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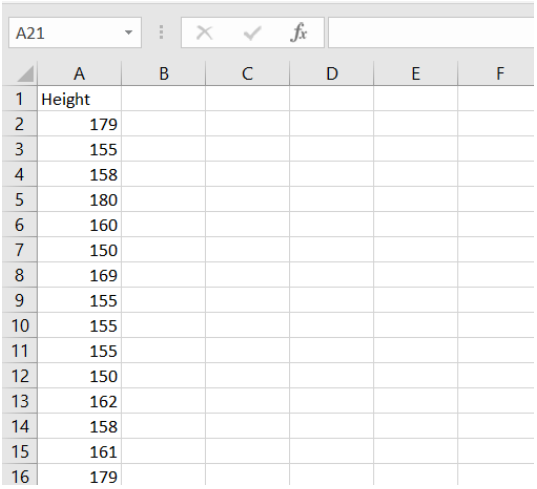
Practical 1

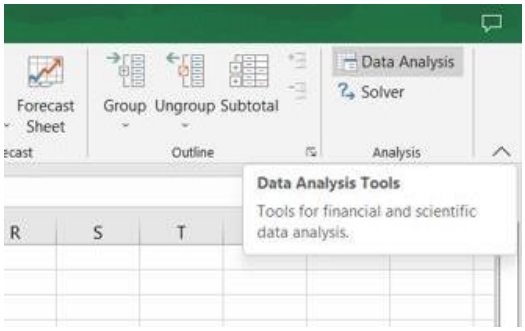
A. Write a program for obtaining descriptive statistics of data.

Step 1: Open your data in excel

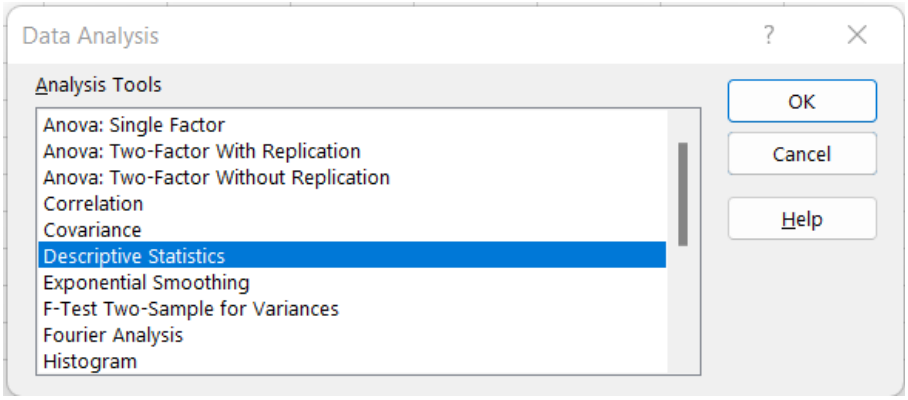


	A	B	C	D	E	F
1	Height					
2	179					
3	155					
4	158					
5	180					
6	160					
7	150					
8	169					
9	155					
10	155					
11	155					
12	150					
13	162					
14	158					
15	161					
16	179					

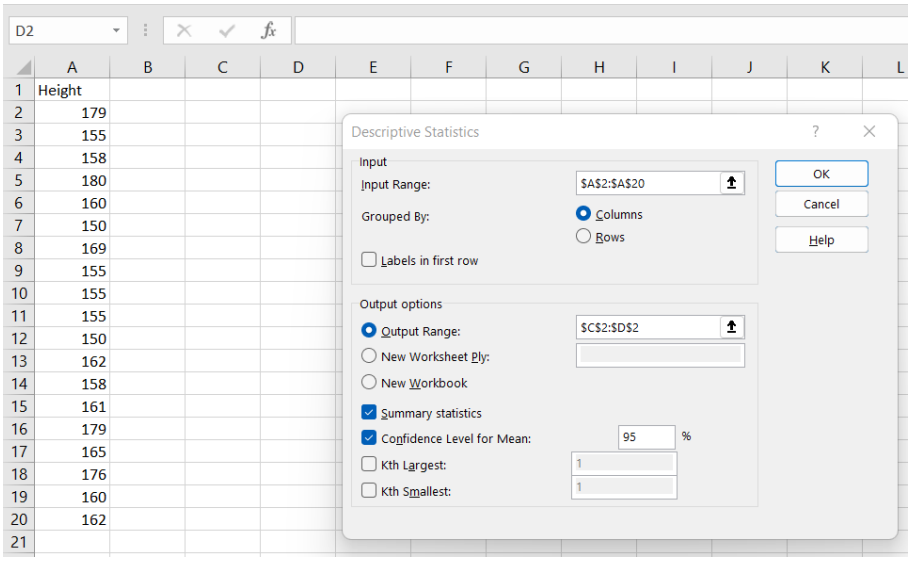
Step 2: From the Data Tool in the ribbon choose Data Analysis.



Step 3: Select the option of descriptive statistics



Step 4: Select an input range, output range, and check summary statistics and confidence level.



Step 5: The output may appear as follows.

	Height		Column1	
2	179			
3	155			
4	158		Mean	162.5789474
5	180		Standard Error	2.212822533
6	160		Median	160
7	150		Mode	155
8	169		Standard Deviation	9.645469803
9	155		Sample Variance	93.03508772
10	155		Kurtosis	-0.561004927
11	155		Skewness	0.753286117
12	150		Range	30
13	162		Minimum	150
14	158		Maximum	180
15	161		Sum	3089
16	179		Count	19
17	165		Confidence Level(95.0%)	4.648967631
18	176			
19	160			
20	162			

Conclusion: Descriptive statistics is a form of data analysis that involves the use of numerical measures to describe the characteristics of a given set of data. The goal of descriptive statistics is to summarize the data into a meaningful and useful form. The most common forms of descriptive statistics include the mean, median, mode, and standard deviation. These measures allow researchers to understand the characteristics of the data, such as its spread and distribution. Descriptive statistics can also be used to make predictions about future data. For example, if the mean of a set of data is consistently

higher than the median, it may be possible to predict that future data will also have a higher mean.

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

Code:

1 - SQLite3

```
import sqlite3 as sq

import pandas as pd

##############################################

Base='C:/VKHCG'

sDatabaseName=Base + '/01-Vermeulen/04-
Transform//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('## Data Values')

print(TestData)

print('## Data Profile')

print('Rows :',TestData.shape[0])

print('Columns :',TestData.shape[1])

print('Successful')1
```

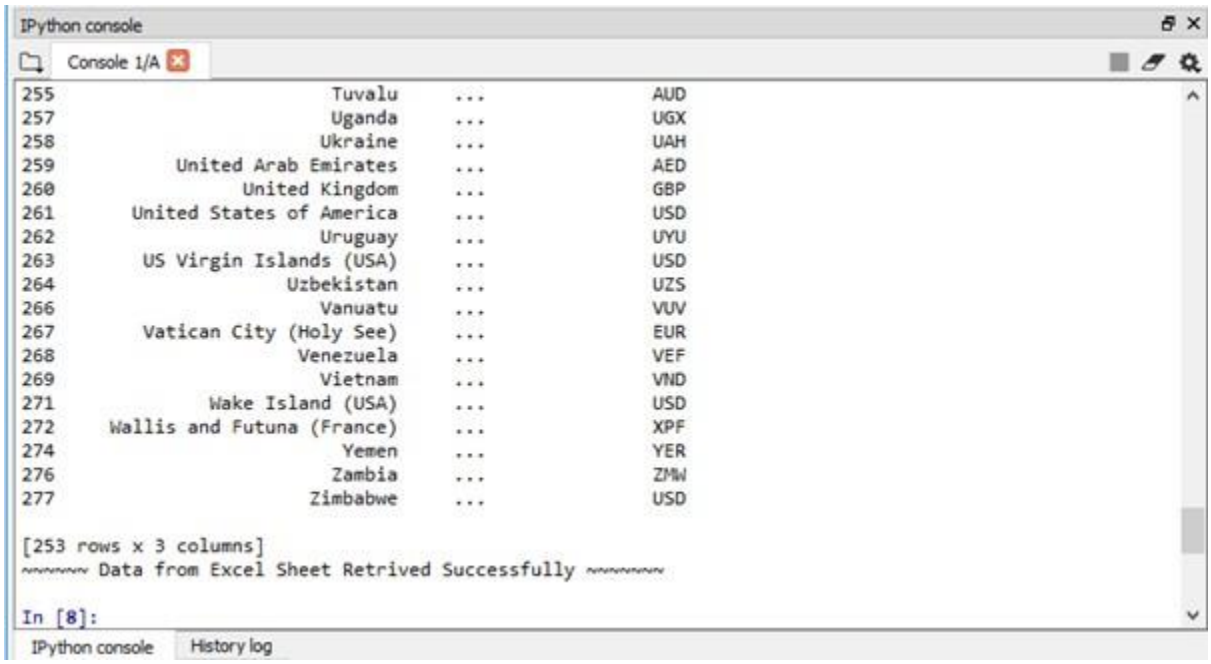
Output:

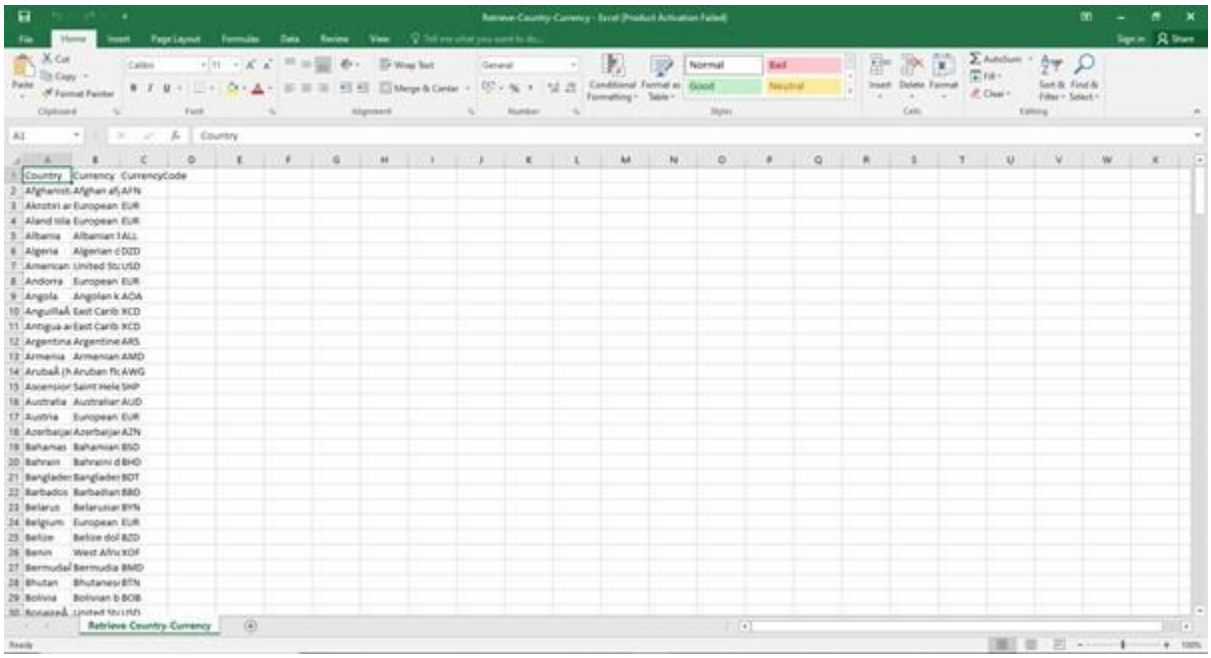
```
Loading : C:/VKHCG/01-Vermeulen/01-Retrieve/01-EDS/02-Python/
Retrieve_IP_DATA.csv
Storing : C:/VKHCG/01-Vermeulen/04-Transform//SQLite/
vermeulen.db  Table: IP_DATA_ALL
Loading : C:/VKHCG/01-Vermeulen/04-Transform//SQLite/
vermeulen.db  Table: IP_DATA_ALL
## Data Values
         RowIDCSV    RowID  ...  First.IP.Number
Last.IP.Number
0               0        0  ...        692781056
692781567
1               1        1  ...        692781824
692783103
2               2        2  ...        692909056
692909311
3               3        3  ...        692909568
692910079
4               4        4  ...        693051392
693052415
...           ...      ...  ...              ...
...
1247497   1247497  1247497  ...       1068157850
1068157850
1247498   1247498  1247498  ...       1334409600
1334409607
1247499   1247499  1247499  ...       1596886528
1596886783
1247500   1247500  1247500  ...       1742189568
1742190591
1247501   1247501  1247501  ...       1905782573
1905782573

[1247502 rows x 11 columns]
## Data Profile
Rows : 1247502
```

2 - Excel

```
import os

import pandas as pd
```

```
Base='C:/VKHCG'

sFileDir=Base + '/01-Vermeulen/01-Retrieve/01-EDS/02-Python'

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-Country-Currency.csv'

CurrencyData.to_csv(sFileName, index = False)
```





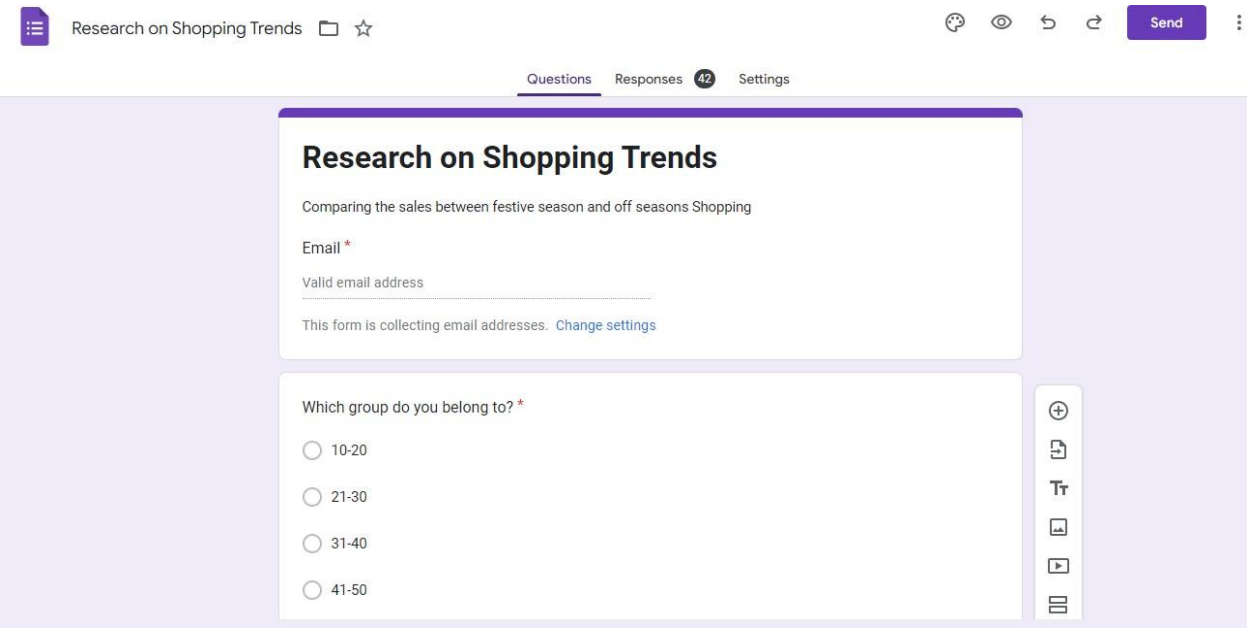
Conclusion: SQLite/Python/Excel

This type of coding are very much helpful to get the correct exact output we can compare all the outputs for getting the more exact value for the accurate answering. Using Python and Excel helps us to do any formulation for finding accuracy getting the answers/the outputs very quickly and easily. SQLite is a database to store various data easily and easy to access.

Practical 2

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

Step 1: In order to make a survey we used Google forms. Our case study's aim was to find out which age group did Shopping in festive seasons.



Step 2: The questions and options entered were as follows.

