Research in Computing

&

Data Science

Certified Journal

Submitted in partial fulfilment of the

Requirements for the award of the Degree of

MASTER OF SCIENCE

(INFORMATION_TECHNOLOGY)

By

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DEPARTMENT OF INFORMATION TECHNOLOGY

KERALEEYA SAMAJAM (REGD.) DOMBIVLI'S
MODEL COLLEGE (AUTONOMOUS)
Re-Accredited 'A' Grade by NAAC

(Affiliated to University of Mumbai)

FOR THE YEAR

(2022-23)

Keraleeya Samajam(Regd.) Dombivli's

MODEL COLLEGE

Re-Accredited Grade "A" by NAAC

Kanchan Goan Village, Khambalpada, Thakurli East – 421201
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DEPARTMENT OF INFORMATION TECHNOLOGY AND COMPUTER SCIENCE

CERTIFICATE

This is to certify that Mr. /Miss ____________________________________

*Studying in Class*__________________*Seat No.* ______________________

*Has completed the prescribed practicals in the subject*__________________

*During the academic year*____

Date : ________________

External Examiner

Internal Examiner
M.Sc. Information Technology

RESEARCH IN COMPUTING PRACTICAL

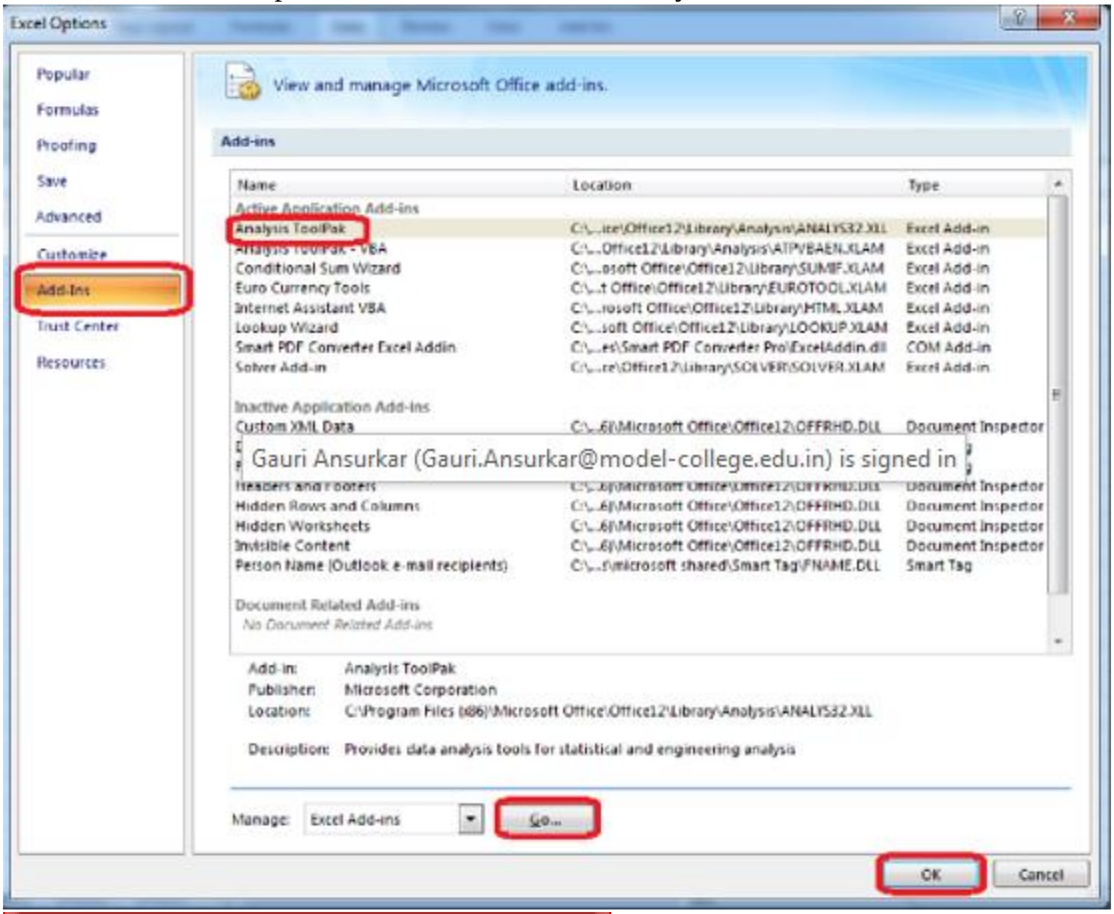
Sr No.	Practical No.		Name of the Practical	Datasets	Date	Signature
1.	1.	A	Write a program for obtaining descriptive statistics of data.			
2.		B	Import data from different data sources (from Excel, csv, mysql, sql server, oracle to R/Python/Excel)			
3.	2.	B	Perform suitable analysis of given secondary data.			
4.	3.	A	Perform testing of hypothesis using one sample t-test.	ages.csv		
5.		B	Perform testing of hypothesis using two sample t-test.			
6.		C	Perform testing of hypothesis using paired t-test.	blood_pressure.csv		
7.	4.	A	Perform testing of hypothesis using chi-squared goodness-of-fit test.			
8.		B	Perform testing of hypothesis using chi-squared Test of Independence	Students_Score.xlsx		
9.	5.	A	Compute different types of correlation			
10.	6.	A	Perform testing of hypothesis using one-way ANOVA.	scores.xlsx		
11.		B	Perform testing of hypothesis using two-way ANOVA.	ToothGrowth.csv		
12.	7.	A	Perform linear regression for prediction			
13.	8.	A	Perform Logistic regression	quality.csv		
14.	9.	A	Perform testing of hypothesis using Z-test	blood_pressure.csv		

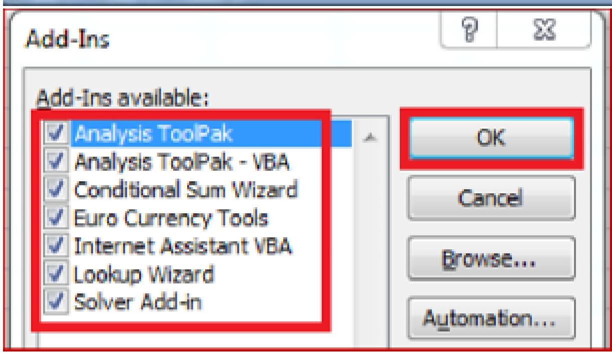
Practical 1:

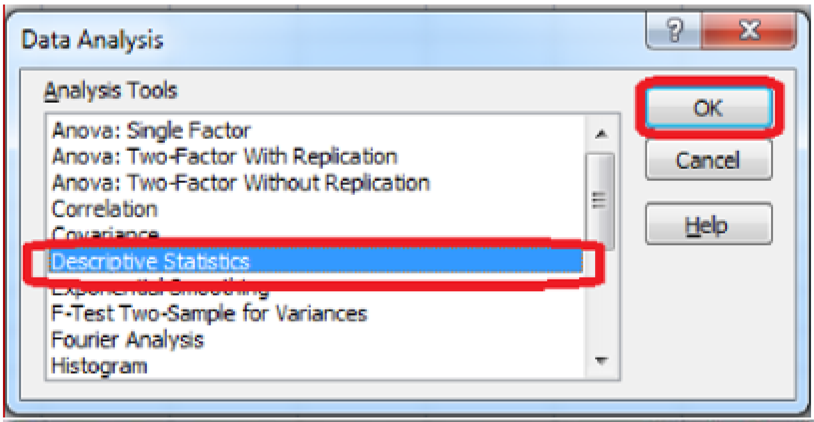
A. Write a program for obtaining descriptive statistics of data

Using Excel

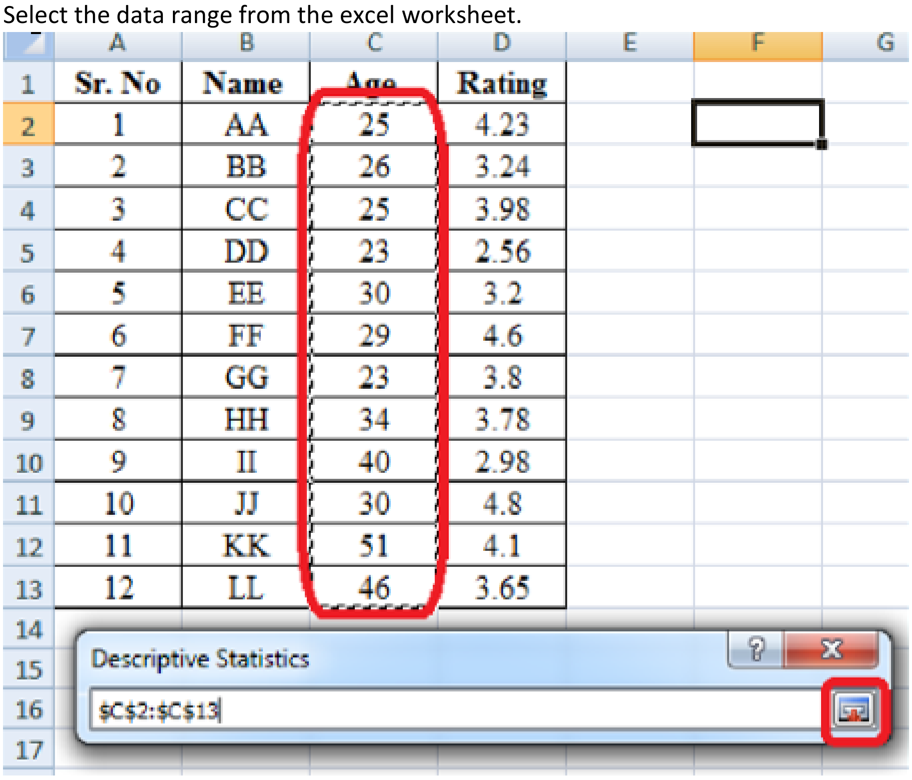
Go to File Menu → Options → Add-Ins→ Select Analysis ToolPak→ Press OK



