong	f	O
8	7	34	Blida	m	O		68	36	Tlemcen	f	O
9	8	35	Oran	m	O		69	40	Adrar	f	O
10	9	38	Saefda	m	O		70	41	Tindouf	f	O
11	10	42	Constantine	m	O		71	46	Skikda	f	O
12	11	43	Annaba	m	O		72	47	Ouargla	f	O
13	12	45	Bejaefa	m	O		73	10	Matola	f	D
14	13	48	Medea	m	O		74	20	Legon	f	D
15	14	49	Djelfa	m	O		75	21	Sunyani	f	D
16	15	50	Tipaza	m	O		76	72	Teenas	f	D
17	16	51	Bechar	m	O		77	73	Kouba	f	D
18	17	54	Mostaganem	m	O		78	75	Hussen Dey	f	D
19	18	55	Tiaret	m	O		79	77	Khenchela	f	D
20	19	56	Bouira	m	O		80	82	Hassi Bahbah	f	D
21	20	59	Tebessa	m	O		81	84	Baraki	f	D
22	21	61	El Harrach	m	O		82	91	Boudouaou	f	D
23	22	62	Mila	m	O		83	95	Tadjenanet	f	D
24	23	65	Fouka	m	O		84	4	Molepolole	f	C

Set Cell O1 = Male and Cell O2 = Female

To generate a random sample for male students from given population go to Cell O1 and type

=INDEX(E$2:E$62,RANK(B2,B$2:B$62))

Drag teh formula to the desired no of cell to select random sample.

Now, to generate a random sample for female students go to cell P1 and type

=INDEX(K$2:K$40,RANK(H2,H$2:H$40))

Drag teh formula to the desired no of cell to select random sample

Output:

O	P
Male	Female
A	A
A	A
A	A
B	A
C	B
C	C
D	C
D	C
D	C
D	C
D	D
D	A
D	B
D	B
O	D
O	D
O	D
O	D
O	O
O	O
O	O
O	O
O	A

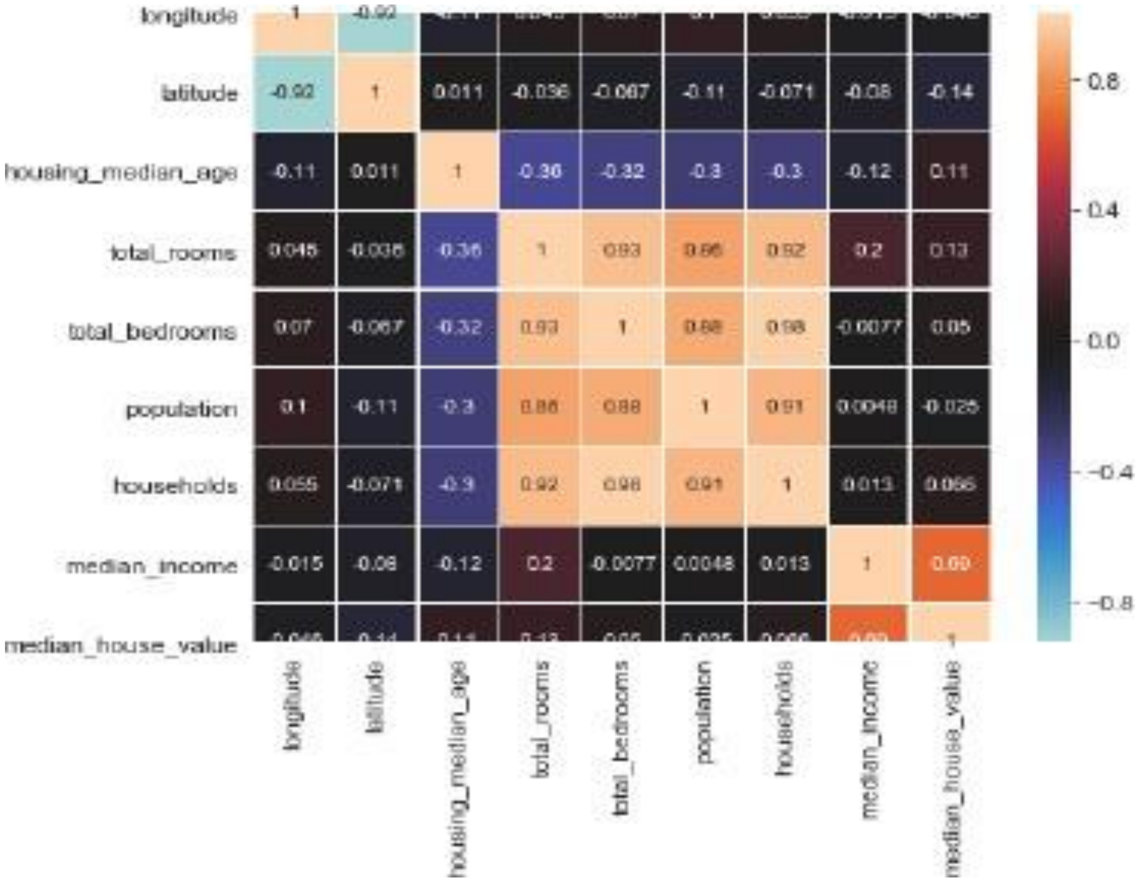
B. Perform the Stratified sampling for the given data and analyse it.