Q1.Which group do you belong to?
(a)10-20 (b)21-30 (c)31-40 (d)41-50 (e)51 Above

Q2.What is your Gender?
(a)Male (b)Female

Q3.What is your Occupation?
(a)Business (b)Student (c)Employee (d)Retired (e)Self Employed (f)Household

Q4.What's your Monthly Income?
(a)10,000 - 20,000 (b)21,000 - 30,000 (c)31,000 - 40,000 (d)41,000 and above (e)N/A

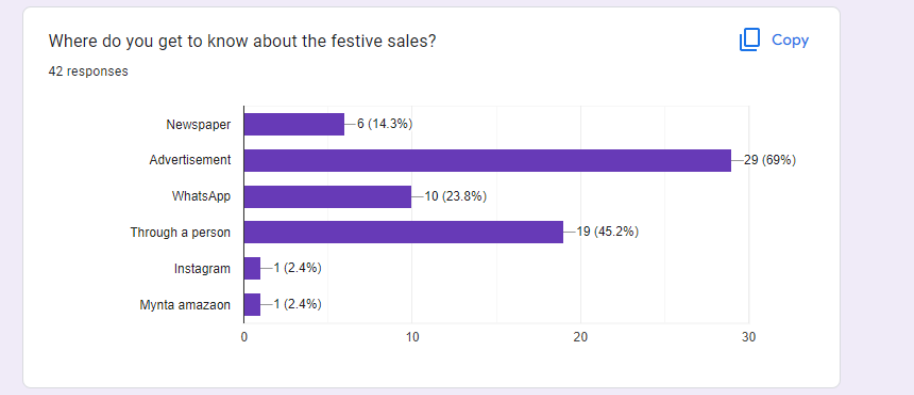
Q5.How often do you shop?
(a)Monthly (b)Occasionally (c)Festive Seasons (d)Rarely

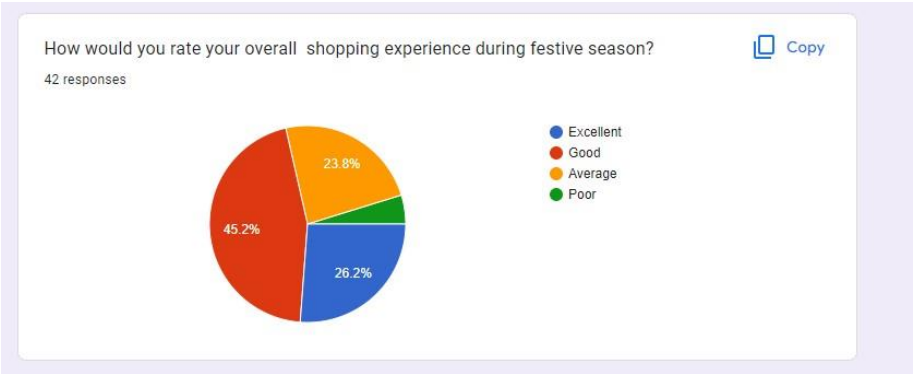
Q6.Purpose of Shopping?
(a)Personal Use (b)Gifting

Q7.Where do you get to know about the festive sales?
(a)Newspaper (b)Advertisement (c)WhatsApp (d)Through a person

Q8.How would you rate your overall shopping experience during festive season?
(a)Excellent (b)Good (c)Average (d)Poor

Step 3 : Google forms tool was chosen because analysis becomes easier on Google forms.





Conclusion: we have successfully made the survey form for the given case study.
In the above practical, we have successfully demonstrated Designing of survey form to collect the shopping trend data of people from different age group. From the above survey we can observe that 42.9% people shop on monthly basis and in this 57.1% women are involved shopping. 45.2% people have Good shopping experience whereas 26.2% people have Excellent shopping experience. Advertisement (69%) is the main source for people to know about festive shopping.

B. Perform analysis of given secondary data.

Step 1: Open Data in excel

	age	male	female	total
2	0 to 4	328759	307079	635838
3	4 to 9	315119	293664	608783
4	10 to 14	311456	290598	602054
5	15 to 19	312831	293313	606144
6	20 to 24	311077	295739	606816
7	25 to 29	284258	273379	557637
8	30 to 34	255596	247383	502979
9	35 to 39	248575	241938	490513
10	40 to 44	232217	226914	459131
11	45 to 49	202633	201142	403775
12	50 to 54	176241	176440	352681
13	55 to 59	153494	156283	309777
14	60 to 64	114194	121200	235394
15	65 to 69	83129	92071	175200
16	70 to 74	65266	77990	143256
17	75 to 79	43761	56895	100656
18	80 to 84	25060	37873	62933
19	85+	14164	28156	42320
20				
21		3477830	3418057	6895887

Step 2: Calculate the total sum of each column. Select the cell for Sum→ add formula SUM in formula bar→ select the range.

	age	male	female	total
2	0 to 4	328759	307079	635838
3	4 to 9	315119	293664	608783
4	10 to 14	311456	290598	602054
5	15 to 19	312831	293313	606144
6	20 to 24	311077	295739	606816
7	25 to 29	284258	273379	557637
8	30 to 34	255596	247383	502979
9	35 to 39	248575	241938	490513
10	40 to 44	232217	226914	459131
11	45 to 49	202633	201142	403775
12	50 to 54	176241	176440	352681
13	55 to 59	153494	156283	309777
14	60 to 64	114194	121200	235394
15	65 to 69	83129	92071	175200
16	70 to 74	65266	77990	143256
17	75 to 79	43761	56895	100656
18	80 to 84	25060	37873	62933
19	85+	14164	28156	42320
20				
21		3477830	3418057	6895887

Step 3: Calculate the percentage of male in cell E. Use formula -1*100*B2/$D$21

SUM =-1*100*B2/$D$21

	A	B	C	D	E	F
1	age	male	female	total	Male(%)	
2	0 to 4	328759	307079	635838	=-1*100*B2/$D$21	
3	4 to 9	315119	293664	608783		
4	10 to 14	311456	290598	602054		
5	15 to 19	312831	293313	606144		
6	20 to 24	311077	295739	606816		
7	25 to 29	284258	273379	557637		
8	30 to 34	255596	247383	502979		
9	35 to 39	248575	241938	490513		
10	40 to 44	232217	226914	459131		
11	45 to 49	202633	201142	403775		
12	50 to 54	176241	176440	352681		

Step 4: Calculate the percentage female in cell F. Use formula 100*C2/$D$21

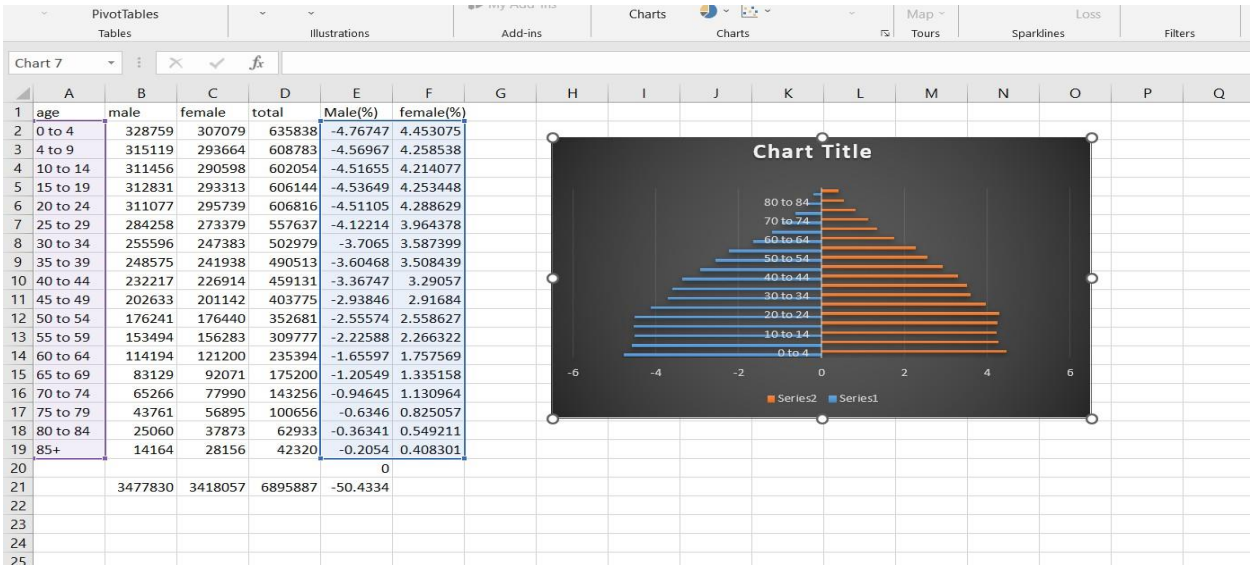
F2 =100*C2/$D$21

	A	B	C	D	E	F
1	age	male	female	total	Male(%)	female(%)
2	0 to 4	328759	307079	635838	-4.76747	4.453075
3	4 to 9	315119	293664	608783	-4.56967	4.258538
4	10 to 14	311456	290598	602054	-4.51655	4.214077
5	15 to 19	312831	293313	606144	-4.53649	4.253448
6	20 to 24	311077	295739	606816	-4.51105	4.288629
7	25 to 29	284258	273379	557637	-4.12214	3.964378
8	30 to 34	255596	247383	502979	-3.7065	3.587399
9	35 to 39	248575	241938	490513	-3.60468	3.508439
10	40 to 44	232217	226914	459131	-3.36747	3.29057
11	45 to 49	202633	201142	403775	-2.93846	2.91684
12	50 to 54	176241	176440	352681	-2.55574	2.558627
13	55 to 59	153494	156283	309777	-2.22588	2.266322
14	60 to 64	114194	121200	235394	-1.65597	1.757569
15	65 to 69	83129	92071	175200	-1.20549	1.335158

Step 5: The modified data may seem as follows.

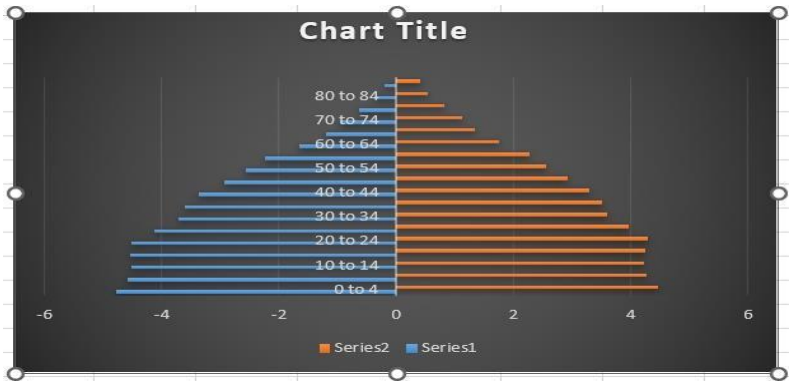
	A	B	C	D	E	F
1	age	male	female	total	Male(%)	female(%)
2	0 to 4	328759	307079	635838	-4.76747	4.453075
3	4 to 9	315119	293664	608783	-4.56967	4.258538
4	10 to 14	311456	290598	602054	-4.51655	4.214077
5	15 to 19	312831	293313	606144	-4.53649	4.253448
6	20 to 24	311077	295739	606816	-4.51105	4.288629
7	25 to 29	284258	273379	557637	-4.12214	3.964378
8	30 to 34	255596	247383	502979	-3.7065	3.587399
9	35 to 39	248575	241938	490513	-3.60468	3.508439
10	40 to 44	232217	226914	459131	-3.36747	3.29057
11	45 to 49	202633	201142	403775	-2.93846	2.91684
12	50 to 54	176241	176440	352681	-2.55574	2.558627
13	55 to 59	153494	156283	309777	-2.22588	2.266322

Step 6: For analysis go to Insert → Bar → 2D



	A	B	C	D	E	F
1	age	male	female	total	Male(%)	female(%)
2	0 to 4	328759	307079	635838	-4.76747	4.453075
3	4 to 9	315119	293664	608783	-4.56967	4.258538
4	10 to 14	311456	290598	602054	-4.51655	4.214077
5	15 to 19	312831	293313	606144	-4.53649	4.253448
6	20 to 24	311077	295739	606816	-4.51105	4.288629
7	25 to 29	284258	273379	557637	-4.12214	3.964378
8	30 to 34	255596	247383	502979	-3.7065	3.587399
9	35 to 39	248575	241938	490513	-3.60468	3.508439
10	40 to 44	232217	226914	459131	-3.36747	3.29057
11	45 to 49	202633	201142	403775	-2.93846	2.91684
12	50 to 54	176241	176440	352681	-2.55574	2.558627
13	55 to 59	153494	156283	309777	-2.22588	2.266322
14	60 to 64	114194	121200	235394	-1.65597	1.757569
15	65 to 69	83129	92071	175200	-1.20549	1.335158
16	70 to 74	65266	77990	143256	-0.94645	1.130964
17	75 to 79	43761	56895	100656	-0.6346	0.825057
18	80 to 84	25060	37873	62933	-0.36341	0.549211
19	85+	14164	28156	42320	-0.2054	0.408301
20					0	
21		3477830	3418057	6895887	-50.4334	

Step 7 :Drag the data and set the graph for analysis.



Conclusion: We have successfully performed the analysis for the given secondary data. We have opened the given data in excel and calculated the total sum of each column and applied formula for the respectively. Then we selected the graph to be a bar graph in 2D for the modified data and the output is obtained.

Practical 3

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

Code:

```
from scipy.stats import ttest_1samp

import numpy as np

ages=np.genfromtxt('H:/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 accepeting null hypothesis")
```

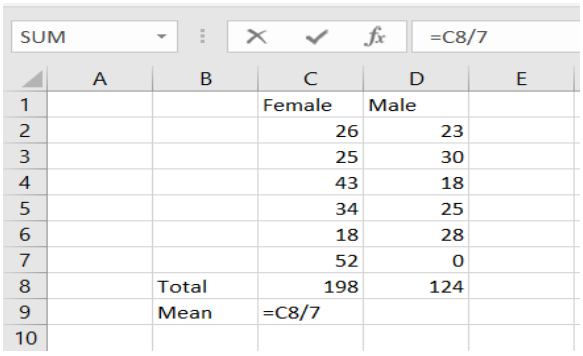
Output:

```
In [3]: runfile('H:/3a.py', wdir='H:')
[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
```

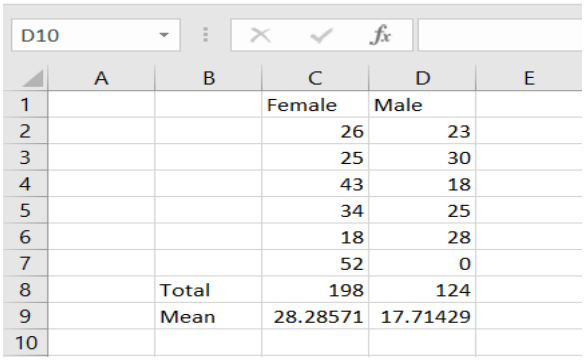
Conclusion: we have successfully performed testing of hypothesis using one sample t-test. The one-sample t-test is a statistical hypothesis test used to determine whether an unknown population mean is different from a specific value.