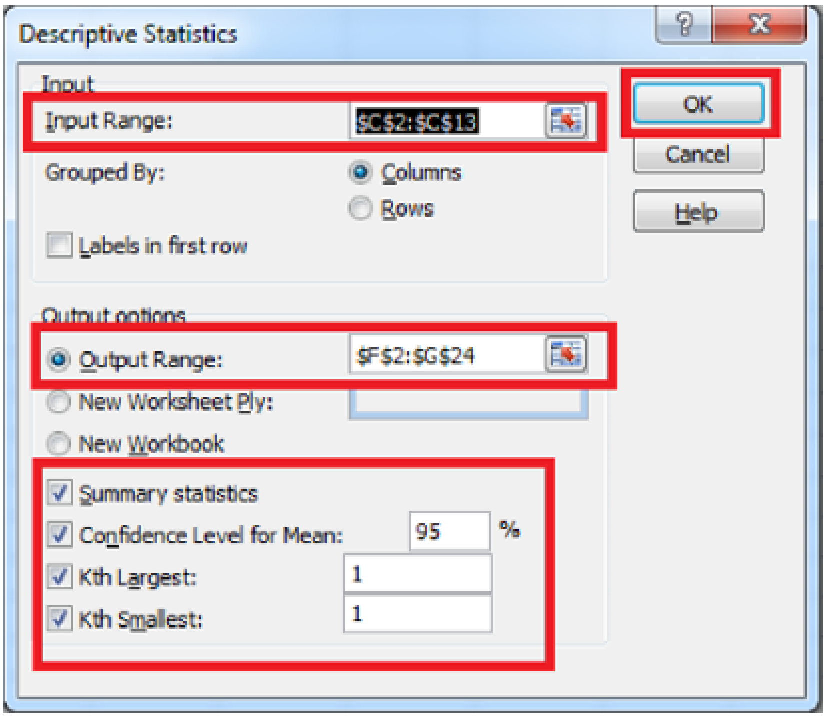




Select the data range from the excel worksheet.



Sr. No	Name	Age	Rating
1	AA	25	4.23
2	BB	26	3.24
3	CC	25	3.98
4	DD	23	2.56
5	EE	30	3.2
6	FF	29	4.6
7	GG	23	3.8
8	HH	34	3.78
9	II	40	2.98
10	JJ	30	4.8
11	KK	51	4.1
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)
NOTE: Create database in MySqL named as itvoyagers using command:
create database itvoyagers;

```
import mysql.connector
#creating connection object
db=mysql.connector.connect(user='root',passwd='',host='127.0.0.1',database='itvoyagers')
# prepare a cursor object using cursor() method
cur = db.cursor()
# execute SQL query using execute() method.
cur.execute("SELECT VERSION()")
# Fetch a single row using fetchone() method.
data = cur.fetchone()
print ("Database version : " , data)
# disconnect from server
db.close()
```

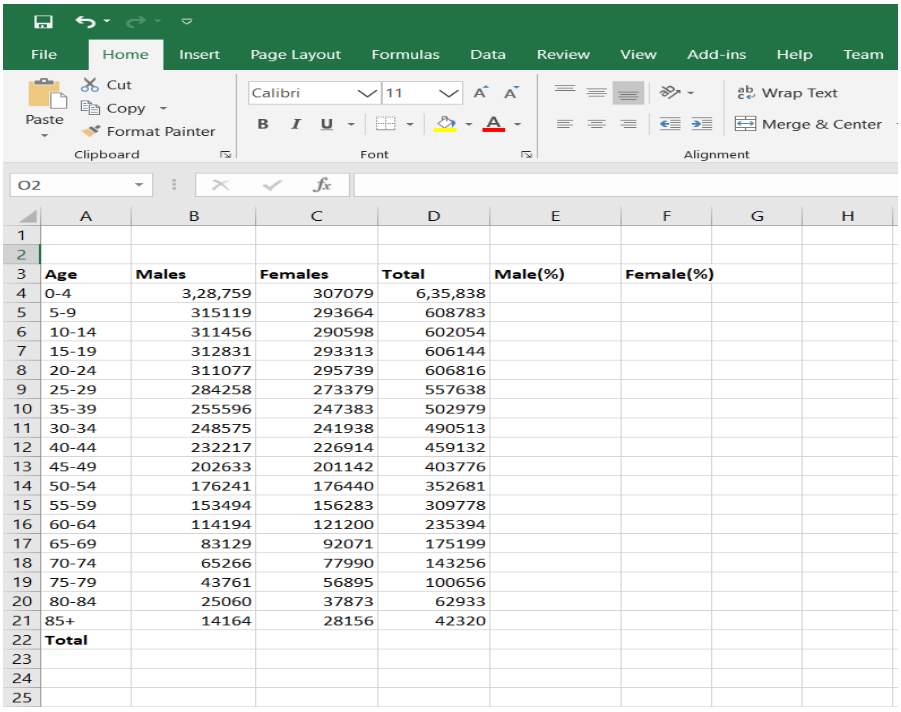
OUTPUT

```
Python 3.4.3 (v3.4.3:9b73f1c3e601, Feb 24 2015, 22:43:06) [MSC v.1600 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>> ================================ RESTART ================================
>>>
Database version :  ('5.1.36-community',)
```

Practical 2:

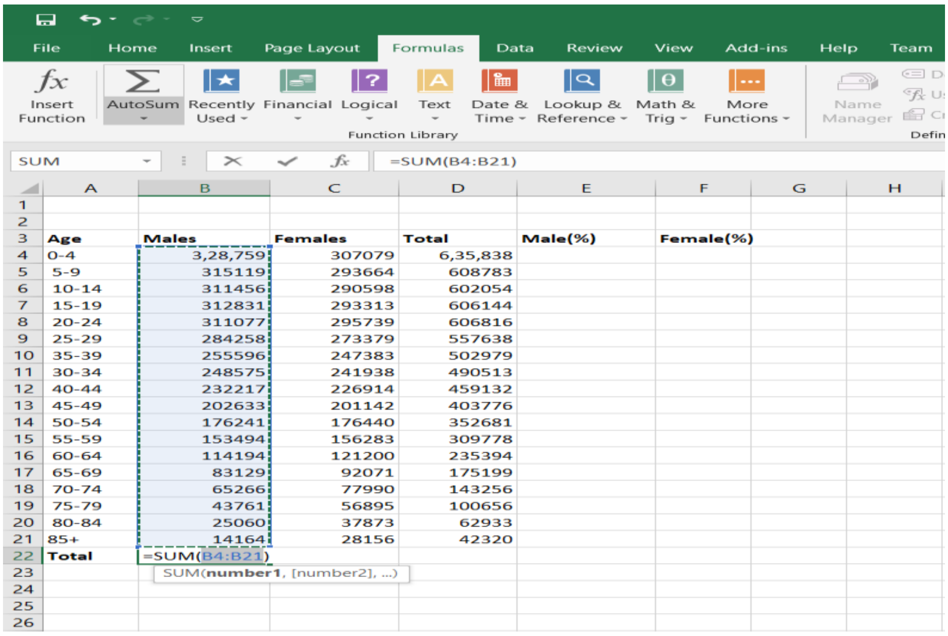
B. Write a program for obtaining descriptive statistics of data

Step 1 - Analyse the given Population Census Data for Planning and Decision Making by using the size and composition of populations.



Age	Males	Females	Total	Male(%)	Female(%)
0-4	3,28,759	307079	6,35,838		
5-9	315119	293664	608783		
10-14	311456	290598	602054		
15-19	312831	293313	606144		
20-24	311077	295739	606816		
25-29	284258	273379	557638		
35-39	255596	247383	502979		
30-34	248575	241938	490513		
40-44	232217	226914	459132		
45-49	202633	201142	403776		
50-54	176241	176440	352681		
55-59	153494	156283	309778		
60-64	114194	121200	235394		
65-69	83129	92071	175199		
70-74	65266	77990	143256		
75-79	43761	56895	100656		
80-84	25060	37873	62933		
85+	14164	28156	42320		
Total					

Step 2 - 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.