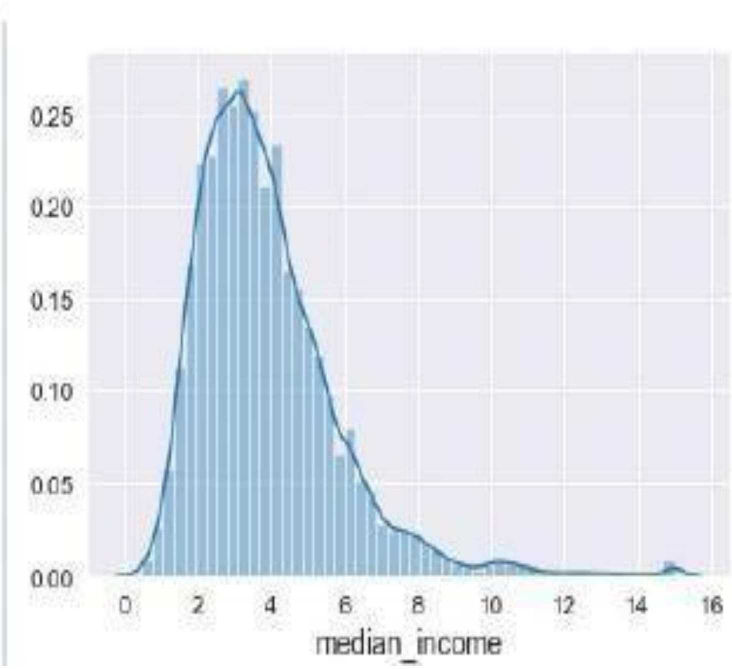
Program Code:

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

plt.rcParams['axes.labelsize'] = 14
plt.rcParams['xtick.labelsize'] = 12
plt.rcParams['ytick.labelsize'] = 12

importseaborn as sns
color = sns.color_palette()
sns.set_style('darkgrid')
import sklearn
from sklearn.model_selection import train_test_split
housing =pd.read_csv('housing.csv')
print(housing.head()) print(housing.info())

#creating a heatmap of the attributes in the dataset
correlation_matrix = housing.corr() plt.subplots(figsize=(8,6))
sns.heatmap(correlation_matrix, center=0, annot=True, linewidths=.3)
corr =housing.corr()
print(corr['median_house_value'].sort_values(ascending=False))
sns.distplot(housing.median_income)
plt.show()
```

output

```
In [28]: runfile('J:/Research In Computing/Practical Material/Programs/Practical_05/
Stratified_Sample.py', wdir='J:/Research In Computing/Practical Material/Programs/Practical_05')
   longitude  latitude  ...  median_house_value  ocean_proximity
0    -122.23     37.88  ...            452600.0         NEAR BAY
1    -122.22     37.86  ...            358500.0         NEAR BAY
2    -122.24     37.85  ...            352100.0         NEAR BAY
3    -122.25     37.85  ...            341300.0         NEAR BAY
4    -122.25     37.85  ...            342200.0         NEAR BAY