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

Step 1: Calculate the mean of the samples (Total /Count)

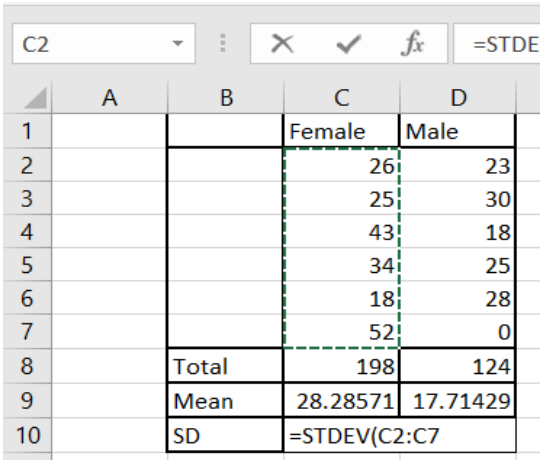


	A	B	C	D	E
1			Female	Male	
2			26	23	
3			25	30	
4			43	18	
5			34	25	
6			18	28	
7			52	0	
8		Total	198	124	
9		Mean	=C8/7		
10					



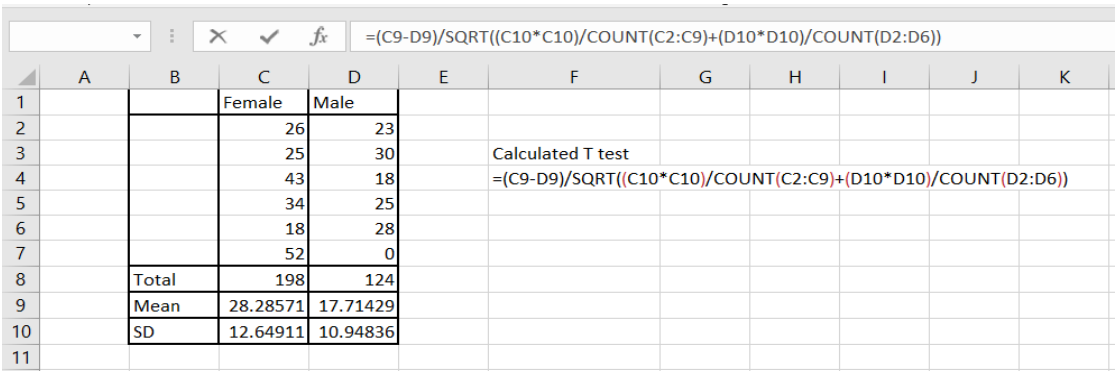
	A	B	C	D	E
1			Female	Male	
2			26	23	
3			25	30	
4			43	18	
5			34	25	
6			18	28	
7			52	0	
8		Total	198	124	
9		Mean	28.28571	17.71429	
10					

Step 2: Calculate the SD of samples STDEV(range)



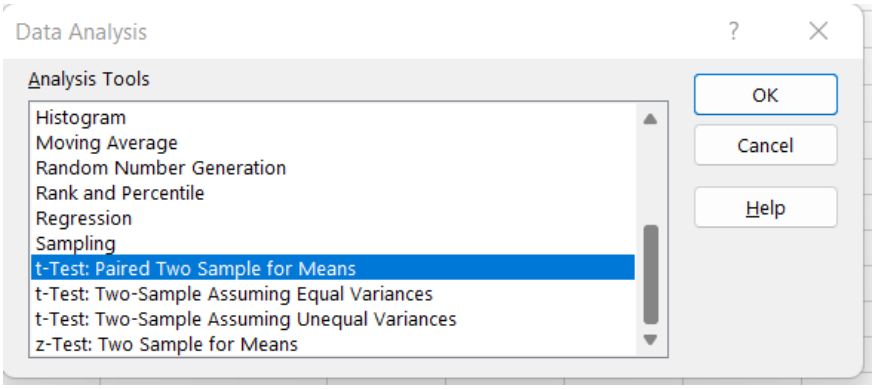
	A	B	C	D
1			Female	Male
2			26	23
3			25	30
4			43	18
5			34	25
6			18	28
7			52	0
8		Total	198	124
9		Mean	28.28571	17.71429
10		SD	=STDEV(C2:C7	

Step 3: Calculate the t-test

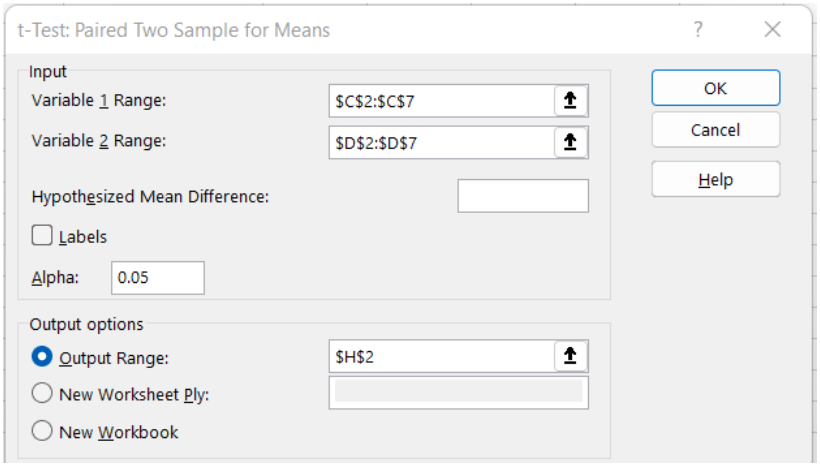


	A	B	C	D	E	F	G	H	I	J	K
1			Female	Male							
2			26	23							
3			25	30		Calculated T test					
4			43	18		=(C9-D9)/SQRT((C10*C10)/COUNT(C2:C9)+(D10*D10)/COUNT(D2:D6))					
5			34	25							
6			18	28							
7			52	0							
8		Total	198	124							
9		Mean	28.28571	17.71429							
10		SD	12.64911	10.94836							
11											

Step 4: Apply t-test paired two Samples for Means.



Step 5: Apply input Range and Output range.



Step 6: Hence we reject null hypothesis.

H15 — t Critical two-tail

	B	C	D
1		Female	Male
2		26	23
3		25	30
4		43	18
5		34	25
6		18	28
7		52	0
8	Total	198	124
9	Mean	28.28571	17.71429
10	SD	12.64911	10.94836

F
Calculated T test
1.594185981

t-Test: Paired Two Sample for Means

	Variable 1	*Variable 2*
Mean	33	20.66666667
Variance	160	119.8666667
Observations	6	6
Pearson Correlation	-0.889613782	
Hypothesized Mean Difference	0	
df	5	
t Stat	1.316901108	
P(T<=t) one-tail	0.122498157	
t Critical one-tail	2.015048373	
P(T<=t) two-tail	0.244996315	
t Critical two-tail	2.570581836	

Conclusion: we have successfully compared the two means of independent samples for a t-test. The Independent Samples t Test compares the means of two independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different.

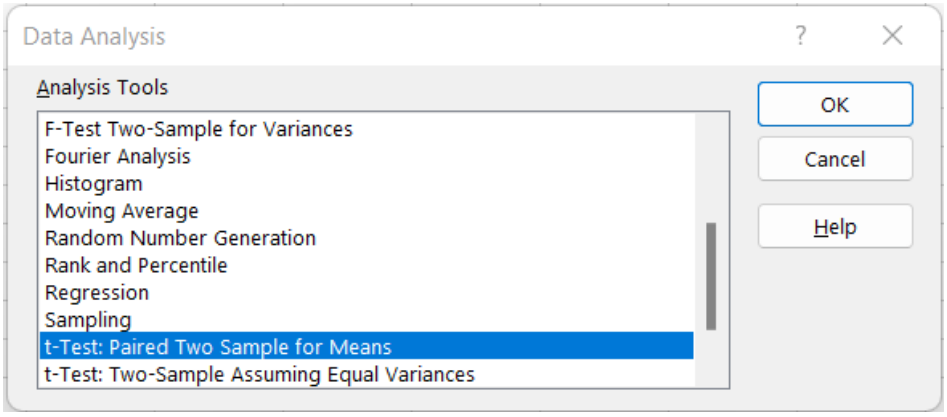
C. Perform testing of Hypothesis using paired t-test.

Step 1: Load the Data

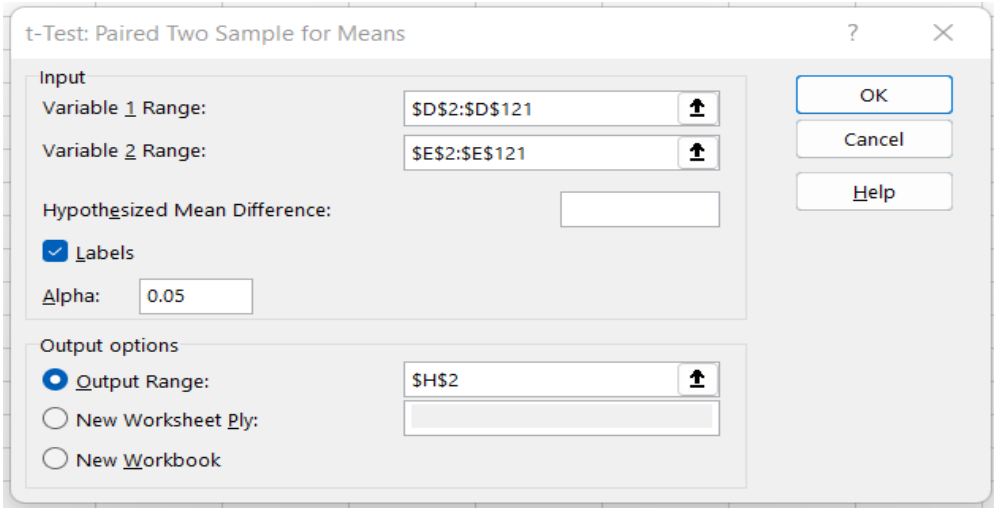
L13

	A	B	C	D	E	F
1	patient	gender	agegrp	bp_before	bp_after	
2	1	Male	30-45	143	153	
3	2	Male	30-45	163	170	
4	3	Male	30-45	153	168	
5	4	Male	30-45	153	142	
6	5	Male	30-45	146	141	
7	6	Male	30-45	150	147	
8	7	Male	30-45	148	133	
9	8	Male	30-45	153	141	
10	9	Male	30-45	153	131	
11	10	Male	30-45	158	125	
12	11	Male	30-45	149	164	
13	12	Male	30-45	173	159	

Step 2: Data -> Data Analysis -> t-test between samples for means.



Step 3: Choose the Input and Output range.



Step 4: Since the samples Means of the Data samples are not equal we reject the null hypothesis that they might be equal.

H21

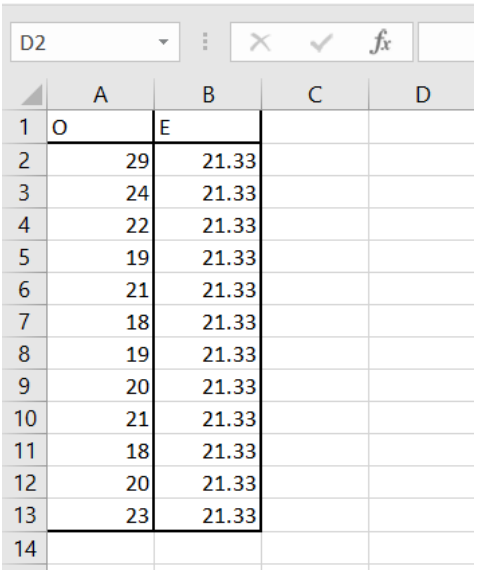
	A	B	C	D	E	F	G	H	I	J	K
1	patient	gender	agegrp	bp_before	bp_after						
2	1	Male	30-45	143	153			t-Test: Paired Two Sample for Means			
3	2	Male	30-45	163	170						
4	3	Male	30-45	153	168				*143*	*153*	
5	4	Male	30-45	153	142			Mean	156.5630252	151.3445378	
6	5	Male	30-45	146	141			Variance	129.2820111	202.6853725	
7	6	Male	30-45	150	147			Observations	119	119	
8	7	Male	30-45	148	133			Pearson Correlation	0.161241417		
9	8	Male	30-45	153	141			Hypothesized Mean Difference	0		
10	9	Male	30-45	153	131			df	118		
11	10	Male	30-45	158	125			t Stat	3.403463555		
12	11	Male	30-45	149	164			P(T<=t) one-tail	0.000454744		
13	12	Male	30-45	173	159			t Critical one-tail	1.657869522		
14	13	Male	30-45	165	135			P(T<=t) two-tail	0.000909488		
15	14	Male	30-45	145	159			t Critical two-tail	1.980272249		
16	15	Male	30-45	143	153						
17	16	Male	30-45	152	126						
18	17	Male	30-45	141	162						
19	18	Male	30-45	176	134						
20	19	Male	30-45	143	136						
21	20	Male	30-45	162	150						

Conclusion: We have performed the testing of hypothesis using paired t-test. A paired t-test is used when we are interested in the difference between two variables for the same subject. The Data is loaded and Data analysis for paired t-test is selected. Input and Output Range of the variables are entered (Labels=tick, Alpha =0.5). In Step 4, the output for the following is displayed.

Practical 4

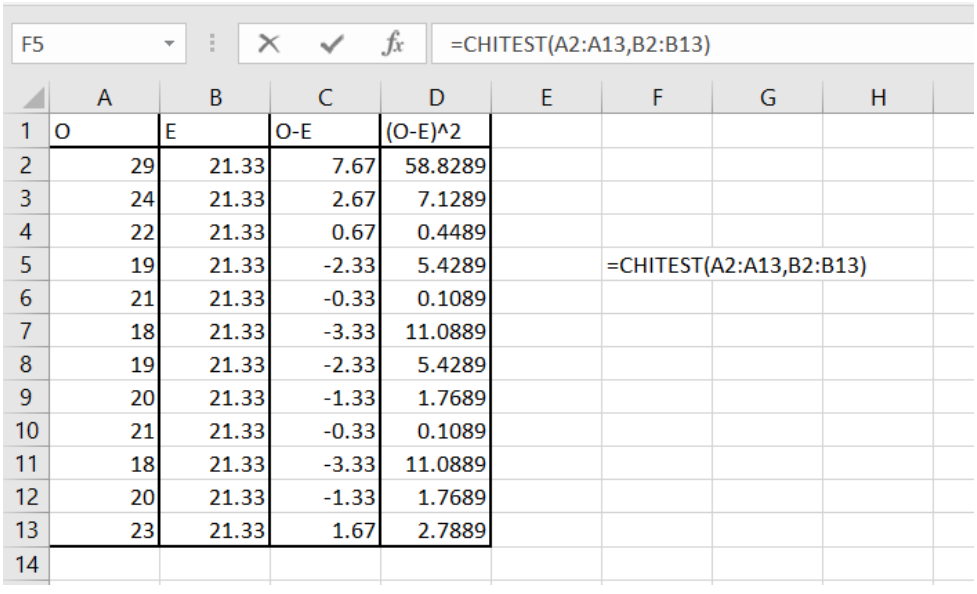
A. Perform testing of hypothesis using chi-squared goodness-of-fit test.

Step 1: Load the data.



	A	B	C	D
1	O	E		
2	29	21.33		
3	24	21.33		
4	22	21.33		
5	19	21.33		
6	21	21.33		
7	18	21.33		
8	19	21.33		
9	20	21.33		
10	21	21.33		
11	18	21.33		
12	20	21.33		
13	23	21.33		
14				

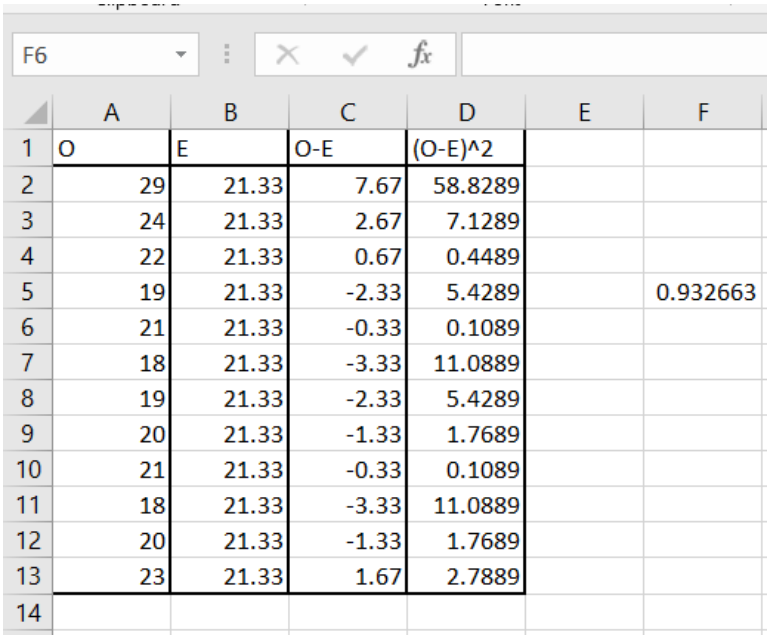
Step 2: Type CHITEST and select Actual(observed value range) and Expected value range.



	A	B	C	D	E	F	G	H
1	O	E	O-E	(O-E)^2				
2	29	21.33	7.67	58.8289				
3	24	21.33	2.67	7.1289				
4	22	21.33	0.67	0.4489				
5	19	21.33	-2.33	5.4289		=CHITEST(A2:A13,B2:B13)		
6	21	21.33	-0.33	0.1089				
7	18	21.33	-3.33	11.0889				
8	19	21.33	-2.33	5.4289				
9	20	21.33	-1.33	1.7689				
10	21	21.33	-0.33	0.1089				
11	18	21.33	-3.33	11.0889				
12	20	21.33	-1.33	1.7689				
13	23	21.33	1.67	2.7889				
14								

Step 3: This calculated value is less than table value which is 19.68. Hence we accept null hypothesis.

i.e 0.932663 < 19.68. H0 accepted.