Age	Males	Females	Total	Male(%)	Female(%)
0-4	3,28,759	307079	6,35,838		
5-9	315119	293664	608783		
10-14	311456	290598	602054		
15-19	312831	293313	606144		
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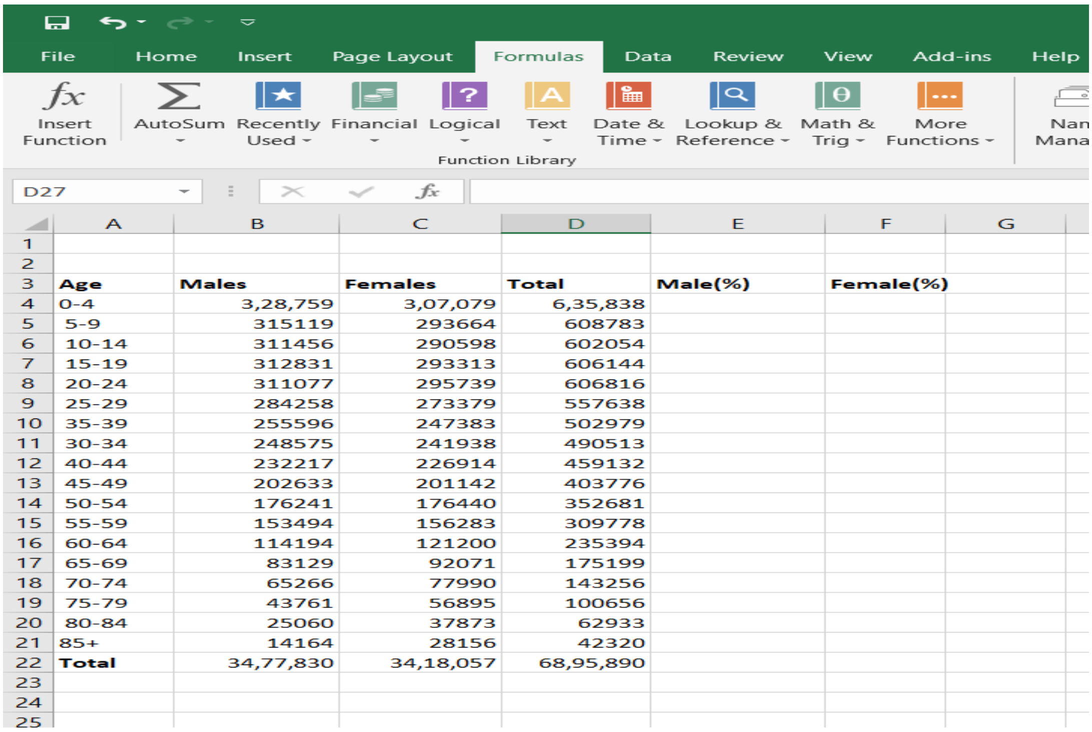
40-44	232217	226914	459132		
45-49	202633	201142	403776		
50-54	176241	176440	352681		
55-59	153494	156283	309778		
60-64	114194	121200	235394		
65-69	83129	92071	175199		
70-74	65266	77990	143256		
75-79	43761	56895	100656		
80-84	25060	37873	62933		
85+	14164	28156	42320		
Total	=SUM(B4:B21)				



Age	Males	Females	Total	Male(%)	Female(%)
0-4	3,28,759	3,07,079	6,35,838		
5-9	315119	293664	608783		
10-14	311456	290598	602054		
15-19	312831	293313	606144		
20-24	311077	295739	606816		
25-29	284258	273379	557638		
35-39	255596	247383	502979		
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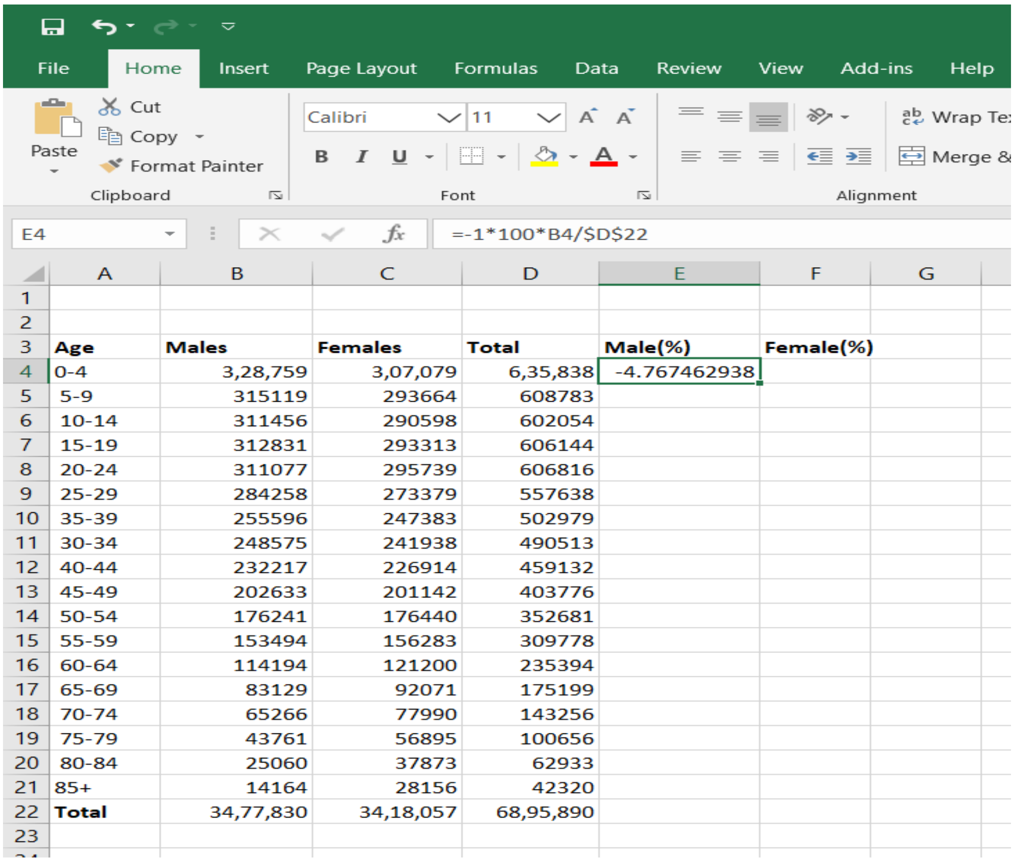
65-69	83129	92071	175199		
70-74	65266	77990	143256		
75-79	43761	56895	100656		
80-84	25060	37873	62933		
85+	14164	28156	42320		
Total	34,77,830	34,18,057	68,95,890		

Step 3 - 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.



Age	Males	Females	Total	Male(%)	Female(%)
0-4	3,28,759	3,07,079	6,35,838	-4.767462938	
5-9	315119	293664	608783		
10-14	311456	290598	602054		
15-19	312831	293313	606144		
20-24	311077	295739	606816		
25-29	284258	273379	557638		
35-39	255596	247383	502979		
30-34	248575	241938	490513		
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45-49	202633	201142	403776		
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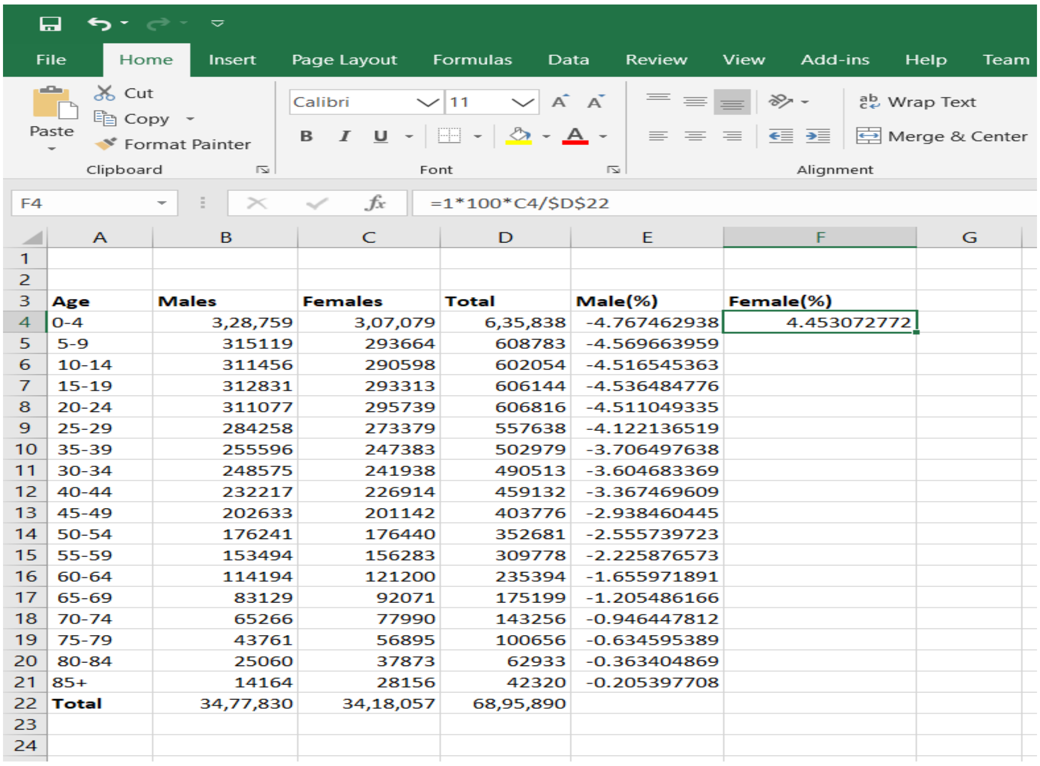
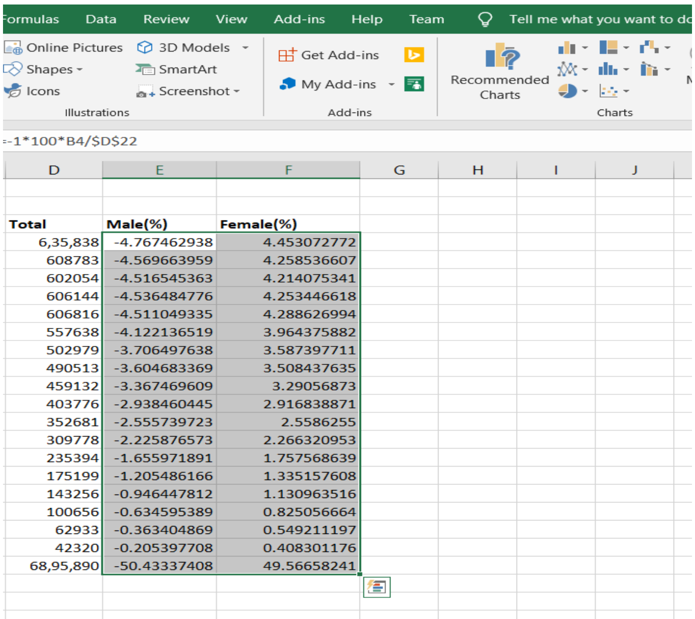
55-59	153494	156283	309778		
60-64	114194	121200	235394		
65-69	83129	92071	175199		
70-74	65266	77990	143256		
75-79	43761	56895	100656		
80-84	25060	37873	62933		
85+	14164	28156	42320		
Total	34,77,830	34,18,057	68,95,890		

Step 4 - To calculate the percent of females in cell F4, enter the formula =1*100*C4/$D$22. Copy the formula in cell F4 down to cell F21.