[5 rows x 10 columns]
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20640 entries, 0 to 20639
Data columns (total 10 columns):
longitude             20640 non-null float64
latitude              20640 non-null float64
housing_median_age    20640 non-null float64
total_rooms           20640 non-null float64
total_bedrooms        20433 non-null float64
population            20640 non-null float64
households            20640 non-null float64
median_income         20640 non-null float64
median_house_value    20640 non-null float64
ocean_proximity       20640 non-null object
dtypes: float64(9), object(1)
memory usage: 1.6+ MB
None
median_house_value    1.000000
median_income         0.688075
total_rooms           0.134153
housing_median_age    0.105623
households            0.065843
total_bedrooms        0.049686
population           -0.024650
longitude            -0.045967
latitude             -0.144160
Name: median_house_value, dtype: float64
```


longitude
latitude
housing_median_age
total_rooms
total_bedrooms
population
households
median_income
median_house_value
0.8
0.4
0.0
−0.4
−0.8


0.25
0.20
0.15
0.10
0.05
0.00
0
2
4
6
8
10
12
14
16
median_income

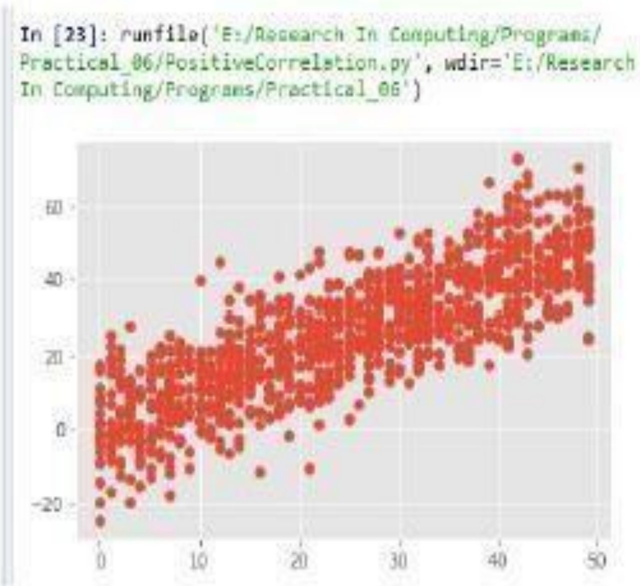
Practical 8:

Write a program for computing different correlation.

Code:

```
import numpy as np
import matplotlib.pyplot as plt
np.random.seed(1)
# 1000 random integers between 0 and 50
x = np.random.randint(0, 50, 1000)
# Positive Correlation with some noise
y = x + np.random.normal(0, 10, 1000)
np.corrcoef(x, y)
matplotlib.style.use('ggplot')
plt.scatter(x, y)
plt.show()
```

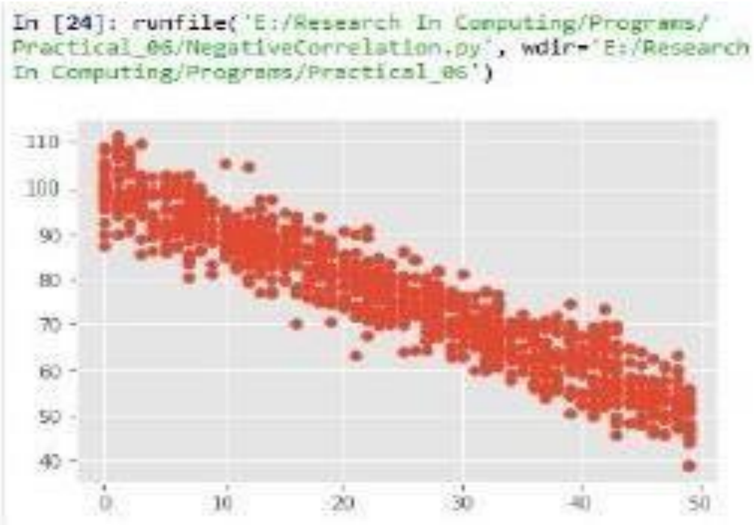
Output:



Negative Correlation:

```
import numpy as np
import matplotlib.pyplot as plt
np.random.seed(1)
# 1000 random integers between 0 and 50
x = np.random.randint(0, 50, 1000)
# Negative Correlation with some noise
 y = 100 - x + np.random.normal(0, 5, 1000)

 np.corrcoef(x, y)
 plt.scatter(x, y)
 plt.show()
```

Output:



No/Weak Correlation:

```
import numpy as np
import matplotlib.pyplot as plt
np.random.seed(1)
x = np.random.randint(0, 50, 1000)
y = np.random.randint(0, 50, 1000)
np.corrcoef(x, y)
plt.scatter(x, y)
plt.show()
```

Output:

Practical 9

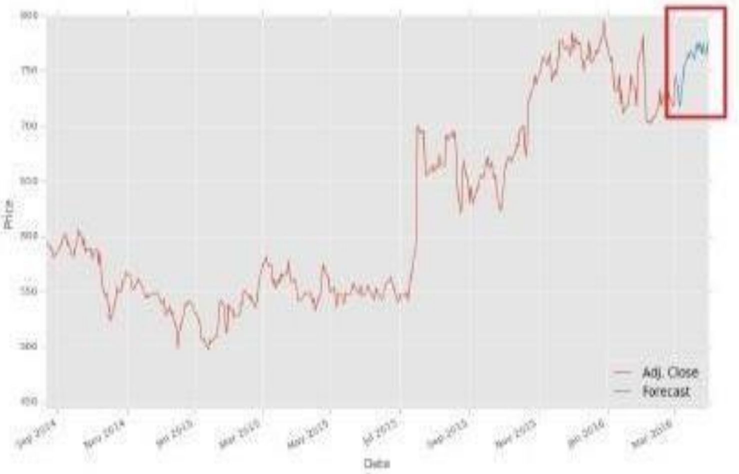
A. Write a program to Perform linear regression for prediction. V

code

```
import Quandl, math
import numpy as np
import pandas as pd
from sklearn import preprocessing, cross_validation, svm
from sklearn.linear_model import LinearRegression import
matplotlib.pyplot as plt
from matplotlib import style
import datetime

style.use('ggplot')
df = Quandl.get("WIKI/GOOGL")
df = df[['Adj. Open', 'Adj. High', 'Adj. Low', 'Adj. Close', 'Adj. Volume']]
df['HL_PCT'] = (df['Adj. High'] - df['Adj. Low']) / df['Adj. Close'] * 100.0
df['PCT_change'] = (df['Adj. Close'] - df['Adj. Open']) / df['Adj. Open'] * 100.0

df = df[['Adj. Close', 'HL_PCT', 'PCT_change', 'Adj. Volume']]
forecast_col = 'Adj. Close'
df.fillna(value=-99999, inplace=True)
forecast_out =int(math.ceil(0.01 * len(df)))
df['label'] = df[forecast_col].shift(-forecast_out)
X = np.array(df.drop(['label'], 1))
X = preprocessing.scale(X)
X_lately = X[forecast_out:]
X = X[:-forecast_out]

df.dropna(inplace=True)
y = np.array(df['label'])
X_train, X_test, y_train, y_test = cross_validation.train_test_split(X, y, test_size=0.2)
clf = LinearRegression(n_jobs=-1)
clf.fit(X_train, y_train)
confidence = clf.score(X_test, y_test)

forecast_set = clf.predict(X_lately)
df['Forecast'] = np.nan

last_date = df.iloc[-1].name
last_unix = last_date.timestamp()
one_day = 86400
next_unix = last_unix + one_day

for i in forecast_set:
    next_date = datetime.datetime.fromtimestamp(next_unix)
    next_unix += 86400
    df.loc[next_date] = [np.nan for _ in range(len(df.columns)-1)]+[i]
```