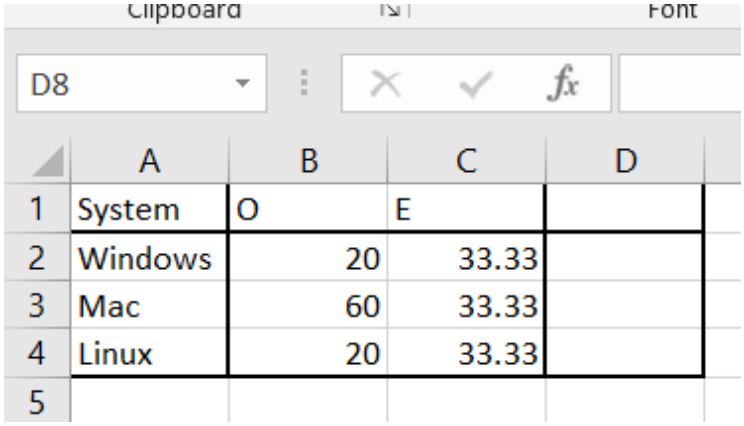
F6

	A	B	C	D	E	F
1	O	E	O-E	(O-E)^2		
2	29	21.33	7.67	58.8289		
3	24	21.33	2.67	7.1289		
4	22	21.33	0.67	0.4489		
5	19	21.33	-2.33	5.4289		0.932663
6	21	21.33	-0.33	0.1089		
7	18	21.33	-3.33	11.0889		
8	19	21.33	-2.33	5.4289		
9	20	21.33	-1.33	1.7689		
10	21	21.33	-0.33	0.1089		
11	18	21.33	-3.33	11.0889		
12	20	21.33	-1.33	1.7689		
13	23	21.33	1.67	2.7889		
14						

Conclusion: In the above practical, we have successfully performed Testing of hypothesis using Chi squared goodness of fit test using Excel. The calculated value of Chi-Square goodness of fit test is compared with the table value. If the calculated value of Chi-Square goodness of fit test is greater than the table value, we will reject the null hypothesis and conclude that there is a significant difference between the observed and the expected frequency.

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

Step 1: Load the data

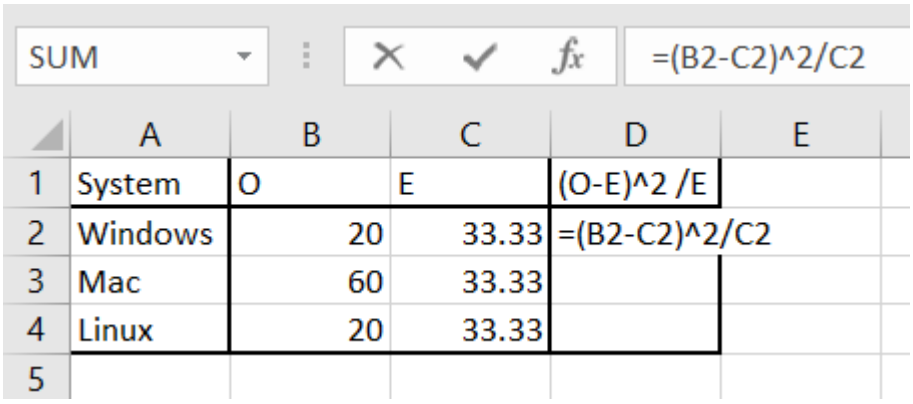


Clipboard Font

D8

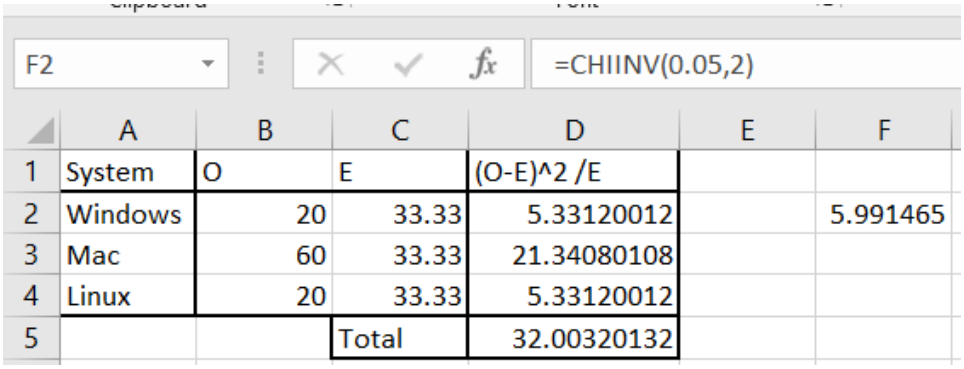
	A	B	C	D
1	System	O	E	
2	Windows	20	33.33	
3	Mac	60	33.33	
4	Linux	20	33.33	
5				

Step 2: Calculate the value of (O-E)^2 /E



	A	B	C	D	E
1	System	O	E	(O-E)^2 /E	
2	Windows	20	33.33	=(B2-C2)^2/C2	
3	Mac	60	33.33		
4	Linux	20	33.33		
5					

Step 3: Calculate Chi square at 5% confidence and degree of freedom n-1=2(in our case)



	A	B	C	D	E	F
1	System	O	E	(O-E)^2 /E		
2	Windows	20	33.33	5.33120012		5.991465
3	Mac	60	33.33	21.34080108		
4	Linux	20	33.33	5.33120012		
5			Total	32.00320132		

Conclusion: Using a chi square test, you've just determined that there is, in fact, a statistically significant relationship between our two categorical variables, s2q10 and s1truan. In addition, we've run another chi square, determining that there is a statistically significant relationship between s2q10 and s1q62a, a measure of whether or not a respondent's father had obtained a degree. Remember that you are simply able to say now that paternal degree and Year 11 truancy both have relationships with respondent enrolment in full time education after secondary school. We cannot say, for example, that a paternal degree causes enrolment in full time education.

Practical 5

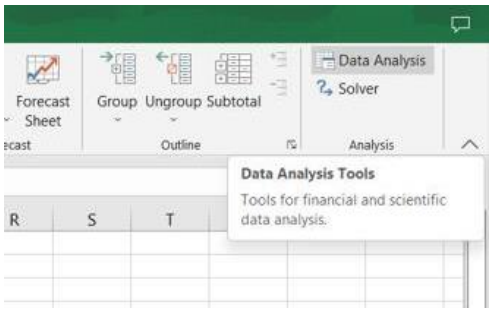
Perform testing of hypothesis using Z-test.

Step 1: Load the data

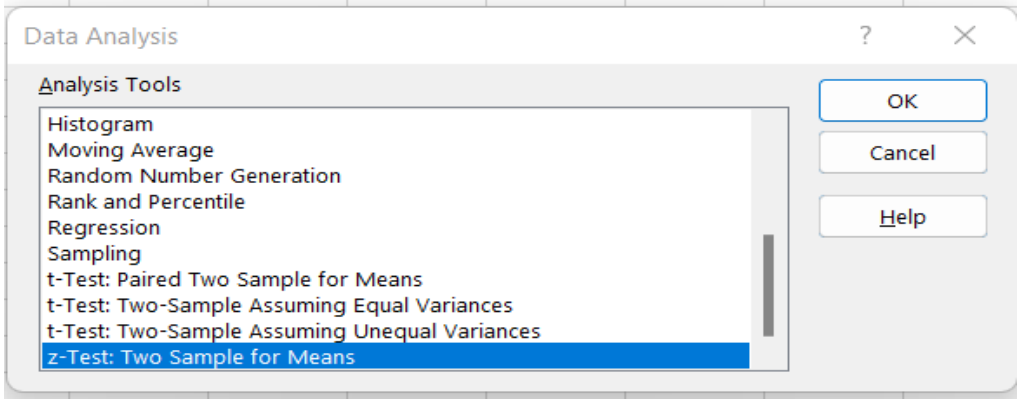
H14

	A	B	C	D	E	F
1	patient	gender	agegrp	bp_before	bp_after	
2	1	Male	30-45	143	153	
3	2	Male	30-45	163	170	
4	3	Male	30-45	153	168	
5	4	Male	30-45	153	142	
6	5	Male	30-45	146	141	
7	6	Male	30-45	150	147	
8	7	Male	30-45	148	133	
9	8	Male	30-45	153	141	
10	9	Male	30-45	153	131	

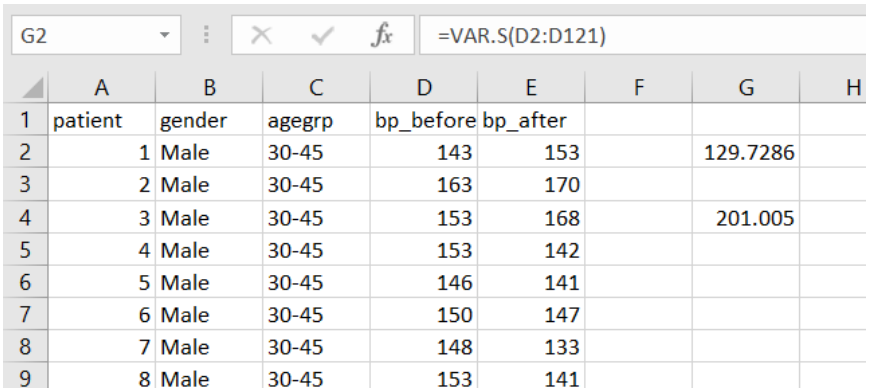
Step 2: To apply Z test we need a sample size over 30. Here our sample size is 120 data points , so to apply Z-test go to Data -> Data analysis.



Step 3: Select Z-Test: Two Sample for means.



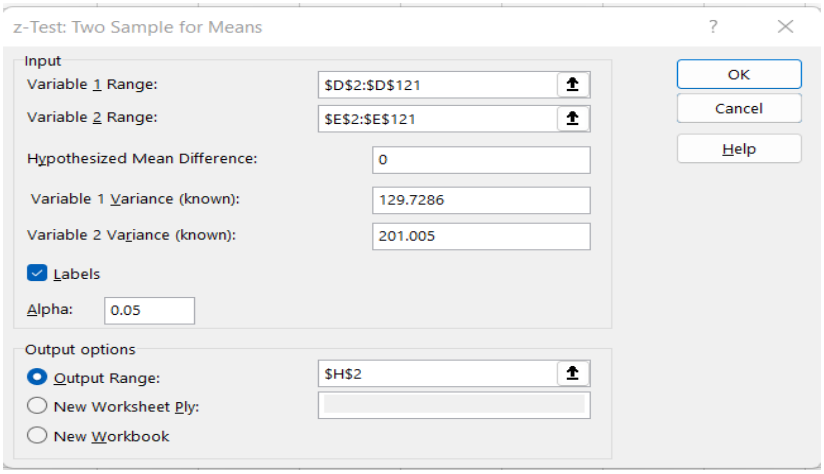
Step 4: Varience can be calculated using VAR.S (range)



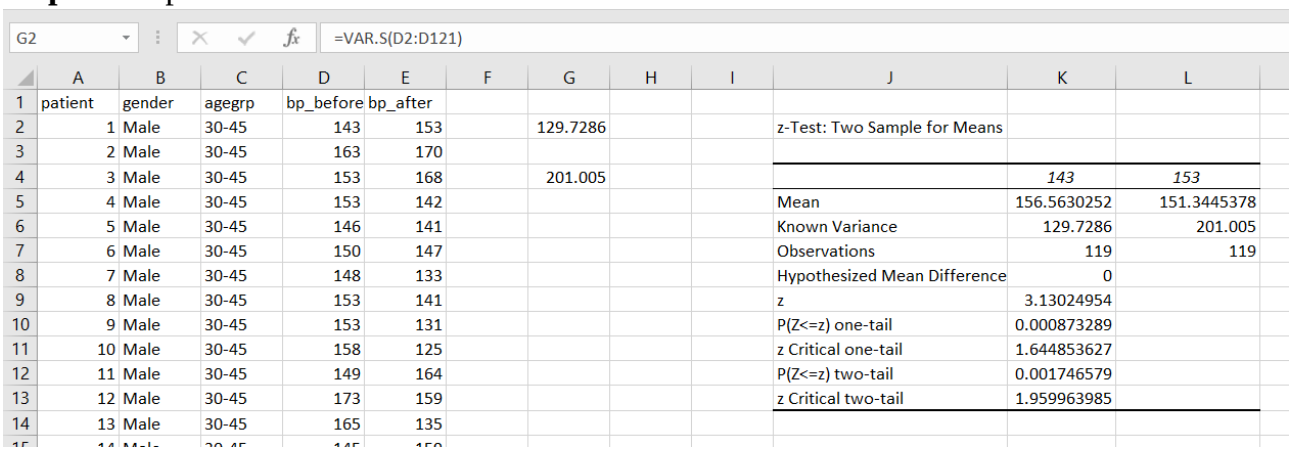
G2 | =VAR.S(D2:D121)

	A	B	C	D	E	F	G	H
1	patient	gender	agegrp	bp_before	bp_after			
2	1	Male	30-45	143	153		129.7286	
3	2	Male	30-45	163	170			
4	3	Male	30-45	153	168		201.005	
5	4	Male	30-45	153	142			
6	5	Male	30-45	146	141			
7	6	Male	30-45	150	147			
8	7	Male	30-45	148	133			
9	8	Male	30-45	153	141			

Step 5: Set the Variable 1 and 2 range.



Step 6: Output



G2 | =VAR.S(D2:D121)

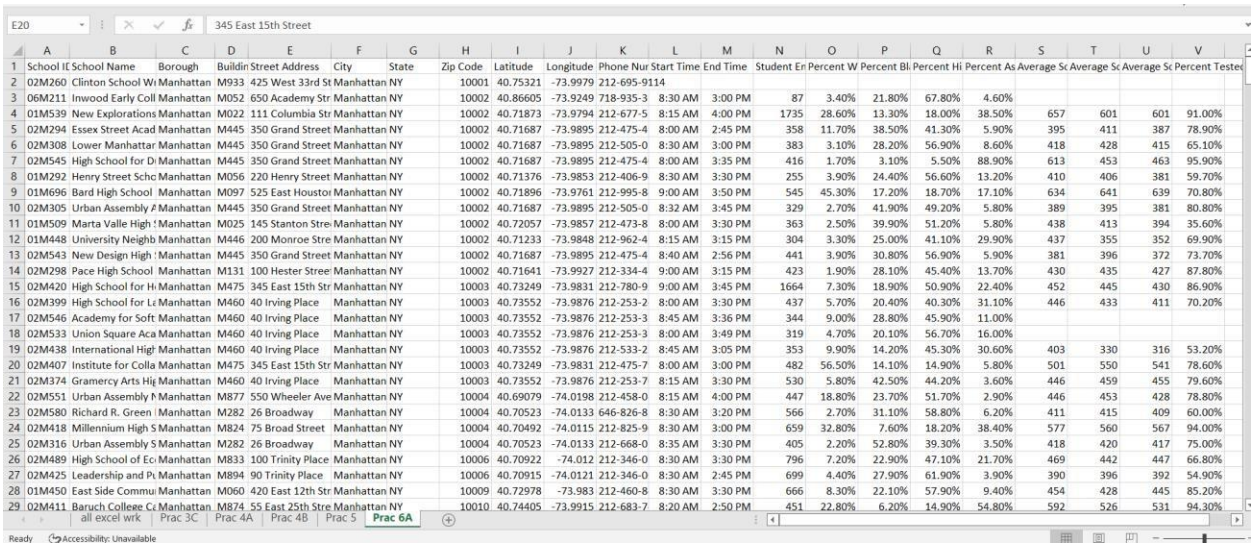
	A	B	C	D	E	F	G	H	I	J	K	L
1	patient	gender	agegrp	bp_before	bp_after							
2	1	Male	30-45	143	153		129.7286			z-Test: Two Sample for Means		
3	2	Male	30-45	163	170							
4	3	Male	30-45	153	168		201.005				*143*	*153*
5	4	Male	30-45	153	142					Mean	156.5630252	151.3445378
6	5	Male	30-45	146	141					Known Variance	129.7286	201.005
7	6	Male	30-45	150	147					Observations	119	119
8	7	Male	30-45	148	133					Hypothesized Mean Difference	0	
9	8	Male	30-45	153	141					z	3.13024954	
10	9	Male	30-45	153	131					P(Z<=z) one-tail	0.000873289	
11	10	Male	30-45	158	125					z Critical one-tail	1.644853627	
12	11	Male	30-45	149	164					P(Z<=z) two-tail	0.001746579	
13	12	Male	30-45	173	159					z Critical two-tail	1.959963985	
14	13	Male	30-45	165	135							

Conclusion: The pre-requisite for using one-sample Z-test for means is that data must belong to normal distribution and the population standard deviation is known. In case, the population standard deviation is unknown, t-test gets used. The z-test for hypothesis testing will help you make confident decisions about your data.