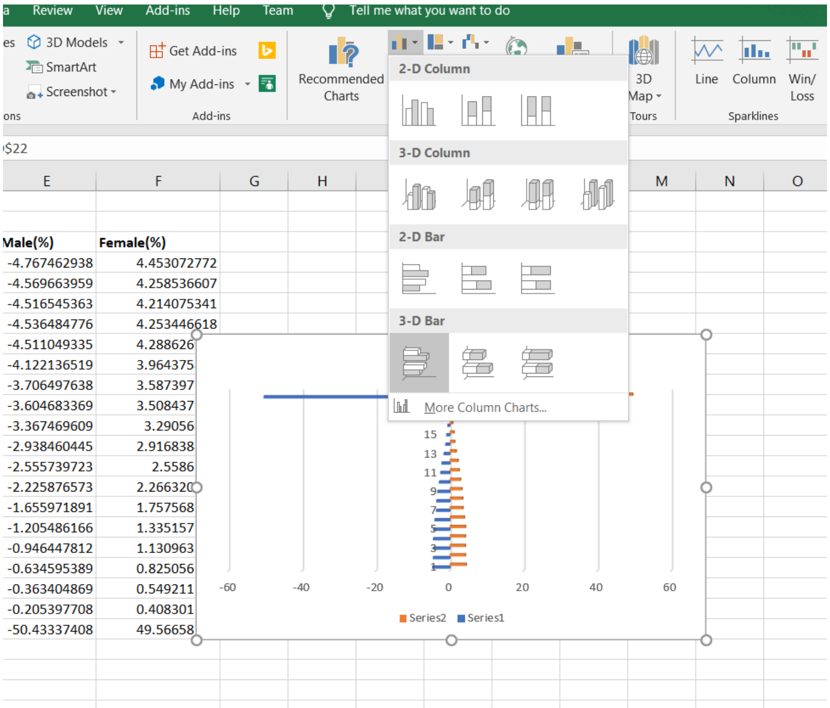


	A	B	C	D	E	F	G
1							
2							
3	**Age**	**Males**	**Females**	**Total**	**Male(%)**	**Female(%)**	
4	0-4	3,28,759	3,07,079	6,35,838	-4.767462938	4.453072772	
5	5-9	315119	293664	608783	-4.569663959		
6	10-14	311456	290598	602054	-4.516545363		
7	15-19	312831	293313	606144	-4.536484776		
8	20-24	311077	295739	606816	-4.511049335		
9	25-29	284258	273379	557638	-4.122136519		
10	35-39	255596	247383	502979	-3.706497638		
11	30-34	248575	241938	490513	-3.604683369		
12	40-44	232217	226914	459132	-3.367469609		
13	45-49	202633	201142	403776	-2.938460445		
14	50-54	176241	176440	352681	-2.555739723		
15	55-59	153494	156283	309778	-2.225876573		
16	60-64	114194	121200	235394	-1.655971891		
17	65-69	83129	92071	175199	-1.205486166		
18	70-74	65266	77990	143256	-0.946447812		
19	75-79	43761	56895	100656	-0.634595389		
20	80-84	25060	37873	62933	-0.363404869		
21	85+	14164	28156	42320	-0.205397708		
22	**Total**	34,77,830	34,18,057	68,95,890			
23							
24							

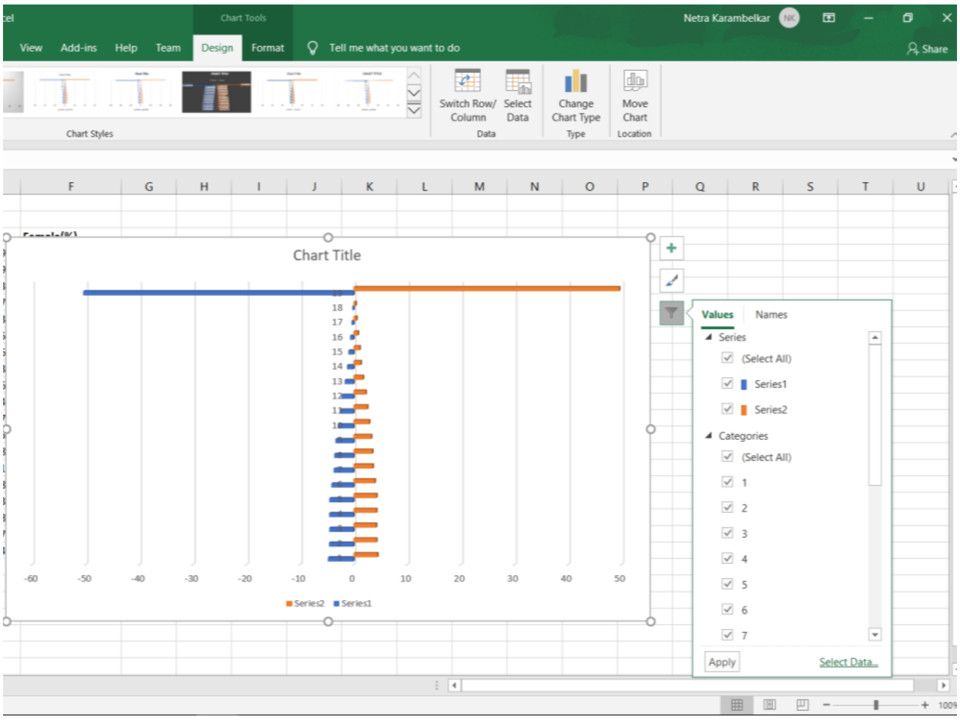
Step 5 - To build the population pyramid, we need to choose a horizontal bar chart with two series of data (% male and % female) and the age labels in column A as the Category X-axis labels. Highlight the range E3:F21 and under inset tab, under horizontal bar charts select clustered bar chart.



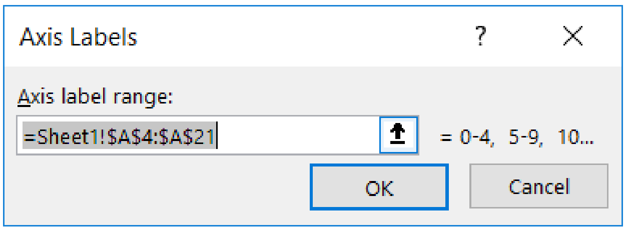
D	E	F	G	H	I	J
Total	**Male(%)**	**Female(%)**				
6,35,838	-4.767462938	4.453072772				
608783	-4.569663959	4.258536607				
602054	-4.516545363	4.214075341				
606144	-4.536484776	4.253446618				
606816	-4.511049335	4.288626994				
557638	-4.122136519	3.964375882				
502979	-3.706497638	3.587397711				
490513	-3.604683369	3.508437635				
459132	-3.367469609	3.29056873				
403776	-2.938460445	2.916838871				
352681	-2.555739723	2.5586255				
309778	-2.225876573	2.266320953				
235394	-1.655971891	1.757568639				
175199	-1.205486166	1.335157608				
143256	-0.946447812	1.130963516				
100656	-0.634595389	0.825056664				
62933	-0.363404869	0.549211197				
42320	-0.205397708	0.408301176				
68,95,890	-50.43337408	49.56658241				



Step 6 – Go to Charts Filter option and click on Select Data.

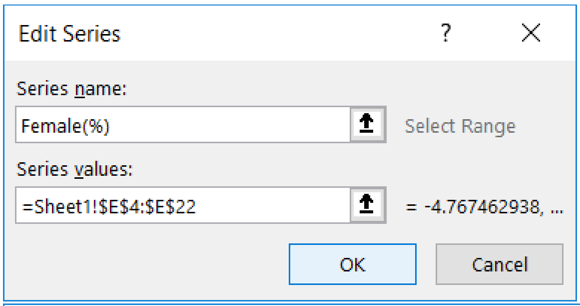


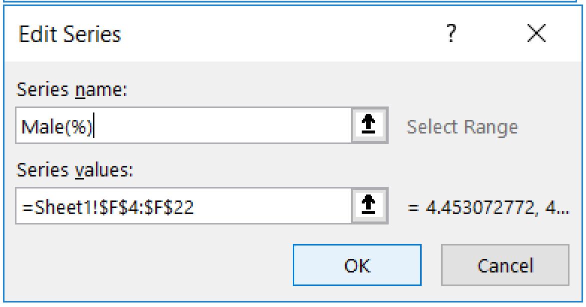
Step 7 – In Select Data Source Tab → Horizontal (Category) axis label and select the age range from A4:A21