```
df['Adj. Close'].plot()
df['Forecast'].plot()
plt.legend(loc=4)
plt.xlabel('Date') plt.ylabel('Price')
plt.show()
```

output



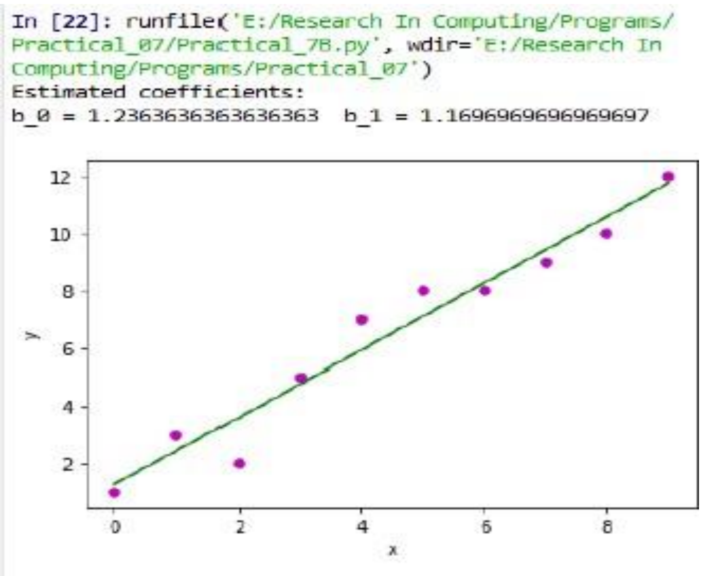
B. Perform polynomial regression for prediction.

Code:

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

defestimate_coef(x, y):
        # number of observations/points
        n = np.size(x)

        # mean of x and y vector
        m_x, m_y = np.mean(x), np.mean(y)

        # calculating cross-deviation and deviation about x
        SS_xy = np.sum(y*x) - n*m_y*m_x
        SS_xx = np.sum(x*x) - n*m_x*m_x

        # calculating regression coefficients
        b_1 = SS_xy / SS_xx b_0 = m_y -
        b_1*m_x
        return(b_0, b_1)
defplot_regression_line(x, y, b):
        # plotting the actual points as scatter plot plt.scatter(x,
        y, color = "m",
         marker = "o", s = 30)
```

```
        # predicted response
        y_pred = b[0] + b[1]*x

        # plotting the regression line
        plt.plot(x, y_pred, color = "g")

        # putting labels
        plt.xlabel('x')
        plt.ylabel('y')

        # function to show plot
        plt.show()

def main(): #
        observations
        x = np.array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
        y = np.array([1, 3, 2, 5, 7, 8, 8, 9, 10, 12])

        # estimating coefficients
        b = estimate_coef(x, y)
        print("Estimated coefficients:\nb_0 = {} b_1 = {}".format(b[0], b[1]))

        # plotting regression line
        plot_regression_line(x, y, b)

if_name_== " main ":
        main()
```

output



Practical 10

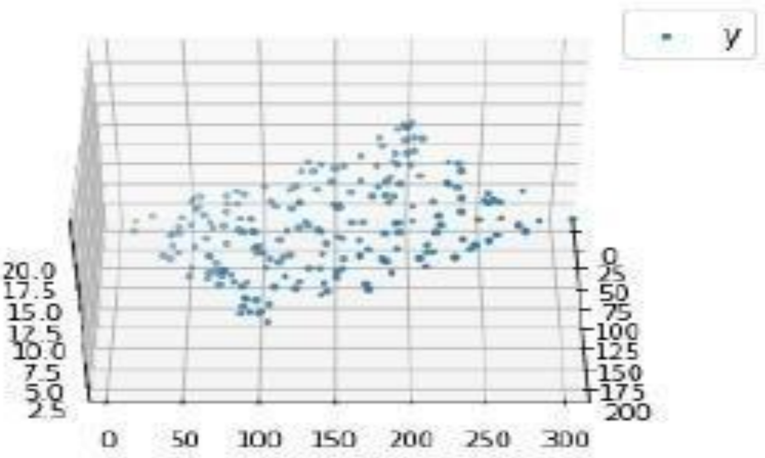
A. Write a program for multiple linear regression analysis.