Practical 6

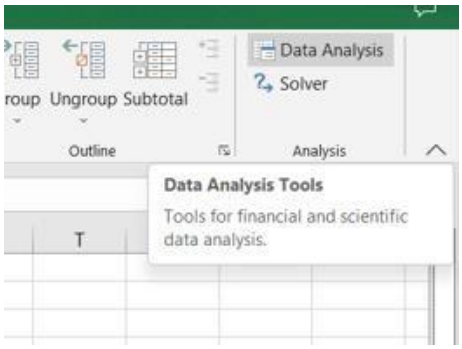
A. Perform testing of hypothesis using One-way ANOVA.

Step 1: Load the data

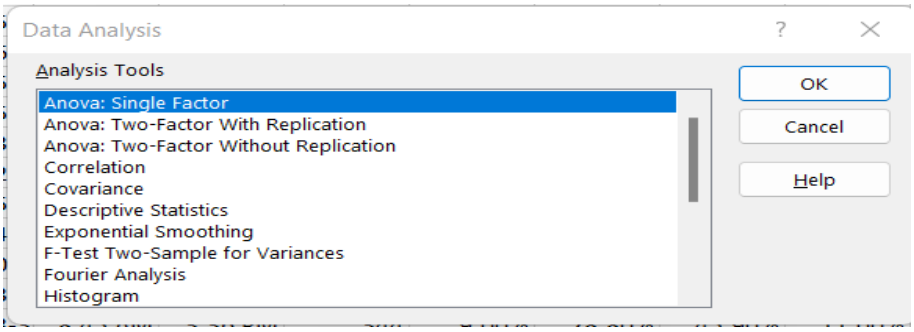


School ID	School Name	Borough	Buildin	Street Address	City	State	Zip Code	Latitude	Longitude	Phone Nur	Start Time	End Time	Student En	Percent W	Percent Bl	Percent Hi	Percent As	Average Sc	Average Sc	Average Sc	Percent Tested
02M260	Clinton School Wi	Manhattan	M933	425 West 33rd St	Manhattan	NY	10001	40.75321	-73.9979	212-695-9114											
06M211	Inwood Early Coll	Manhattan	M052	650 Academy Str	Manhattan	NY	10002	40.86605	-73.9249	718-935-3	8:30 AM	3:00 PM	87	3.40%	21.80%	67.80%	4.60%				
01M539	New Explorations	Manhattan	M022	111 Columbia Str	Manhattan	NY	10002	40.71873	-73.9794	212-677-5	8:15 AM	4:00 PM	1735	28.60%	13.30%	18.00%	38.50%	657	601	601	91.00%
02M294	Essex Street Acad	Manhattan	M445	350 Grand Street	Manhattan	NY	10002	40.71687	-73.9895	212-475-4	8:00 AM	2:45 PM	358	11.70%	38.50%	41.30%	5.90%	395	411	387	78.90%
02M308	Lower Manhattar	Manhattan	M445	350 Grand Street	Manhattan	NY	10002	40.71687	-73.9895	212-505-0	8:30 AM	3:00 PM	383	3.10%	28.20%	56.90%	8.60%	418	428	415	65.10%
02M545	High School for Di	Manhattan	M445	350 Grand Street	Manhattan	NY	10002	40.71687	-73.9895	212-475-4	8:00 AM	3:35 PM	416	1.70%	3.10%	5.50%	88.90%	613	453	463	95.90%
01M292	Henry Street Schc	Manhattan	M056	220 Henry Street	Manhattan	NY	10002	40.71376	-73.9853	212-406-9	8:30 AM	3:30 PM	255	3.90%	24.40%	56.60%	13.20%	410	406	381	59.70%
01M696	Bard High School	Manhattan	M097	525 East Houstor	Manhattan	NY	10002	40.71896	-73.9761	212-995-8	9:00 AM	3:50 PM	545	45.30%	17.20%	18.70%	17.10%	634	641	639	70.80%
02M305	Urban Assembly A	Manhattan	M445	350 Grand Street	Manhattan	NY	10002	40.71687	-73.9895	212-505-0	8:32 AM	3:45 PM	329	2.70%	41.90%	49.20%	5.80%	389	395	381	80.80%
01M509	Marta Valle High	Manhattan	M025	145 Stanton Stre	Manhattan	NY	10002	40.72057	-73.9857	212-473-8	8:00 AM	3:30 PM	363	2.50%	39.90%	51.20%	5.80%	438	413	394	35.60%
01M448	University Neighb	Manhattan	M446	200 Monroe Stre	Manhattan	NY	10002	40.71233	-73.9848	212-962-4	8:15 AM	3:15 PM	304	3.30%	25.00%	41.10%	29.90%	437	355	352	69.90%
02M543	New Design High	Manhattan	M445	350 Grand Street	Manhattan	NY	10002	40.71687	-73.9895	212-475-4	8:40 AM	2:56 PM	441	3.90%	30.80%	56.90%	5.90%	381	396	372	73.70%
02M298	Pace High School	Manhattan	M131	100 Hester Stree	Manhattan	NY	10002	40.71641	-73.9927	212-334-4	9:00 AM	3:15 PM	423	1.90%	28.10%	45.40%	13.70%	430	435	427	87.80%
02M420	High School for Hi	Manhattan	M475	345 East 15th Str	Manhattan	NY	10003	40.73249	-73.9831	212-780-9	9:00 AM	3:45 PM	1664	7.30%	18.90%	50.90%	22.40%	452	445	430	86.90%
02M399	High School for La	Manhattan	M460	40 Irving Place	Manhattan	NY	10003	40.73552	-73.9876	212-253-2	8:00 AM	3:30 PM	437	5.70%	20.40%	40.30%	31.10%	446	433	411	70.20%
02M546	Academy for Soft	Manhattan	M460	40 Irving Place	Manhattan	NY	10003	40.73552	-73.9876	212-253-3	8:45 AM	3:36 PM	344	9.00%	28.80%	45.90%	11.00%				
02M533	Union Square Aca	Manhattan	M460	40 Irving Place	Manhattan	NY	10003	40.73552	-73.9876	212-253-3	8:00 AM	3:49 PM	319	4.70%	20.10%	56.70%	16.00%				
02M438	International High	Manhattan	M460	40 Irving Place	Manhattan	NY	10003	40.73552	-73.9876	212-533-2	8:45 AM	3:05 PM	353	9.90%	14.20%	45.30%	30.60%	403	330	316	53.20%
02M407	Institute for Colla	Manhattan	M475	345 East 15th Str	Manhattan	NY	10003	40.73249	-73.9831	212-475-7	8:00 AM	3:00 PM	482	56.50%	14.10%	14.90%	5.80%	501	550	541	78.60%
02M374	Gramercy Arts Hig	Manhattan	M460	40 Irving Place	Manhattan	NY	10003	40.73552	-73.9876	212-253-7	8:15 AM	3:30 PM	530	5.80%	42.50%	44.20%	3.60%	446	459	455	79.60%
02M551	Urban Assembly N	Manhattan	M877	550 Wheeler Ave	Manhattan	NY	10004	40.69079	-74.0198	212-458-0	8:15 AM	4:00 PM	447	18.80%	23.70%	51.70%	2.90%	446	453	428	78.80%
02M580	Richard R. Green	Manhattan	M282	26 Broadway	Manhattan	NY	10004	40.70523	-74.0133	646-826-8	8:30 AM	3:20 PM	566	2.70%	31.10%	58.80%	6.20%	411	415	409	60.00%
02M418	Millennium High S	Manhattan	M824	75 Broad Street	Manhattan	NY	10004	40.70492	-74.0115	212-825-9	8:30 AM	3:00 PM	659	32.80%	7.60%	18.20%	38.40%	577	560	567	94.00%
02M316	Urban Assembly S	Manhattan	M282	26 Broadway	Manhattan	NY	10004	40.70523	-74.0133	212-668-0	8:35 AM	3:30 PM	405	2.20%	52.80%	39.30%	3.50%	418	420	417	75.00%
02M489	High School of Ec	Manhattan	M833	100 Trinity Place	Manhattan	NY	10006	40.70922	-74.012	212-346-0	8:30 AM	3:30 PM	796	7.20%	22.90%	47.10%	21.70%	469	442	447	66.80%
02M425	Leadership and Pu	Manhattan	M894	90 Trinity Place	Manhattan	NY	10006	40.70915	-74.0121	212-346-0	8:30 AM	2:45 PM	699	4.40%	27.90%	61.90%	3.90%	390	396	392	54.90%
01M450	East Side Commu	Manhattan	M060	420 East 12th Str	Manhattan	NY	10009	40.72978	-73.983	212-460-8	8:30 AM	3:30 PM	666	8.30%	22.10%	57.90%	9.40%	454	428	445	85.20%
02M411	Baruch College Ca	Manhattan	M874	55 East 25th Stre	Manhattan	NY	10010	40.74405	-73.9915	212-683-7	8:20 AM	2:50 PM	451	22.80%	6.20%	14.90%	54.80%	592	526	531	94.30%

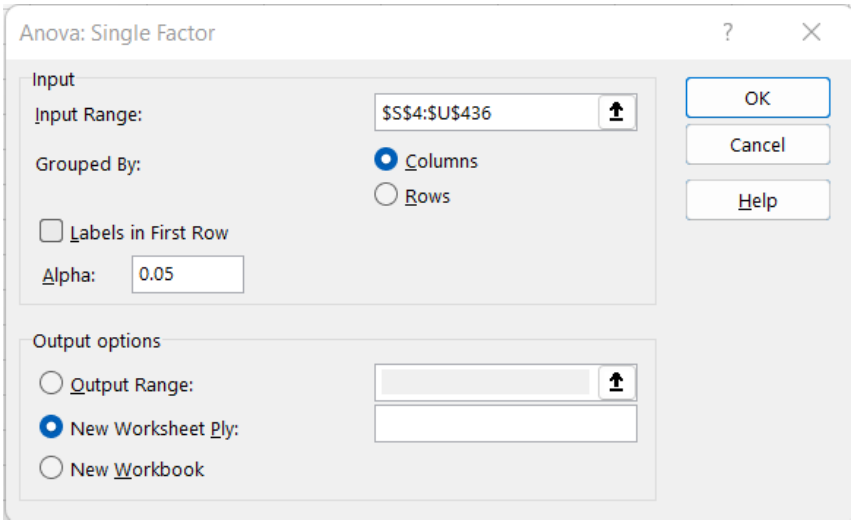
Step 2: To Calculate Single factor(one-way) anova we use cells S,T,U .
Data -> Data Analysis.



Step 3: Select Anova: Single Factor



Step 4: Select the cells of S-T-U for input range



Step 5: Output

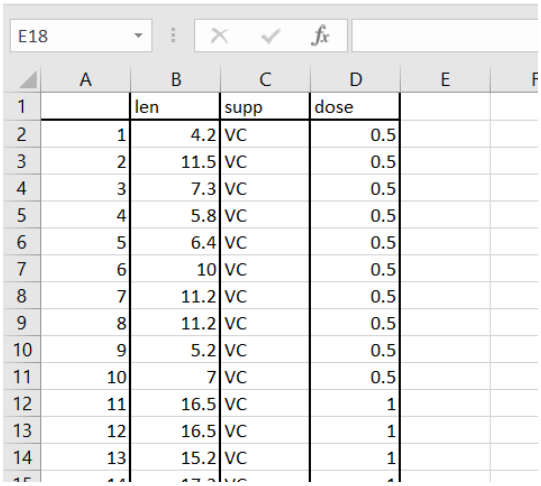
I8

	A	B	C	D	E	F	G
1	Anova: Single Factor						
2							
3	SUMMARY						
4	*Groups*	*Count*	*Sum*	*Average*	*Variance*		
5	Column 1	375	162354	432.944	5177.144		
6	Column 2	375	159189	424.504	3829.267		
7	Column 3	375	156922	418.4587	4166.522		
8							
9							
10	ANOVA						
11	*ce of Varia*	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
12	Between G	39700.57	2	19850.28	4.520698	0.01108	3.003745
13	Within Grc	4926677	1122	4390.977			
14							
15	Total	4966377	1124				
16							

Conclusion: In the above practical, we have successfully performed One-way ANOVA on 'scores.csv' dataset. Since, in the resulting output the p-value is less than 0.05 so we are rejecting Null Hypothesis and we concludes that there is a significant difference between the SAT scores for each group mean.

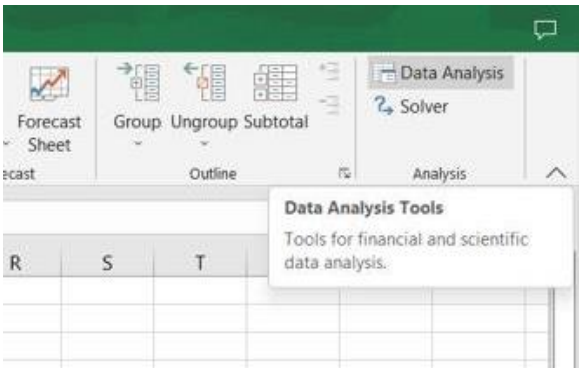
B. Perform testing of hypothesis using Two-way ANOVA.

Step 1: Load the data.