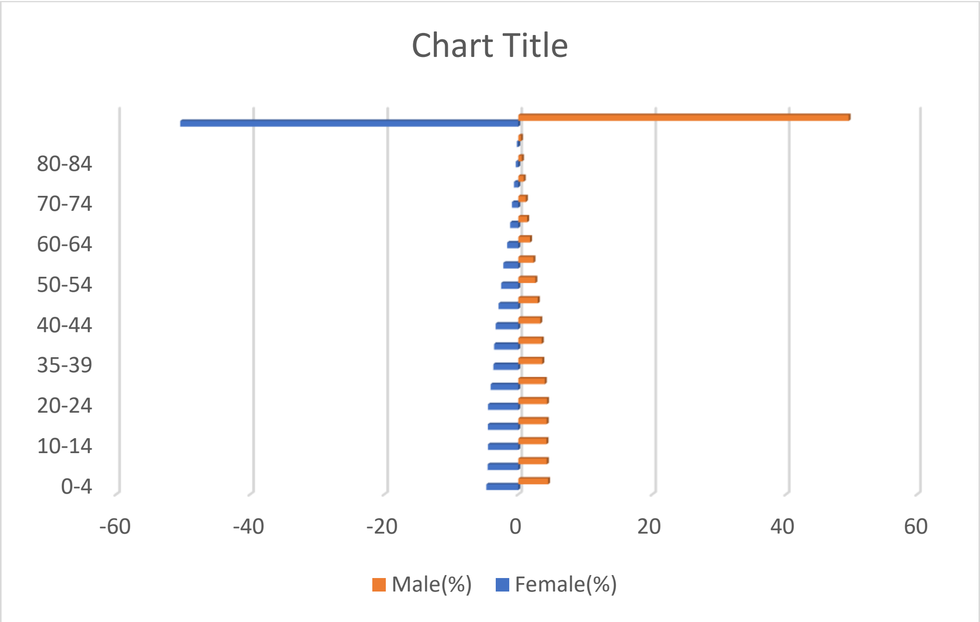
Also, in Legend entries (series) → Series1 → Edit → Series Name = Female(%).

Series2 → Edit → Series Name = Male(%). And finally click on Ok.

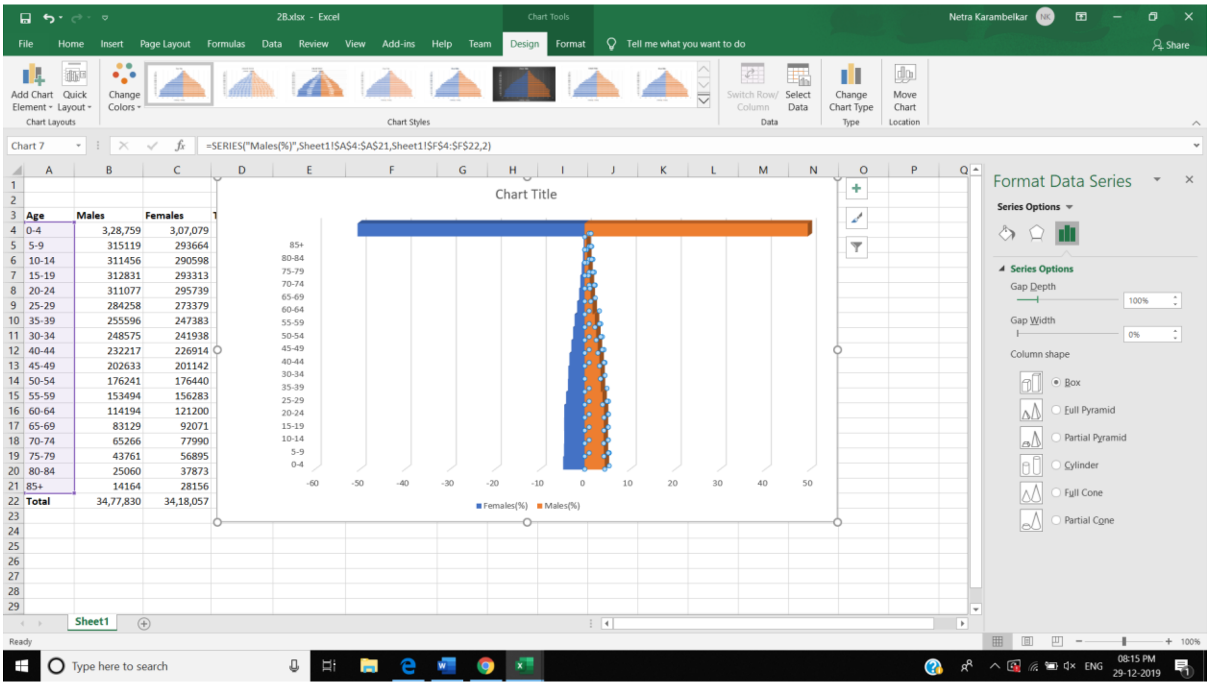




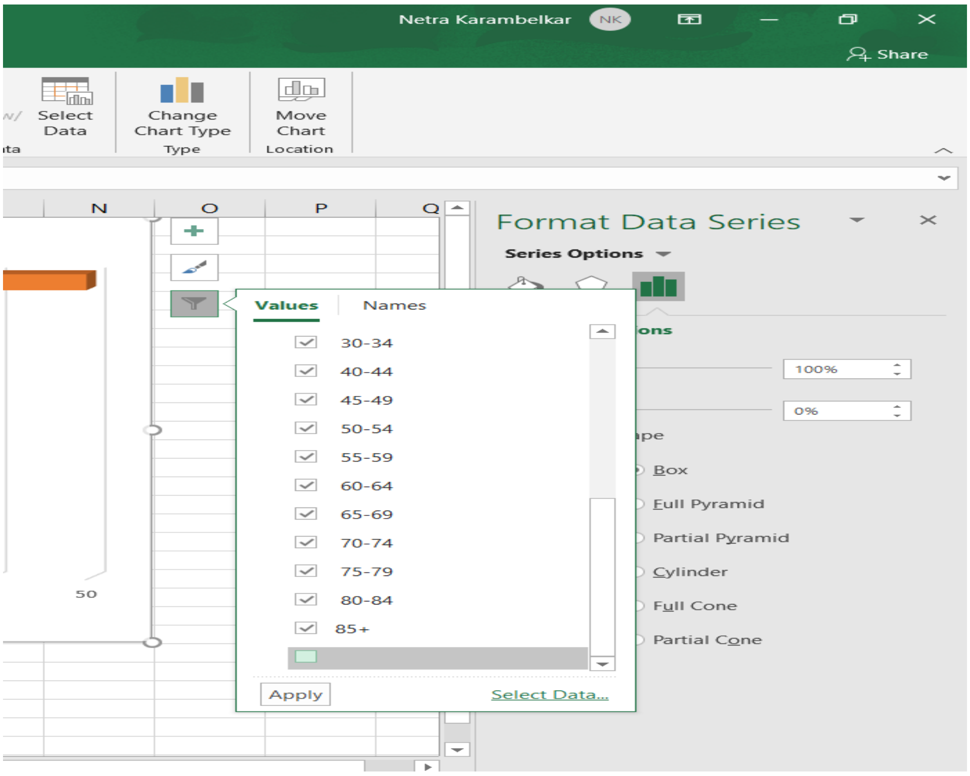
Step 8 – Now in the chart → Right click on Age range → Format Axis → Axis Options → In Tick Marks → Major Type, Minor Type = None → In Labels → Labels Position = Low.



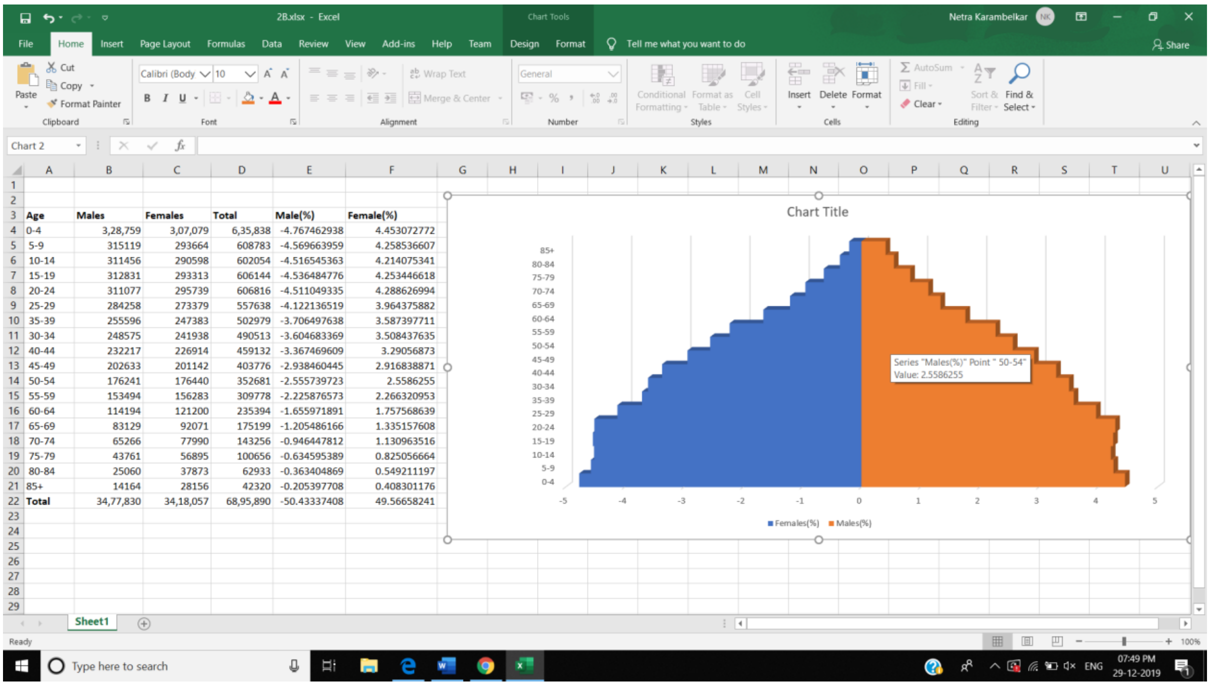
Step 9 – Now put the tip of your mouse arrow on anywhere on the bars of chart → Right Click → Format Data Series → Set the Overlap to 100 and Gap Width to 0 → Click OK.