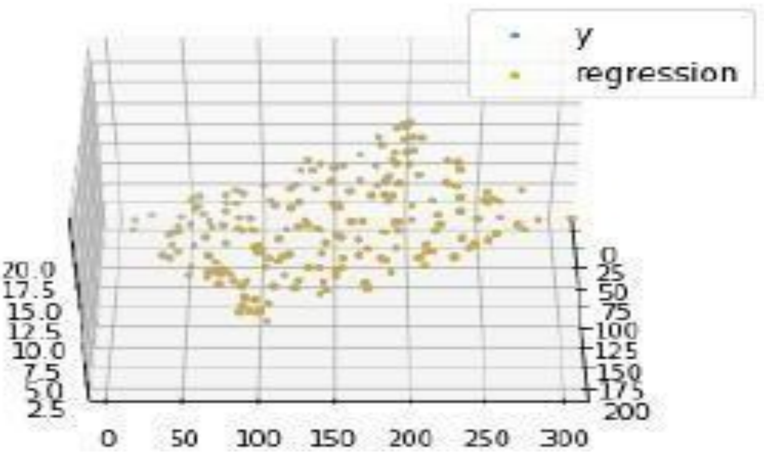
Code

```
Import numpy as np
import matplotlib as mpl
from mpl_toolkits.mplot3d import Axes3D
import matplotlib.pyplot as plt
defgenerate_dataset(n):
    x = []
    y = []
    random_x1 = np.random.rand()
    random_x2 = np.random.rand()
    for i in range(n):
        x1 = i
        x2 = i/2 + np.random.rand()*n
        x.append([1, x1, x2])
        y.append(random_x1 * x1 + random_x2 * x2 + 1)
        returnnp.array(x), np.array(y)
x, y = generate_dataset(200)
mpl.rcParams['legend.fontsize'] = 12
fig = plt.figure()
ax = fig.gca(projection ='3d')
ax.scatter(x[:, 1], x[:, 2], y, label ='y', s = 5)
ax.legend()
ax.view_init(45, 0)
plt.show()
defmse(coef, x, y)
returnnp.mean((np.dot(x, coef) - y)**2)/2

def gradients(coef, x, y):
returnnp.mean(x.transpose()*(np.dot(x,coef)-y), axis = 1)
defmultilinear_regression(coef, x, y, lr, b1 = 0.9, b2 = 0.999, epsilon = 1e-8):
    prev_error = 0
    m_coef = np.zeros(coef.shape)
     v_coef = np.zeros(coef.shape)
    moment_m_coef=np.zeros(coef.shape)
    moment_v_coef = np.zeros(coef.shape)
    t = 0
    while True:
        error = mse(coef, x, y)
        if abs(error - prev_error) <= epsilon:
            break
        prev_error = error
        grad = gradients(coef, x, y)
         t += 1
```

```
                    m_coef = b1 * m_coef + (1-b1)*grad
                    v_coef = b2 * v_coef + (1-b2)*grad**2
                    moment_m_coef = m_coef / (1-b1**t)
                    moment_v_coef = v_coef / (1-b2**t)

                    delta = ((lr / moment_v_coef**0.5 + 1e-8) * (b1 * moment_m_coef + (1-b1)*grad/(1-
                    b1**t)))
                              coef = np.subtract(coef, delta)
                      returncoef
coef = np.array([0, 0, 0])
c = multilinear_regression(coef, x, y, 1e-1)
fig = plt.figure()
ax = fig.gca(projection ='3d')
ax.scatter(x[:, 1], x[:, 2], y, label ='y', s = 5, color="dodgerblue")
ax.scatter(x[:, 1], x[:, 2], c[0] + c[1]*x[:, 1] + c[2]*x[:, 2], label ='regression', s = 5,
                                                                    color ="orange")
ax.view_init(45, 0)
ax.legend()
plt.show()
```

Output





B Perform logistic regression analysis.