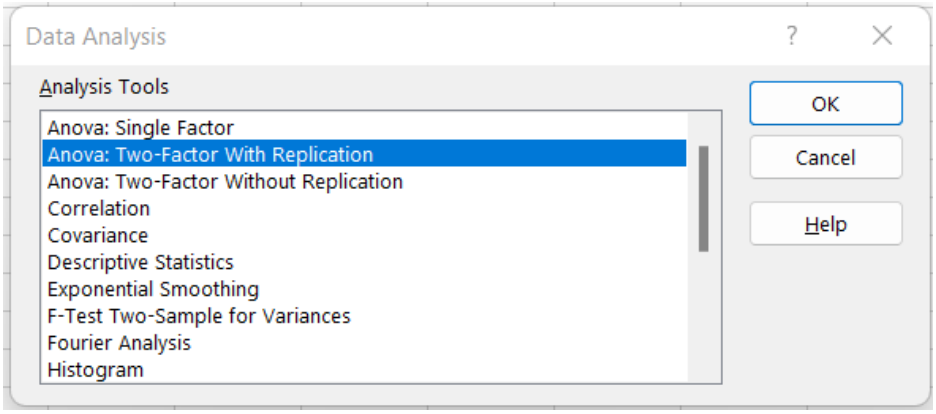


	A	B	C	D
1		len	supp	dose
2	1	4.2	VC	0.5
3	2	11.5	VC	0.5
4	3	7.3	VC	0.5
5	4	5.8	VC	0.5
6	5	6.4	VC	0.5
7	6	10	VC	0.5
8	7	11.2	VC	0.5
9	8	11.2	VC	0.5
10	9	5.2	VC	0.5
11	10	7	VC	0.5
12	11	16.5	VC	1
13	12	16.5	VC	1
14	13	15.2	VC	1

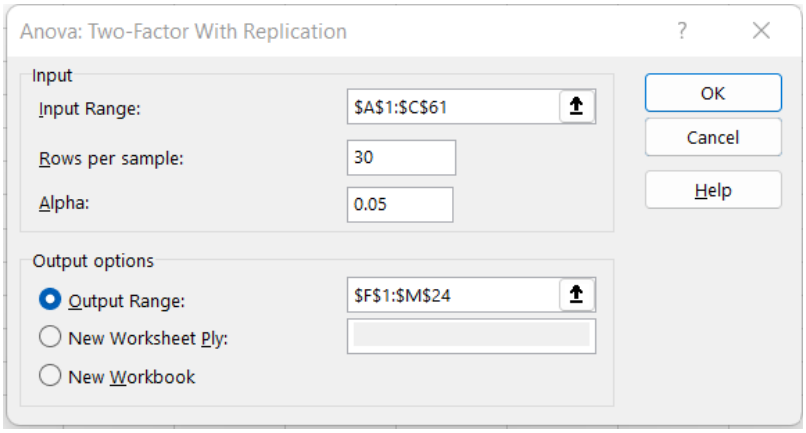
Step 2: Data -> Data Analysis



Step 3: Select Anova: Two Factor with Replication



Step 4: Select input and output range



Step 5: Output

Anova: Two-Factor With Replication

SUMMARY	len	dose	Total
1			
Count	30	30	60
Sum	508.9	35	543.9
Average	16.9633	1.16667	9.065
Variance	68.3272	0.4023	97.2233
31			
Count	30	30	60
Sum	619.9	35	654.9
Average	20.6633	1.16667	10.915
Variance	43.6334	0.4023	118.285
Total			
Count	60	60	
Sum	1128.8	70	
Average	18.8133	1.16667	
Variance	58.512	0.39548	

ANOVA

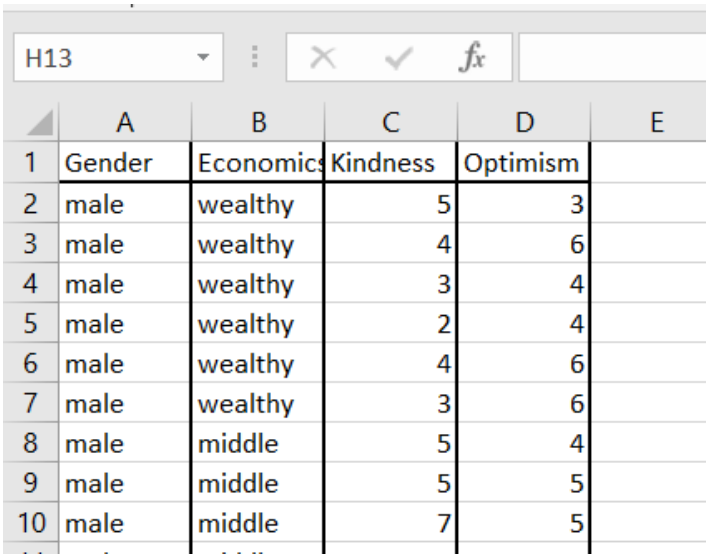
Source of Varia	SS	df	MS	F	P-value	F crit
Sample	102.675	1	102.675	3.64208	0.05881	3.92288
Columns	9342.15	1	9342.15	331.384	8.5E-36	3.92288
Interactior	102.675	1	102.675	3.64208	0.05881	3.92288
Within	3270.19	116	28.1913			
Total	12817.7	119				

Conclusion: In the above practical, we have successfully performed Two-way ANOVA. Since, P-value = 0.0588 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 (0.05881) 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.

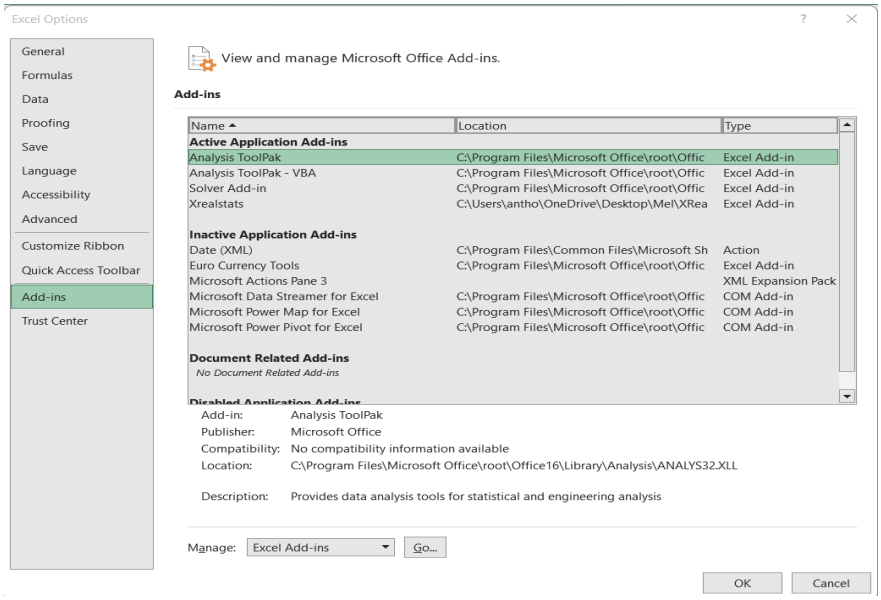
Step 1: Load the Data.



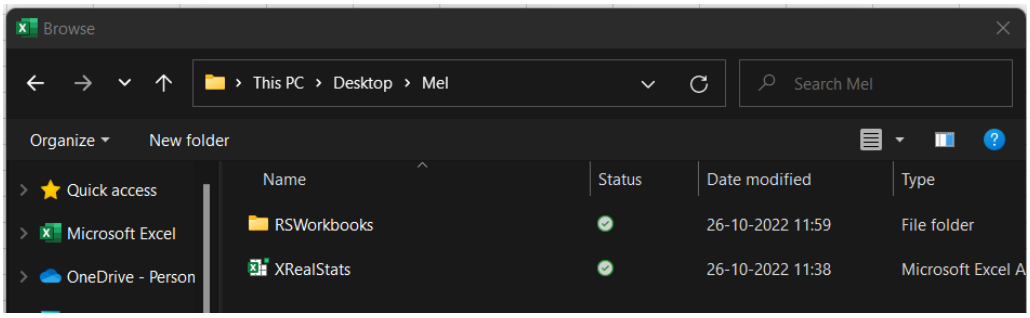
	A	B	C	D	E
1	Gender	Economics	Kindness	Optimism	
2	male	wealthy	5	3	
3	male	wealthy	4	6	
4	male	wealthy	3	4	
5	male	wealthy	2	4	
6	male	wealthy	4	6	
7	male	wealthy	3	6	
8	male	middle	5	4	
9	male	middle	5	5	
10	male	middle	7	5	

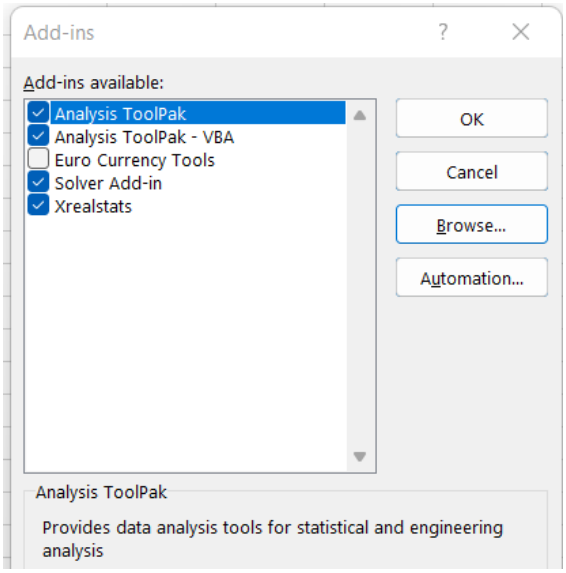
Step 2: Install Add-in in excel.

Select **File -> Help | Options -> Add-Ins** and click on the **Go** button at the bottom of the window.

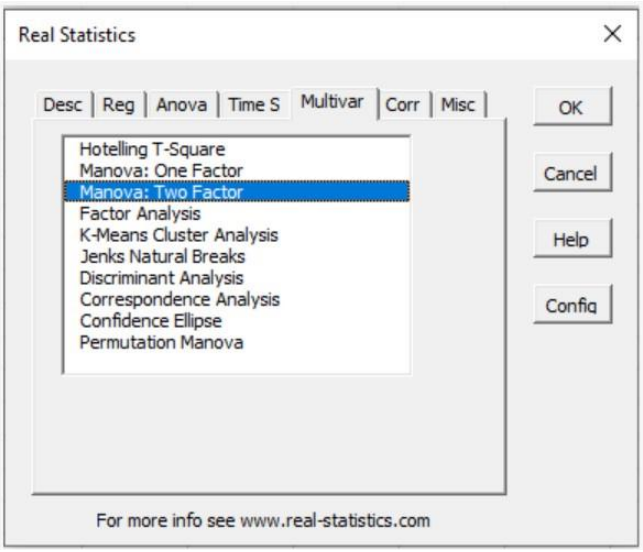


Step 3: Click on browse and select XrealStats file. Check the following check boxes.

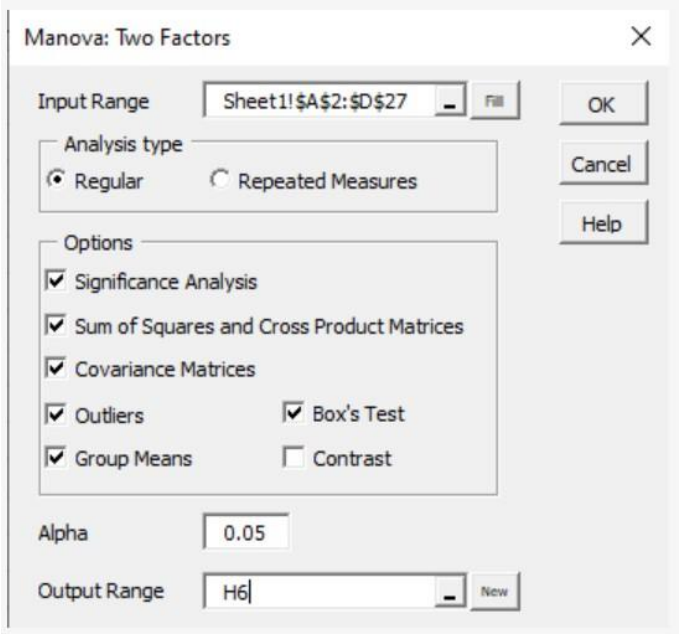




Step 4: Once loaded , CTRL+M to perform MANOVA. Click Multivar -> Manova: two factor -> OK.



Step 5: Select the data excluding column names. Select a cell for output



Step 6: Output

Two-Way MANOVA

fact A	*stat*	*df1*	*df2*	*F*	*p-value*	*part eta-sq*
Pillai Trac	0.214135	2	18	2.452347	0.114323	0.214135
Wilk's Lam	0.785865	2	18	2.452347	0.114323	0.214135
Hotelling	0.272483	2	18	2.452347	0.114323	0.214135
Roy's Lg R	0.272483					

fact B	*stat*	*df1*	*df2*	*F*	*p-value*	*part eta-sq*
Pillai Trac	0.339044	4	38	1.939195	0.123777	0.169522
Wilk's Lam	0.820428	4	36	1.969888	0.120034	0.179572
Hotelling	0.467615	4	34	1.987365	0.118648	0.189501
Roy's Lg R	0.425176					

fact AB	*stat*	*df1*	*df2*	*F*	*p-value*	*part eta-sq*
Pillai Trac	0.249126	4	38	1.35172	0.268831	0.124563
Wilk's Lam	0.871554	4	36	1.326381	0.278864	0.128446
Hotelling	0.304976	4	34	1.296146	0.291053	0.132312
Roy's Lg R	0.260917					

SSCP Matrices

Tot	
130	64
64	142

Row (A)	
27.08333	17.5
17.5	11.30769

Column (B)	
31.90278	28.18056
28.18056	30.36111

Interaction (AB)	
5.963889	0.019444
0.019444	21.0312

Res	
65.05	18.3
18.3	79.3

Conclusion: In the above practical, we have successfully performed two-way MANOVA. Since, the p-value of fact A is 0.114323 and fact B is 0.118648 as we can see they are different so we are rejecting null Hypothesis as there is significant difference between mean SAT scores of two groups.

Practical 7

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

Step 1: Load the data.

I16 sfe

	A	B	C	D	E	F	G	H	I	J	K
1	Sr. No.	Roll No.	Name	Gender	Grade		Sr. No.	Roll No.	Name	Gender	Grade
2	1	1	xyz	Male	O		24	3	add	Female	A
3	2	2	mno	Male	A		25	7	sd	Female	A
4	3	5	pqr	Male	O		26	9	hg	Female	C
5	4	13	abc	Male	B		27	11	dg	Female	D
6	5	16	xyz	Male	O		28	14	pgu	Female	F
7	6	17	mno	Male	O		29	25	yt	Female	O
8	7	34	pqr	Male	D		30	36	f	Female	C
9	8	35	abc	Male	O		31	40	gh	Female	C
10	9	38	xyz	Male	O		32	41	t	Female	B
11	10	42	mno	Male	C		33	46	es	Female	A
12	11	43	pqr	Male	O		34	47	gg	Female	B
13	12	45	abc	Male	O		35	10	gfh	Female	D
14	13	48	xyz	Male	B		36	20	ghy	Female	C
15	14	49	mno	Male	O		37	21	tgs	Female	B
16	15	50	pqr	Male	D		38	72	sfe	Female	O
17	16	51	abc	Male	O		39	73	sgg	Female	D
18	17	54	xyz	Male	A		40	75	dgt	Female	A
19	18	55	mno	Male	B		41	77	dgt	Female	B
20	19	56	pqr	Male	D		42	82	jgt	Female	D
21	20	59	abc	Male	O		43	84	ghh	Female	D
22	21	61	xyz	Male	F		44	91	fer	Female	D
23	22	62	mno	Male	A		45	95	gyd	Female	D
24	23	63	pqr	Male	C		46	4	gtt	Female	C

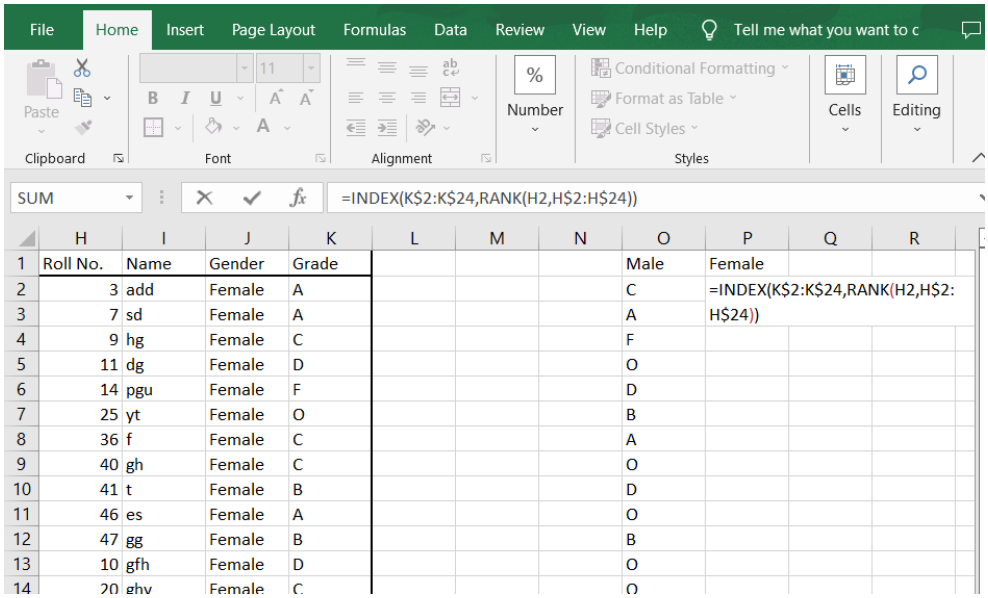
Step 2: Set Cell O1= Male and Cell P2= Female

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))