Step 10 - Go to Charts Filter option → Scroll down Categories → Untick the option after 85+ and Click on Apply.



OUTPUT:



Age	Males	Females	Total	Male(%)	Female(%)
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5-9	315119	293664	608783	-4.569663959	4.258536607
10-14	311456	290598	602054	-4.516545363	4.214075341
15-19	312831	293313	606144	-4.536484776	4.253446618
20-24	311077	295739	606816	-4.511049335	4.288626994
25-29	284258	273379	557638	-4.122136519	3.964375882
35-39	255596	247383	502979	-3.706497638	3.587397711
30-34	248575	241938	490513	-3.604683369	3.508437635
40-44	232217	226914	459132	-3.367469609	3.29056873
45-49	202633	201142	403776	-2.938460445	2.916838871
50-54	176241	176440	352681	-2.555739723	2.5586255
55-59	153494	156283	309778	-2.225876573	2.266320953
60-64	114194	121200	235394	-1.655971891	1.757568639
65-69	83129	92071	175199	-1.205486166	1.335157608
70-74	65266	77990	143256	-0.946447812	1.130963516
75-79	43761	56895	100656	-0.634595389	0.825056664
80-84	25060	37873	62933	-0.363404869	0.549211197
85+	14164	28156	42320	-0.205397708	0.408301176
Total	34,77,830	34,18,057	68,95,890	-50.43337408	49.56658241

Practical 3:

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

USING PYTHON

```
from scipy.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:

```
[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
```

USING EXCEL

A22 =SUM(A2:A21)/20

	A	B	C	D
1	Experimental	Comparison		
2	35	2		
3	40	27		
4	12	38		
5	15	31		
6	21	1		
7	14	19		
8	46	1		
9	10	34		
10	28	3		
11	48	1		
12	16	2		
13	30	3		
14	32	2		
15	48	1		
16	31	2		
17	22	1		
18	12	3		
19	39	29		
20	19	37		
21	25	2		
22	27.15	11.95	Mean	

A23 =STDEV(A2:A21)

	A	B	C	D
1	Experimental	Comparison		
2	35	2		
3	40	27		
4	12	38		
5	15	31		
6	21	1		
7	14	19		
8	46	1		
9	10	34		
10	28	3		
11	48	1		
12	16	2		
13	30	3		
14	32	2		
15	48	1		
16	31	2		
17	22	1		
18	12	3		
19	39	29		
20	19	37		
21	25	2		
22	27.15	11.95	Mean	
23	12.50799744	14.61244963	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.

=(A22-B22)/SQRT((A23*A23)/COUNT(A2:A21)+(B23*B23)/COUNT(A2:A21))

E	F	G	H	I
	t-Test: Paired Two Sample for Means			
		35		
	Mean	26.73684211		
	Variance	161.5380117		
	Observations	19		
	Pearson Correlation	-0.38128717		
	Hypothesized Mean Dif	0		
	df	18		
	t Stat	2.714013677		
	P(T<=t) one-tail	0.007110878		
	t Critical one-tail	1.734063607		
	P(T<=t) two-tail	0.014221756		
	t Critical two-tail	2.10092204		
	calculated value	3.534053898		

=IF(G20<G13,"H0 is Accepted", "H0 is Rejected and H1 is Accepted")

E	F	G	H
	t-Test: Paired Two Sample for Means		
		35	
	Mean	26.73684211	
	Variance	161.5380117	
	Observations	19	
	Pearson Correlation	-0.38128717	
	Hypothesized Mean Dif	0	
	df	18	
	t Stat	2.714013677	
	P(T<=t) one-tail	0.007110878	
	t Critical one-tail	1.734063607	
	P(T<=t) two-tail	0.014221756	
	t Critical two-tail	2.10092204	
	calculated value	3.534053898	
	H0 is Rejected and H1 is Accepted		

B. Perform testing of hypothesis using two sample t-test.

```
import numpy as np
from scipy import stats
from numpy.random import randn
N = 20
#a = [35,40,12,15,21,14,46,10,28,48,16,30, 32,48,31,22,12,39,19,25]
#b = [2,27,31,38,1,19,1,34,3,1,2,1,3,1,2,1,3,29,37,2]
a = 5 * randn(100) + 50
b = 5 * randn(100) + 51
var_a = a.var(ddof=1)
var_b = b.var(ddof=1)
s = np.sqrt((var_a + var_b)/2)
t = (a.mean() - b.mean())/(s*np.sqrt(2/N))
df = 2*N - 2
#p-value after comparison with the t
p = 1 - stats.t.cdf(t,df=df)
print("t = " + str(t))
print("p = " + str(2*p))
if t> p :
  print('Mean of two distribution are differnt and significant')
else:
  print('Mean of two distribution are same and not significant')
```

OUTPUT:

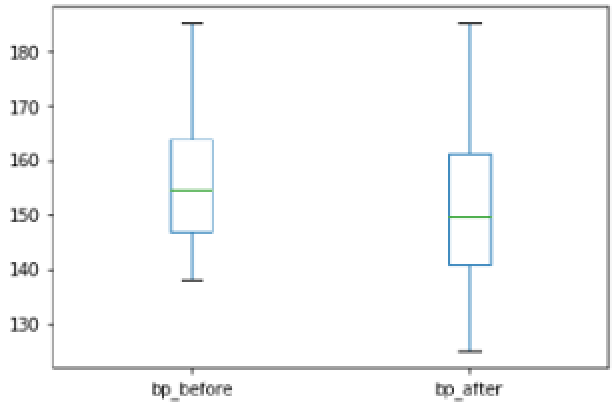
```
t = -0.9017019457173832
p = 1.627104831513666
Mean of two distribution are same and not significant
```

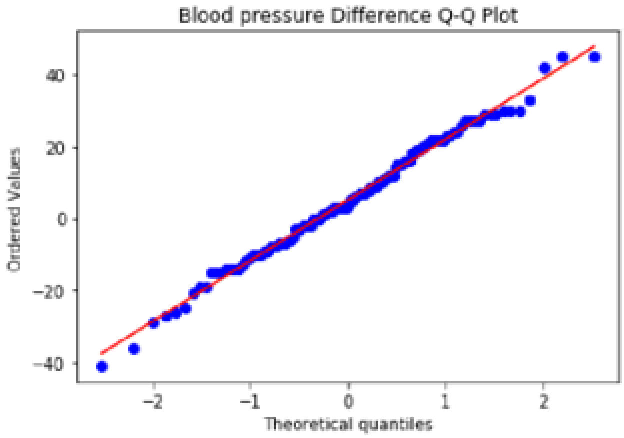
C. Perform testing of hypothesis using paired t-test.

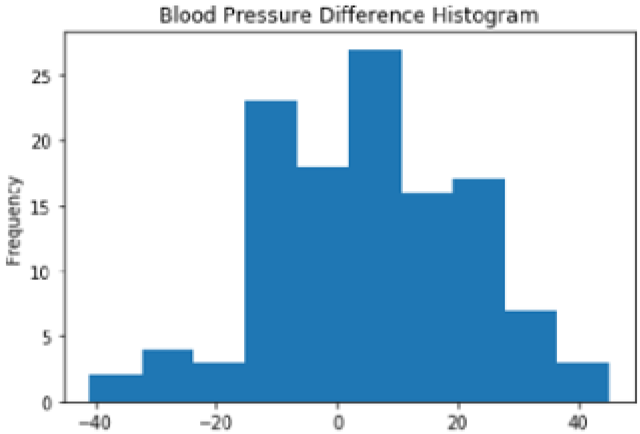
```
from scipy import stats
import matplotlib.pyplot as plt
import pandas as pd
df = pd.read_csv("blood_pressure.csv")
print(df[['bp_before','bp_after']].describe())
#First let’s check for any significant outliers in
#each of the variables.
df[['bp_before', 'bp_after']].plot(kind='box')
# This saves the plot as a png file
plt.savefig('boxplot_outliers.png')
# 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:

```
        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
Ttest_relResult(statistic=3.3371870510833657, pvalue=0.0011297914644840823)
```







Patient	gender	agegrp	bp_before	bp_after	Difference
1	Male	30-45	143	153	-10
2	Male	30-45	163	170	-7
3	Male	30-45	153	168	-15
4	Male	30-45	153	142	11
5	Male	30-45	146	141	5
6	Male	30-45	150	147	3
7	Male	30-45	148	133	15
8	Male	30-45	153	141	12
9	Male	30-45	153	131	22

10	Male	30-45	158	125	33
11	Male	30-45	149	164	-15
12	Male	30-45	173	159	14
13	Male	30-45	165	135	30
14	Male	30-45	145	159	-14
15	Male	30-45	143	153	-10
16	Male	30-45	152	126	26
17	Male	30-45	141	162	-21
18	Male	30-45	176	134	42
19	Male	30-45	143	136	7
20	Male	30-45	162	150	12
21	Male	46-59	149	168	-19
22	Male	46-59	156	155	1
23	Male	46-59	151	136	15
24	Male	46-59	159	132	27
25	Male	46-59	164	160	4
26	Male	46-59	154	160	-6
27	Male	46-59	152	136	16
28	Male	46-59	142	183	-41
29	Male	46-59	162	152	10
30	Male	46-59	155	162	-7
31	Male	46-59	175	151	24
32	Male	46-59	184	139	45
33	Male	46-59	167	175	-8
34	Male	46-59	148	184	-36
35	Male	46-59	170	151	19
36	Male	46-59	159	171	-12
37	Male	46-59	149	157	-8
38	Male	46-59	140	159	-19
39	Male	46-59	185	140	45
40	Male	46-59	160	174	-14
41	Male	60+	157	167	-10
42	Male	60+	158	158	0
43	Male	60+	162	168	-6
44	Male	60+	160	159	1
45	Male	60+	180	153	27
46	Male	60+	155	164	-9
47	Male	60+	172	169	3
48	Male	60+	157	148	9
49	Male	60+	171	185	-14
50	Male	60+	170	163	7
51	Male	60+	175	146	29
52	Male	60+	175	160	15
53	Male	60+	172	175	-3
54	Male	60+	173	163	10
55	Male	60+	170	185	-15