Program Code:

```
import os
import numpy as np
import pandas as pd
import matplotlib
import matplotlib.pyplot as plt
import scipy.stats as stats
from sklearn import linear_model
from sklearn import preprocessing
from sklearn import metrics

matplotlib.style.use('ggplot')
plt.figure(figsize=(9,9))

def sigmoid(t):      # Define the sigmoid function
    return (1/(1 + np.e**(-t)))

plot_range = np.arange(-6, 6, 0.1)

y_values = sigmoid(plot_range)

 # Plot curve

plt.plot(plot_range,          # X-axis range
         y_values,            # Predicted values
         color="red")
titanic_train = pd.read_csv("titanic_train.csv")      # Read the data
char_cabin = titanic_train["Cabin"].astype(str)               # Convert cabin to str
new_Cabin = np.array([cabin[0] for cabin in char_cabin]) # Take first letter

titanic_train["Cabin"] = pd.Categorical(new_Cabin) # Save the new cabin var

# Impute median Age for NA Age values

new_age_var = np.where(titanic_train["Age"].isnull(), # Logical check
                                                          #Value if check is true
                  titanic_train["Age"])          # Value if check is false

titanic_train["Age"] = new_age_var

label_encoder = preprocessing.LabelEncoder()

# Convert Sex variable to numeric
encoded_sex = label_encoder.fit_transform(titanic_train["Sex"])

# Initialize logistic regression model
log_model = linear_model.LogisticRegression()
```

```
# Train the model
log_model.fit(X = pd.DataFrame(encoded_sex), y = titanic_train["Survived"])

# Check trained model intercept print(log_model.intercept_)

# Check trained model coefficients print(log_model.coef_)

# Make predictions
preds = log_model.predict_proba(X= pd.DataFrame(encoded_sex))
preds = pd.DataFrame(preds)
preds.columns = ["Death_prob", "Survival_prob"]

# Generate table of predictions vs Sex
pd.crosstab(titanic_train["Sex"], preds.ix[:, "Survival_prob"])

# Convert more variables to numeric
encoded_class = label_encoder.fit_transform(titanic_train["Pclass"])
encoded_cabin = label_encoder.fit_transform(titanic_train["Cabin"])

train_features = pd.DataFrame([encoded_class,
                    encoded_cabin, encoded_sex, titanic_train["Age"]]).T

# Initialize logistic regression model log_model =
linear_model.LogisticRegression()

# Train the model
log_model.fit(X = train_features , y = titanic_train["Survived"])

# Check trained model intercept
print(log_model.intercept_)

# Check trained model coefficients
print(log_model.coef_)

# Make predictions
preds = log_model.predict(X= train_features)

# Generate table of predictions vs actual
pd.crosstab(preds,titanic_train["Survived"])

log_model.score(X = train_features , y = titanic_train["Survived"])

metrics.confusion_matrix(y_true=titanic_train["Survived"], # True labels y_pred=preds) # Predicted
                labels

# View summary of common classification metrics
print(metrics.classification_report(y_true=titanic_train["Survived"], y_pred=preds)
                    )
```

```
# Read and prepare test data

titanic_test = pd.read_csv("titanic_test.csv")        # Read the data

char_cabin = titanic_test["Cabin"].astype(str)        # Convert cabin to str

new_Cabin = np.array([cabin[0] for cabin in char_cabin]) # Take first letter

titanic_test["Cabin"] = pd.Categorical(new_Cabin) # Save the new cabin var

# Impute median Age for NA Age values
new_age_var = np.where(titanic_test["Age"].isnull(), # Logical check
                       28,          # Value if check is true
                       titanic_test["Age"])        # Value if check is false
titanic_test["Age"] = new_age_var

# Convert test variables to match model features
encoded_sex = label_encoder.fit_transform(titanic_test["Sex"])
encoded_class = label_encoder.fit_transform(titanic_test["Pclass"])
encoded_cabin = label_encoder.fit_transform(titanic_test["Cabin"])

test_features = pd.DataFrame([encoded_class, encoded_cabin,encoded_sex,titanic_test["Age"]]).T

# Make test set predictions
test_preds = log_model.predict(X=test_features)

# Create a submission for Kaggle
submission = pd.DataFrame({"PassengerId":titanic_test["PassengerId"], "Survived":test_preds})

# Save submission to CSV
submission.to_csv("tutorial_logreg_submission.csv", index=False) # Do not save index values

print(pd)
```

Output

Survival_prob	0.193110906347	0.729443792051
Sex		
female	0	312
male	577	0

The table shows that the model predicted a survival chance of roughly 19% for males and 73% for females.

	precision	recall	f1-score	support
0	0.82	0.85	0.83	549
1	0.74	0.70	0.72	340
avg / total	0.79	0.79	0.79	889

For the Titanic competition, accuracy is the scoring metric used to judge the competition, so we don't have to worry too much about other metrics.

Survived	0	1
row_0		
0	467	103
1	82	237

The table above shows the classes our model predicted vs. true values of the Survived variable.