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

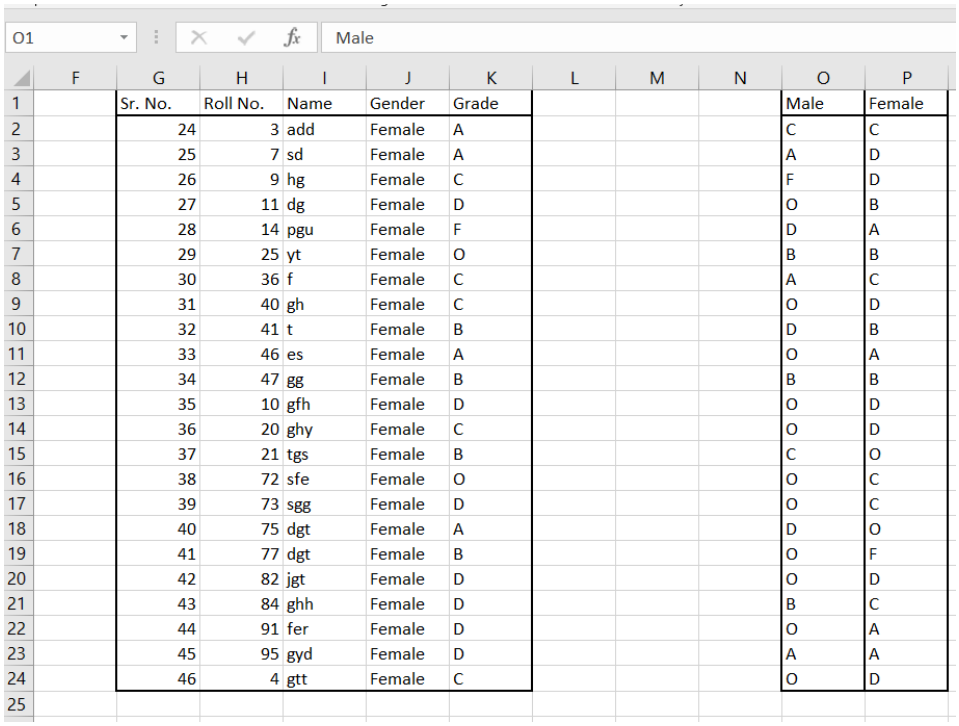
	H	I	J	K	L	M	N	O	P	Q	R
1	Roll No.	Name	Gender	Grade				=INDEX(E$2:E$62,RANK(B2,B$2:B$62))			
2	3	add	Female	A							
3	7	sd	Female	A							
4	9	hg	Female	C							
5	11	dg	Female	D							
6	14	pgu	Female	F							
7	25	yt	Female	O							
8	36	f	Female	C							
9	40	gh	Female	C							
10	41	t	Female	B							
11	46	es	Female	A							
12	47	gg	Female	B							
13	10	gfh	Female	D							

Step 3: Repeat the step to perform random sampling on Female data.



	H	I	J	K	L	M	N	O	P	Q	R
1	Roll No.	Name	Gender	Grade				Male	Female		
2	3	add	Female	A				C	=INDEX(K$2:K$24,RANK(H2,H$2:H$24))		
3	7	sd	Female	A				A			
4	9	hg	Female	C				F			
5	11	dg	Female	D				O			
6	14	pgu	Female	F				D			
7	25	yt	Female	O				B			
8	36	f	Female	C				A			
9	40	gh	Female	C				O			
10	41	t	Female	B				D			
11	46	es	Female	A				O			
12	47	gg	Female	B				B			
13	10	gfh	Female	D				O			
14	20	ghy	Female	C				O			

Step 4: Output

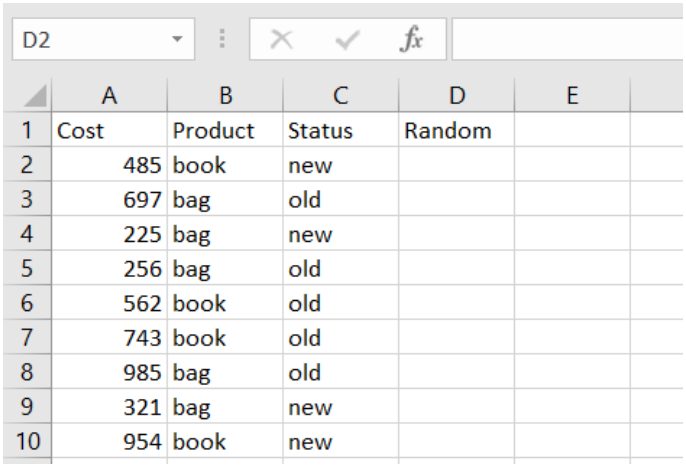


	F	G	H	I	J	K	L	M	N	O	P
1		Sr. No.	Roll No.	Name	Gender	Grade				Male	Female
2		24	3	add	Female	A				C	C
3		25	7	sd	Female	A				A	D
4		26	9	hg	Female	C				F	D
5		27	11	dg	Female	D				O	B
6		28	14	pgu	Female	F				D	A
7		29	25	yt	Female	O				B	B
8		30	36	f	Female	C				A	C
9		31	40	gh	Female	C				O	D
10		32	41	t	Female	B				D	B
11		33	46	es	Female	A				O	A
12		34	47	gg	Female	B				B	B
13		35	10	gfh	Female	D				O	D
14		36	20	ghy	Female	C				O	D
15		37	21	tgs	Female	B				C	O
16		38	72	sfe	Female	O				O	C
17		39	73	sgg	Female	D				O	C
18		40	75	dgt	Female	A				D	O
19		41	77	dgt	Female	B				O	F
20		42	82	jgt	Female	D				O	D
21		43	84	ghh	Female	D				B	C
22		44	91	fer	Female	D				O	A
23		45	95	gyd	Female	D				A	A
24		46	4	gtt	Female	C				O	D
25											

Conclusion: A simple random sample is a subset of a statistical population in which each member of the subset has an equal probability of being chosen.
we have successfully performed Random sampling and analyze it.

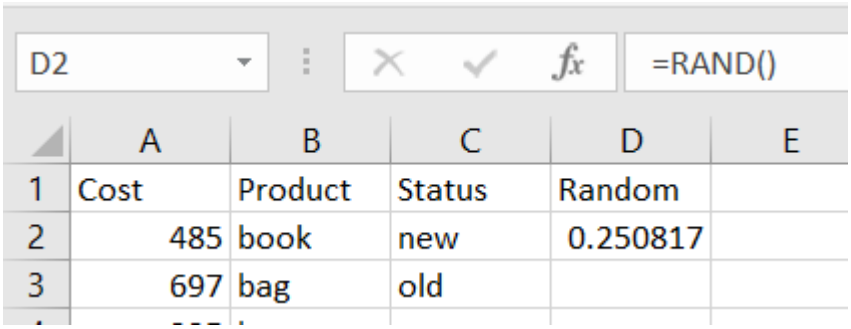
B.Perform the Stratified sampling for the given data and analyse it

Step 1: Load the data.



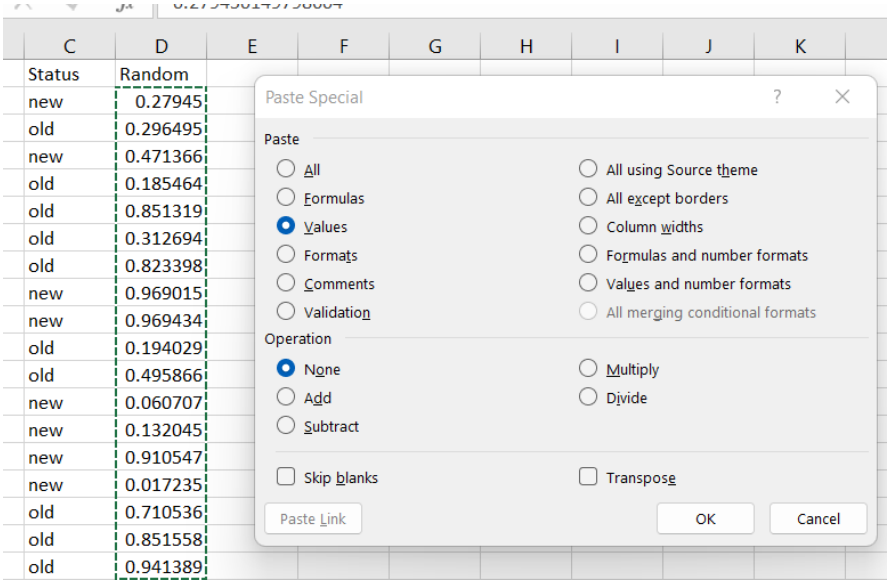
	A	B	C	D	E
1	Cost	Product	Status	Random	
2	485	book	new		
3	697	bag	old		
4	225	bag	new		
5	256	bag	old		
6	562	book	old		
7	743	book	old		
8	985	bag	old		
9	321	bag	new		
10	954	book	new		

Step 2: Assign Random values using RAND() function.



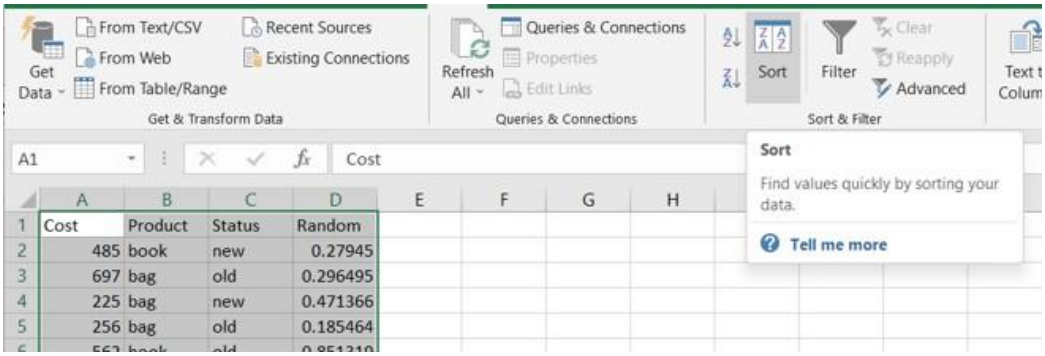
	A	B	C	D	E
1	Cost	Product	Status	Random	
2	485	book	new	0.250817	
3	697	bag	old		

Step 3: Copy the entire column D and paste only values

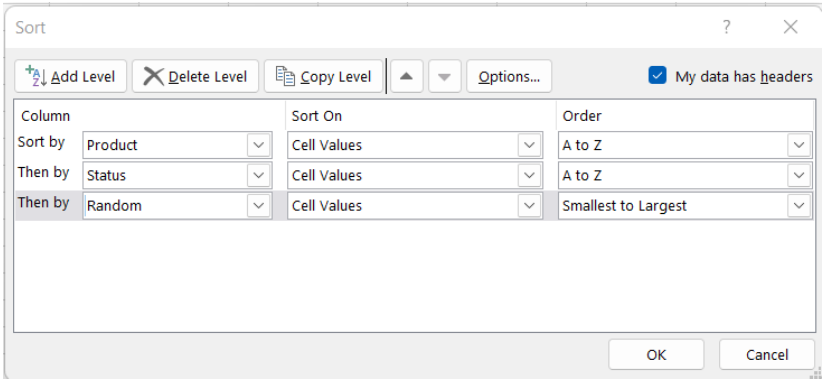


Status	Random
new	0.27945
old	0.296495
new	0.471366
old	0.185464
old	0.851319
old	0.312694
old	0.823398
new	0.969015
new	0.969434
old	0.194029
old	0.495866
new	0.060707
new	0.132045
new	0.910547
new	0.017235
old	0.710536
old	0.851558
old	0.941389

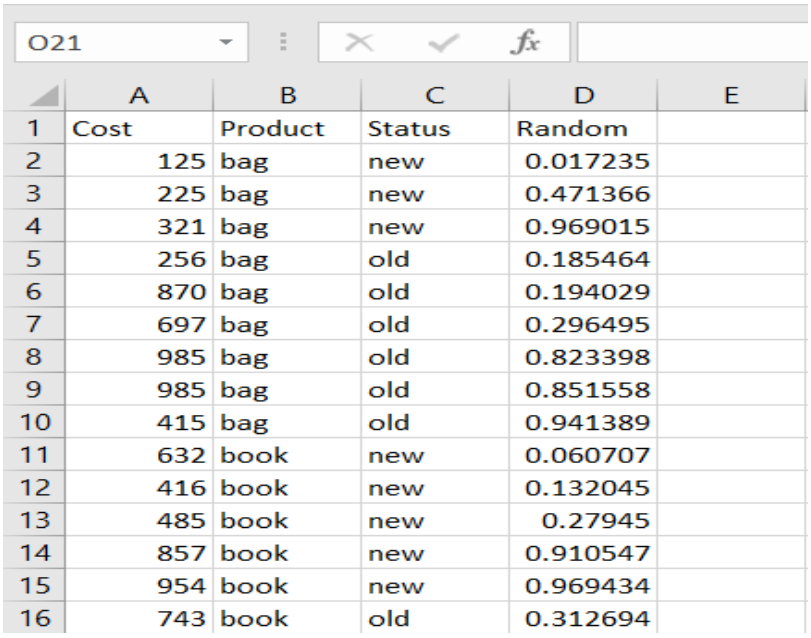
Step 4: To perform stratified sampling and obtain data where we get 2 new books cost, 2 old books cost, 2 new bags cost, 2 old bags cost. Select the data and click on sort.



Step 5: Sort the data by product , status and random.



Step 6: the output obtained will be as follows.



O21

	A	B	C	D	E
1	Cost	Product	Status	Random	
2	125	bag	new	0.017235	
3	225	bag	new	0.471366	
4	321	bag	new	0.969015	
5	256	bag	old	0.185464	
6	870	bag	old	0.194029	
7	697	bag	old	0.296495	
8	985	bag	old	0.823398	
9	985	bag	old	0.851558	
10	415	bag	old	0.941389	
11	632	book	new	0.060707	
12	416	book	new	0.132045	
13	485	book	new	0.27945	
14	857	book	new	0.910547	
15	954	book	new	0.969434	
16	743	book	old	0.312694	

Conclusion: Conclusion: In stratified sampling, researchers divide subjects into subgroups called strata based on characteristics that they share (e.g., race, gender, educational attainment). Once divided, each subgroup is randomly sampled using another probability sampling method. We have successfully performed stratified sampling for the given data and its analysis. We have opened the data in excel and assigned random values using RAND() function followed by data sorting based on the columns and the final output is obtained.

Practical 8

Write a program for computing different correlation

A. Positive Correlation.

Code:

```
import matplotlib

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:

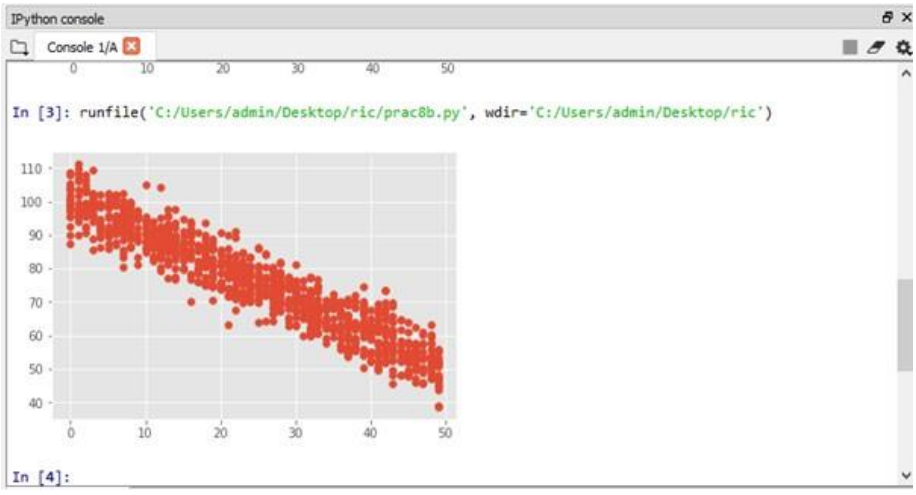
Conclusion: A positive correlation is a relationship between two variables that move in tandem—that is, in the same direction. A positive correlation exists when one variable decreases as the other variable decreases, or one variable increases while the other increases. we have successfully computed positive correlation.

B. Negative Correlation.

Code:

```
import matplotlib

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:



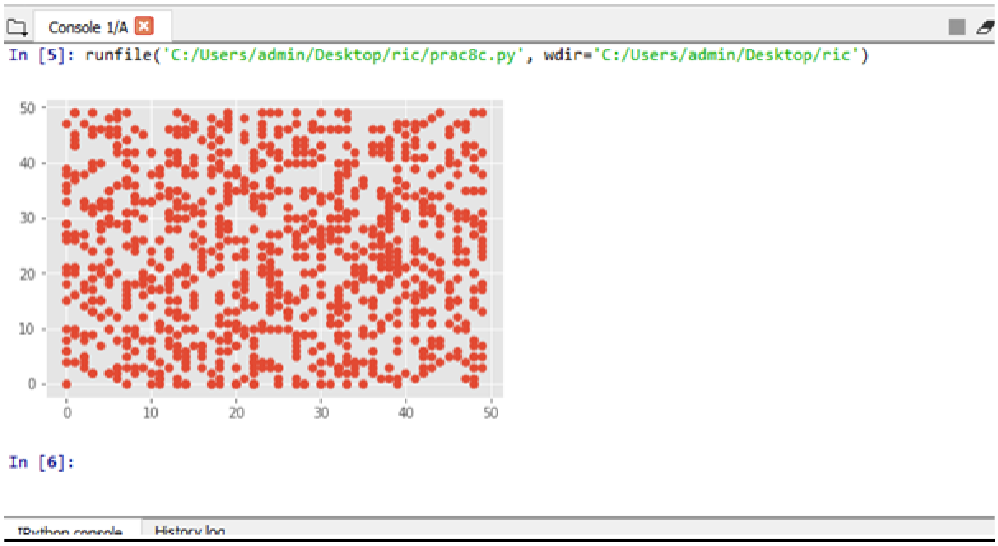
Conclusion: we have successfully computed negative correlation. A negative correlation is a relationship between two variables such that as the value of one variable increases, the other decreases. Correlation is expressed on a range from +1 to -1, known as the correlation coefficient. Values below zero express negative correlation. A perfect negative correlation has a coefficient of -1, indicating that an increase in one variable reliably predicts a decrease in the other one.