56	Male	60+	164	146	18
57	Male	60+	147	176	-29
58	Male	60+	154	147	7
59	Male	60+	172	161	11
60	Male	60+	162	164	-2
61	Female	30-45	152	149	3
62	Female	30-45	147	142	5
63	Female	30-45	144	146	-2
64	Female	30-45	144	138	6
65	Female	30-45	158	131	27
66	Female	30-45	147	145	2
67	Female	30-45	154	134	20
68	Female	30-45	151	135	16
69	Female	30-45	149	131	18
70	Female	30-45	138	135	3
71	Female	30-45	162	133	29
72	Female	30-45	157	135	22
73	Female	30-45	141	168	-27
74	Female	30-45	167	144	23
75	Female	30-45	147	147	0
76	Female	30-45	143	151	-8
77	Female	30-45	142	149	-7
78	Female	30-45	166	147	19
79	Female	30-45	147	149	-2
80	Female	30-45	142	135	7
81	Female	46-59	157	127	30
82	Female	46-59	170	150	20
83	Female	46-59	150	138	12
84	Female	46-59	150	147	3
85	Female	46-59	167	157	10
86	Female	46-59	154	146	8
87	Female	46-59	143	148	-5
88	Female	46-59	157	136	21
89	Female	46-59	149	146	3
90	Female	46-59	161	132	29
91	Female	46-59	142	145	-3
92	Female	46-59	162	132	30
93	Female	46-59	144	157	-13
94	Female	46-59	142	140	2
95	Female	46-59	159	137	22
96	Female	46-59	140	154	-14
97	Female	46-59	144	169	-25
98	Female	46-59	142	145	-3
99	Female	46-59	145	137	8
100	Female	46-59	145	143	2
101	Female	60+	168	178	-10

102	Female	60+	142	141	1
103	Female	60+	147	149	-2
104	Female	60+	148	148	0
105	Female	60+	162	138	24
106	Female	60+	170	143	27
107	Female	60+	173	167	6
108	Female	60+	151	158	-7
109	Female	60+	155	152	3
110	Female	60+	163	154	9
111	Female	60+	183	161	22
112	Female	60+	159	143	16
113	Female	60+	148	159	-11
114	Female	60+	151	177	-26
115	Female	60+	165	142	23
116	Female	60+	152	152	0
117	Female	60+	161	152	9
118	Female	60+	165	174	-9
119	Female	60+	149	151	-2
120	Female	60+	185	163	22

F122 =SUM(F2:F121)/120

	A	B	C	D	E	F	G
120	119	Female	60+	149	151	-2	
121	120	Female	60+	185	163	22	
122						5.091667	Mean diff

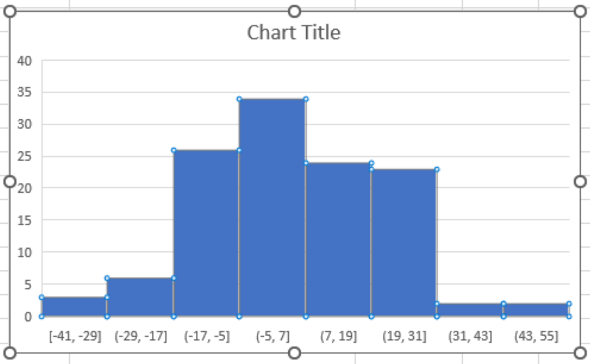
H21 =IF(H122<I11,"H0 is Accepted", "H0 is Rejected and H1 is Accepted")

	A	B	C	D	E	F	G	H	I	J
1	patient	gender	agegrp	bp_before	bp_after	difference				
2	1	Male	30-45	143	153	-10				
3	2	Male	30-45	163	170	-7				
4	3	Male	30-45	153	168	-15		t-Test: Paired Two Sample for Means		
5	4	Male	30-45	153	142	11				
6	5	Male	30-45	146	141	5			*143*	*153*
7	6	Male	30-45	150	147	3		Mean	156.5630252	151.3445
8	7	Male	30-45	148	133	15		Variance	129.2820111	202.6854
9	8	Male	30-45	153	141	12		Observations	119	119
10	9	Male	30-45	153	131	22		Pearson Correlation	0.161241417	
11	10	Male	30-45	158	125	33		Hypothesized Mean Difference	0	
12	11	Male	30-45	149	164	-15		df	118	
13	12	Male	30-45	173	159	14		t Stat	3.403463555	
14	13	Male	30-45	165	135	30		P(T<=t) one-tail	0.000454744	
15	14	Male	30-45	145	159	-14		t Critical one-tail	1.657869522	
16	15	Male	30-45	143	153	-10		P(T<=t) two-tail	0.000909488	
17	16	Male	30-45	152	126	26		t Critical two-tail	1.980272249	
18	17	Male	30-45	141	162	-21				
19	18	Male	30-45	176	134	42				
20	19	Male	30-45	143	136	7				
21	20	Male	30-45	162	150	12		H0 is Rejected and H1 is Accepted		
22	21	Male	46-59	149	168	-19				

A paired sample t -test was used to analyze the blood pressure before and after the intervention to test if the intervention had a significant affect on the blood pressure. The blood pressure before the intervention was higher (156.45 ± 11.39 units) compared to the blood pressure post intervention (151.36 ± 14.18 units); there was a statistically significant decrease in blood pressure($t(119)=3.34, p=0.001$) of 5.09 units

Chart 1

	A	B	C	D	E	F
1	patient	gender	agegrp	bp_before	bp_after	difference
2	1	Male	30-45	143	153	-10
3	2	Male	30-45	163	170	-7
4	3	Male	30-45	153	168	-15
5	4	Male	30-45	153	142	11
6	5	Male	30-45	146	141	5
7	6	Male	30-45	150	147	3
8	7	Male	30-45	148	133	15
9	8	Male	30-45	153	141	12
10	9	Male	30-45	153	131	22
11	10	Male	30-45	158	125	33
12	11	Male	30-45	149	164	-15
13	12	Male	30-45	173	159	14
14	13	Male	30-45	165	135	30
15	14	Male	30-45	145	159	-14
16	15	Male	30-45	143	153	-10
17	16	Male	30-45	152	126	26
18	17	Male	30-45	141	162	-21
19	18	Male	30-45	176	134	42
20	19	Male	30-45	143	136	7
21	20	Male	30-45	162	150	12
22	21	Male	46-59	149	168	-19
23	22	Male	46-59	156	155	1
24	23	Male	46-59	151	136	15
25	24	Male	46-59	159	132	27
26	25	Male	46-59	164	160	4
27	26	Male	46-59	154	160	-6



Practical 4:

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

I9 | fx

	A	B	C	D
1	System	O	Ei	$\chi^2 = \sum_i \frac{(O_i - E_i)^2}{E_i}$
2	Windows	20	33.33%	
3	Mac	50	33.33%	
4	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)*(B2-C2))/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 $\sum \frac{(O_i - E_i)^2}{Ei}$ 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")

D2 | fx | =((B2-C2)*(B2-C2))/C2

	A	B	C	D	E
1	System	O	Ei	$\chi^2 = \sum_i \frac{(O_i - E_i)^2}{E_i}$	
2	Windows	20	33.33%	116045.3312001200%	
3	Mac	50	33.33%	740108.3375007500%	
4	Linux	20	33.33%	116045.3312001200%	

D5 =SUM(D2:D4)

	A	B	C	D	E
1	System	O	Ei	$\chi^2 = \sum_i \frac{(O_i - E_i)^2}{E_i}$	
2	Windows	20	33.33%	116045.3312001200%	
3	Mac	50	33.33%	740108.3375007500%	
4	Linux	20	33.33%	116045.3312001200%	
5				972198.9999009900%	sum

D6 =CHIINV(0.05,2)

	A	B	C	D	E
1	System	O	Ei	$\chi^2 = \sum_i \frac{(O_i - E_i)^2}{E_i}$	
2	Windows	20	33.33%	116045.3312001200%	
3	Mac	50	33.33%	740108.3375007500%	
4	Linux	20	33.33%	116045.3312001200%	
5				972198.9999009900%	sum
6				5.991464547	chi

OUTPUT:

D8 =IF(D5>D6,"H0 Accepted","H0 rejected")

	A	B	C	D	E	F	G
1	System	O	Ei	$\chi^2 = \sum_i \frac{(O_i - E_i)^2}{E_i}$			
2	Windows	20	33.33%	116045.3312001200%			
3	Mac	50	33.33%	740108.3375007500%			
4	Linux	20	33.33%	116045.3312001200%			
5				972198.9999009900%	sum		
6				5.991464547	chi		
7	To get the table value for Chi-Square for α = 0.05 and dof = 2,						
8				H0 Accepted			

B. Perform testing of hypothesis using chi-squared Test of Independence

In a study to understand the performance 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	Tebessam		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	Maputom		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
Sr. No	Roll No	Student's Name	Gen	Grade
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 Boukharif B
94 74 Reghaa f A
95 78 Cheria f A
96 79 Mouzaaf A
97 80 Meskiana f A
98 81 Miliana f A
99 94 Sig f A
100 99 Kadiria f A

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**	
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)