C. No/Weak Correlation.

Code:

```
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:



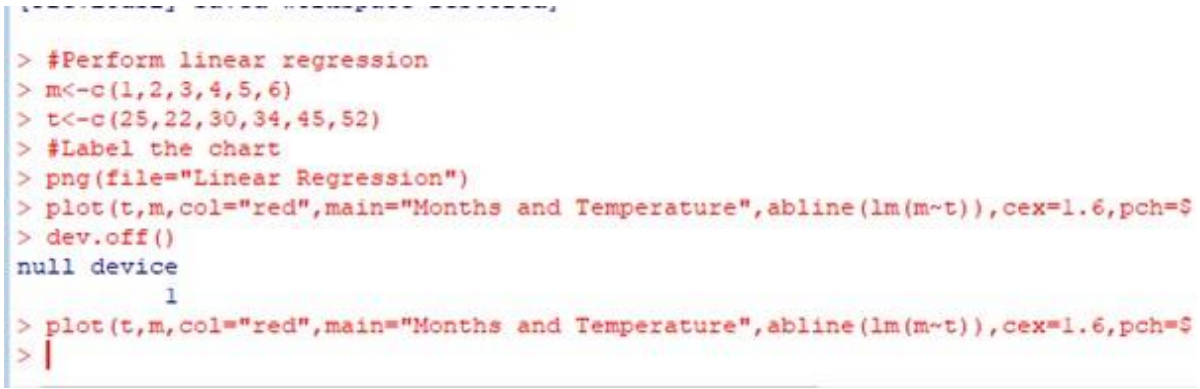
Conclusion: we have successfully computed no/weak correlation. A weak positive correlation indicates that, although both variables tend to go up in response to one another, the relationship is not very strong. A strong negative correlation, on the other hand, indicates a strong connection between the two variables, but that one goes up whenever the other one goes down.

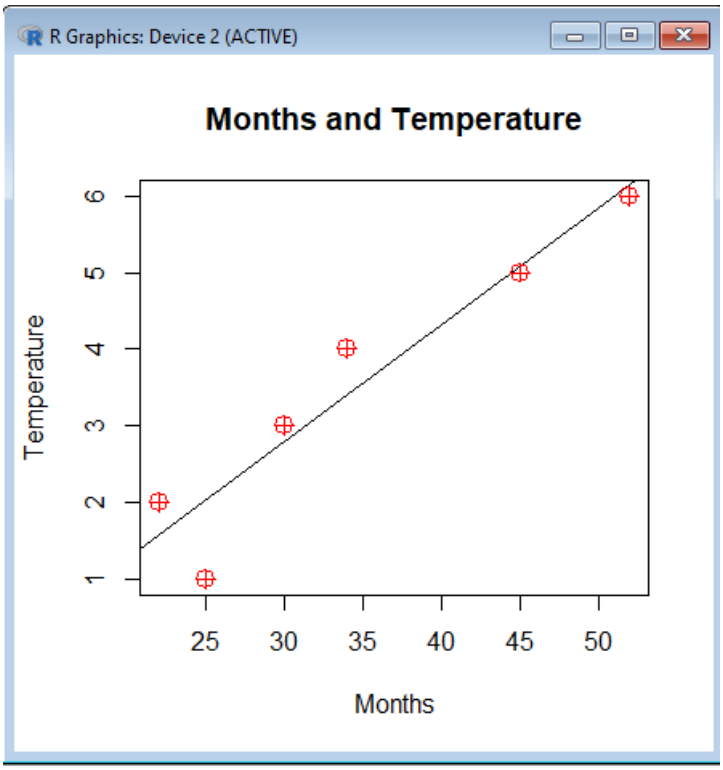
Practical 9

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

Code:

```
> #Perform linear regression

> m<-c(1,2,3,4,5,6)

> t<-c(25,22,30,34,45,52)

> #Label the chart

> png(file="Linear Regression")

> plot(t,m,col="red",main="Months and
Temperature",abline(lm(m~t)),cex=1.6,pch=10,xlab="Months",ylab="
Temperature")

> dev.off()

null device

          1

> plot(t,m,col="red",main="Months and
Temperature",abline(lm(m~t)),cex=1.6,pch=10,xlab="Months",ylab="
Temperature")
```





Conclusion: we have successfully performed linear regression for predicted. Linear regression analysis is used to predict the value of a variable based on the value of another variable. The variable you want to predict is called the dependent variable. The variable you are using to predict the other variable's value is called the independent variable. We have successfully performed linear regression for prediction in R. We have achieved this by defining dataset values for the variables month "m" and temperature "t". We have also labelled the graph as "Months and Temperature" and a precisely jotted straight line graph is obtained.

B. Polynomial Regression.

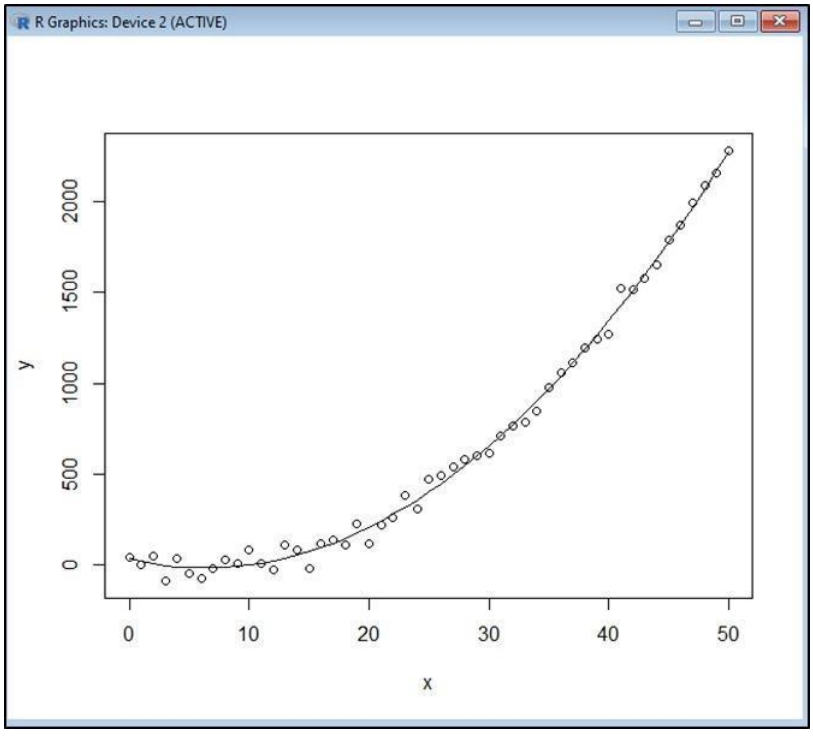
Code:

```
> #Polynomial Regression

> set.seed(16)

> x<-0:50

> y<-2.3-15.1*x+1.2*x^2+rnorm(length(x),20,50)
```

```
> plot(x,y)

> fit <- lm(y ~ 1 + x + I(x^2))

> points(x, predict(fit), type="l")

> summary(fit)
```

Output:

```
Call:
lm(formula = y ~ 1 + x + I(x^2))

Residuals:
    Min      1Q  Median      3Q     Max
-92.173 -28.968   3.673  24.953  97.269

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  33.84216   18.36178   1.843   0.0715 .
x           -15.28705    1.69836  -9.001 7.07e-12 ***
I(x^2)        1.20126    0.03285  36.569  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 45.44 on 48 degrees of freedom
Multiple R-squared:  0.996,     Adjusted R-squared:  0.9959
F-statistic:  6034 on 2 and 48 DF,  p-value: < 2.2e-16
```



Conclusion:

Polynomial regression is a form of regression analysis in which the relationship between the independent variable x and the dependent variable y is modelled as an nth degree polynomial in x. We have successfully performed polynomial regression in R. We have achieved this by defining dataset values for the variables “x” and “y”. Followed by which we have fit a polynomial regression model to get predicted values and a curved scatterplot graph is obtained.

Practical 10

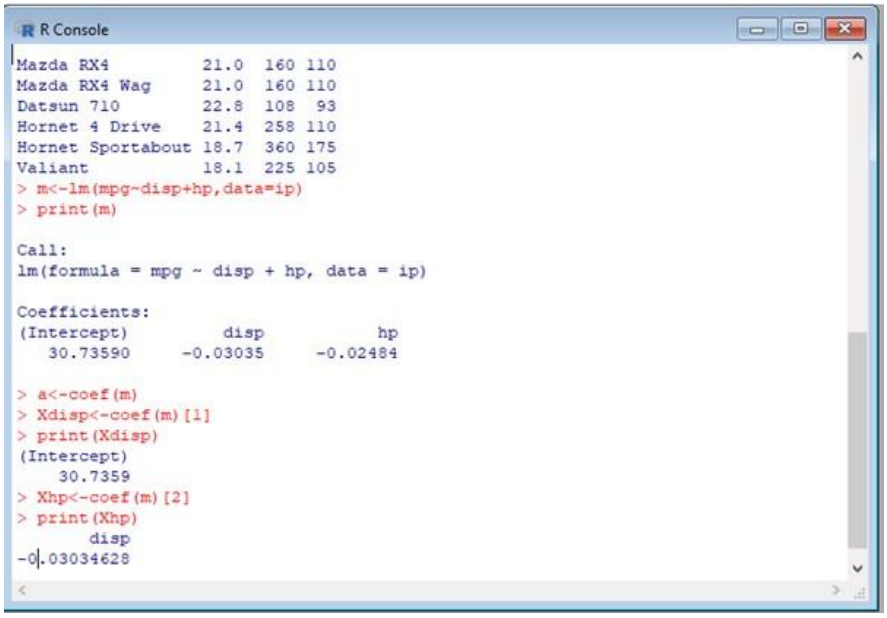
A. Multiple linear regression.

Code:

```
> #Multiple linear regression

>ip<-mtcars[,c("mpg","disp","hp")]

> print(head(ip))

> m<-lm(mpg~disp+hp,data=ip)

> print(m)

> a<-coef(m)

>Xdisp<-coef(m)[1]

> print(Xdisp)

>Xhp<-coef(m)[2]

> print(Xhp)
```

Output:

```
> print(head(ip))
                  am    wt  mpg
Mazda RX4          1 2.620 21.0
Mazda RX4 Wag      1 2.875 21.0
Datsun 710         1 2.320 22.8
Hornet 4 Drive     0 3.215 21.4
Hornet Sportabout  0 3.440 18.7
Valiant            0 3.460 18.1
```



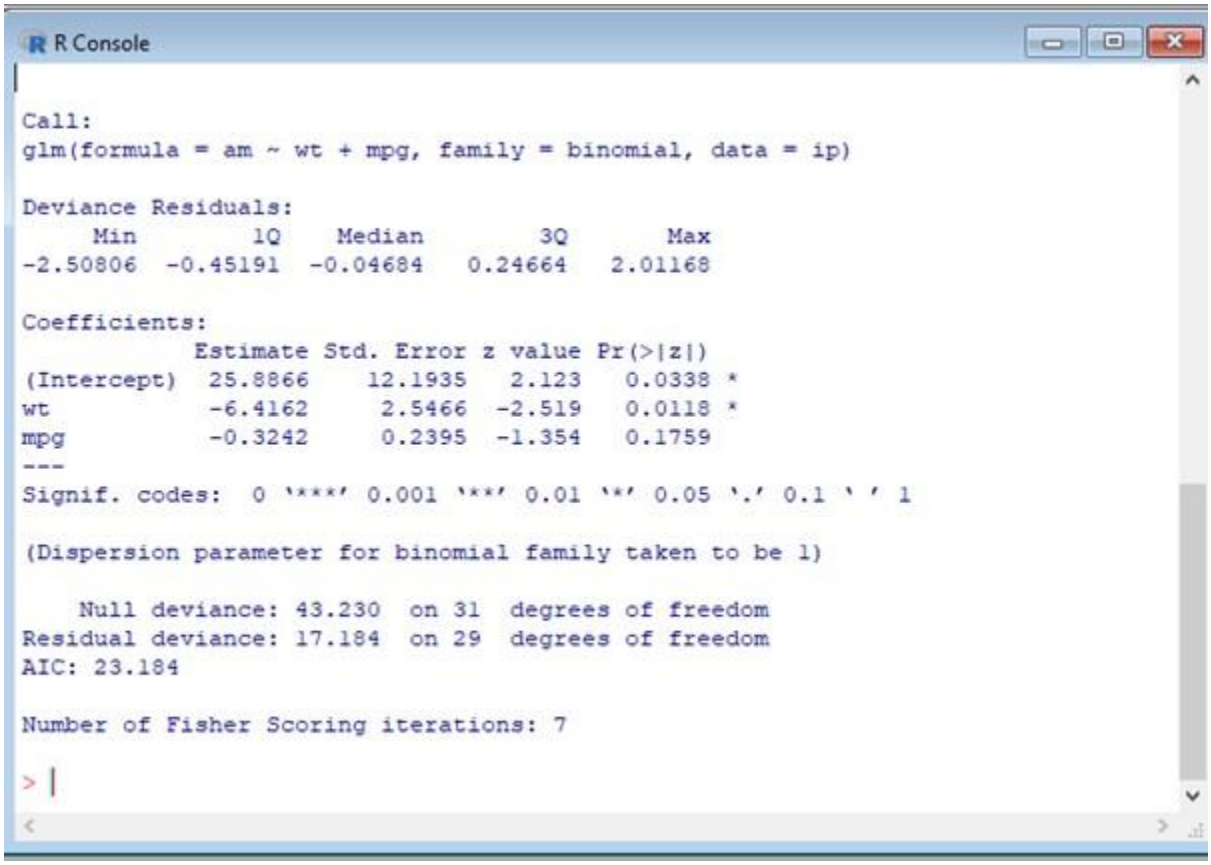
Conclusion: Multiple linear regression is a generalization of simple linear regression, in the sense that this approach makes it possible to relate one variable with several variables through a linear function in its parameters.we have successfully performed multiple linear regression.

B.Logistic Regression.

Code:

```
> #Logistic regression

>ip<-mtcars[,c("am","wt","mpg")]

> print(head(ip))

>am.data<-glm(formula=am~wt+mpg,data=ip,family=binomial)

> summary(am.data)
```

Output:



Conclusion: Logistic regression in R Programming is a classification algorithm used to find the probability of event success and event failure. Logistic regression is used when the dependent variable is binary (0/1, True/False, Yes/No) in nature. Logit function is used as a link function in a binomial distribution. we have successfully performed logistic regression.