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

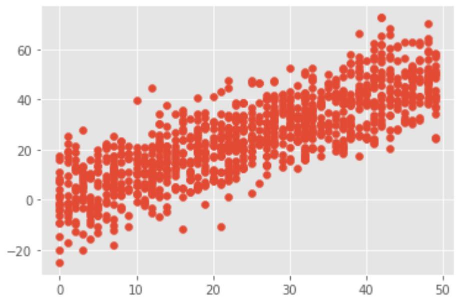
=SUM((N7-$N$9)^2/$N$9,(O7-$O$9)^2/$O$9,(P7-$P$9)^2/$P$9,(Q7-Q$9)^2/$Q$9,
(R7-$R$9)^2/$R$9)
To get the table value go to cell T11 and type **=CHIINV(0.05,4)**
Go to cell O13 and type =IF(T8>=T11," H0 is Accepted", "H0 is Rejected")

Practical 5:

A. Compute different types of correlation

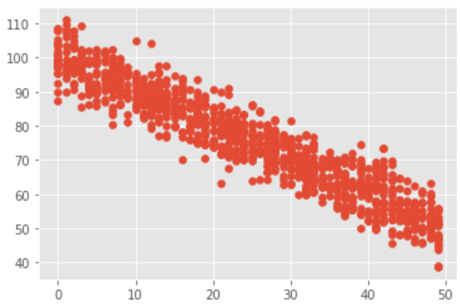
Positive Correlation

```
import numpy as np
import matplotlib
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()
```



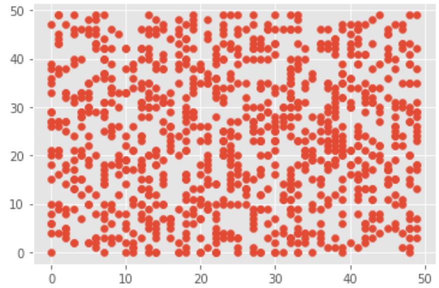
Negative Correlation

```
import numpy as np
import matplotlib
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()
```



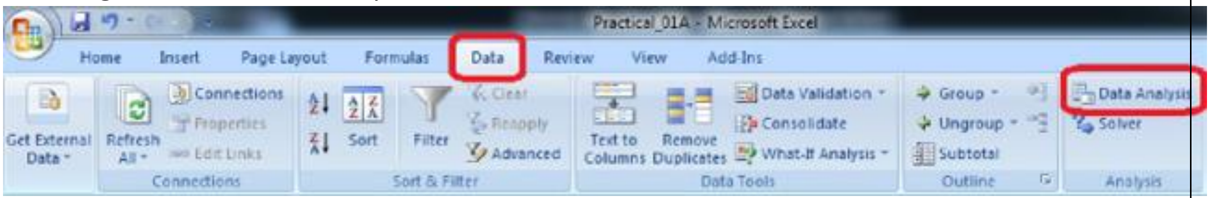
No/Weak Correlation

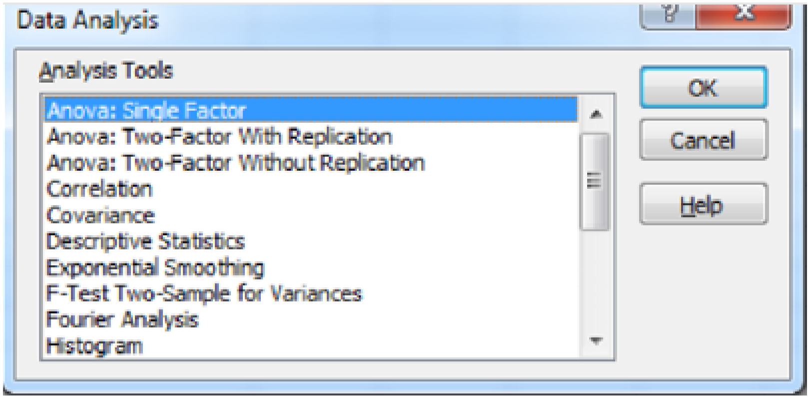
```
import numpy as np
import matplotlib.pyplot as plt
np.random.seed(1)
x = np.random.randint(0, 50, 1000)
y = np.random.randint(0, 50, 1000)
np.corrcoef(x, y)
plt.scatter(x, y)
plt.show()
```

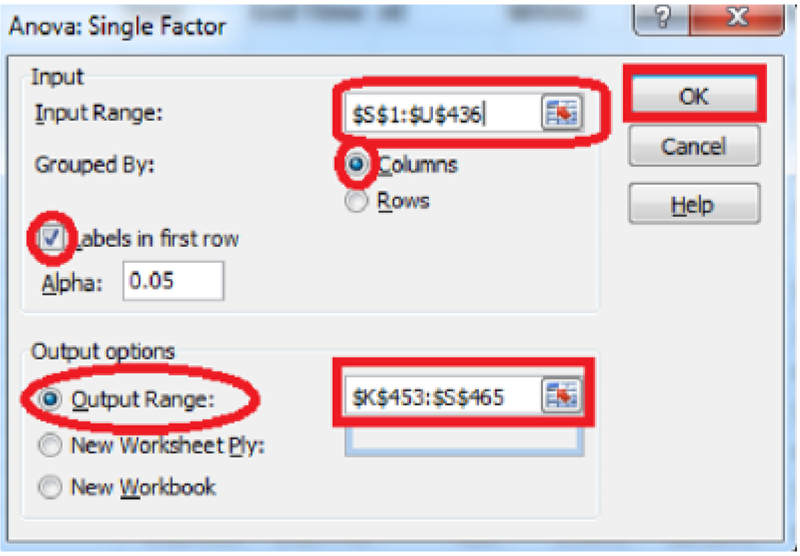


Practical 6:

A. Perform testing of hypothesis using one-way ANOVA.
H0 - There are no significant differences between the Subject's mean SAT scores. µ1 = µ2 = µ3 = µ4 = µ5
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)*

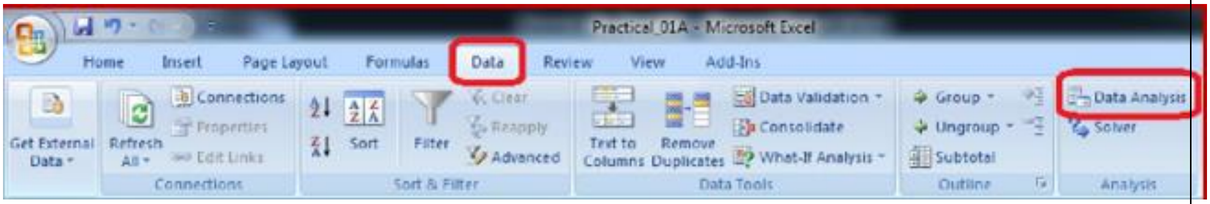
Output Range :$K$453:$S$465*(Can be any Range)*

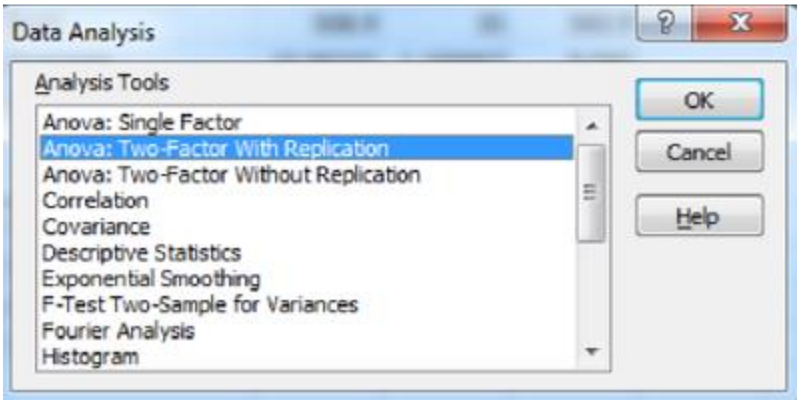
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Average Score (SAT Math)	375	162354	432.944	5177.144		
Average Score (SAT Reading)	375	159189	424.504	3829.267		
Average Score (SAT Writing)	375	156922	418.4587	4166.522		

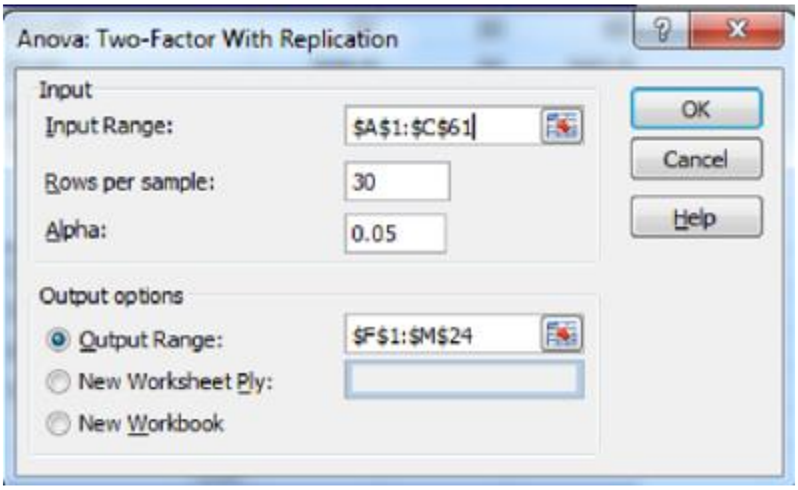
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	39700.57	2	19850.28	4.520698	0.01108	3.003745
Within Groups	4926677	1122	4390.977			
Total	4966377	1124				

Since the resulting pvalue 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.
Go to Data tab → Data Analysis







Input Range - $A$1:$C$61

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.

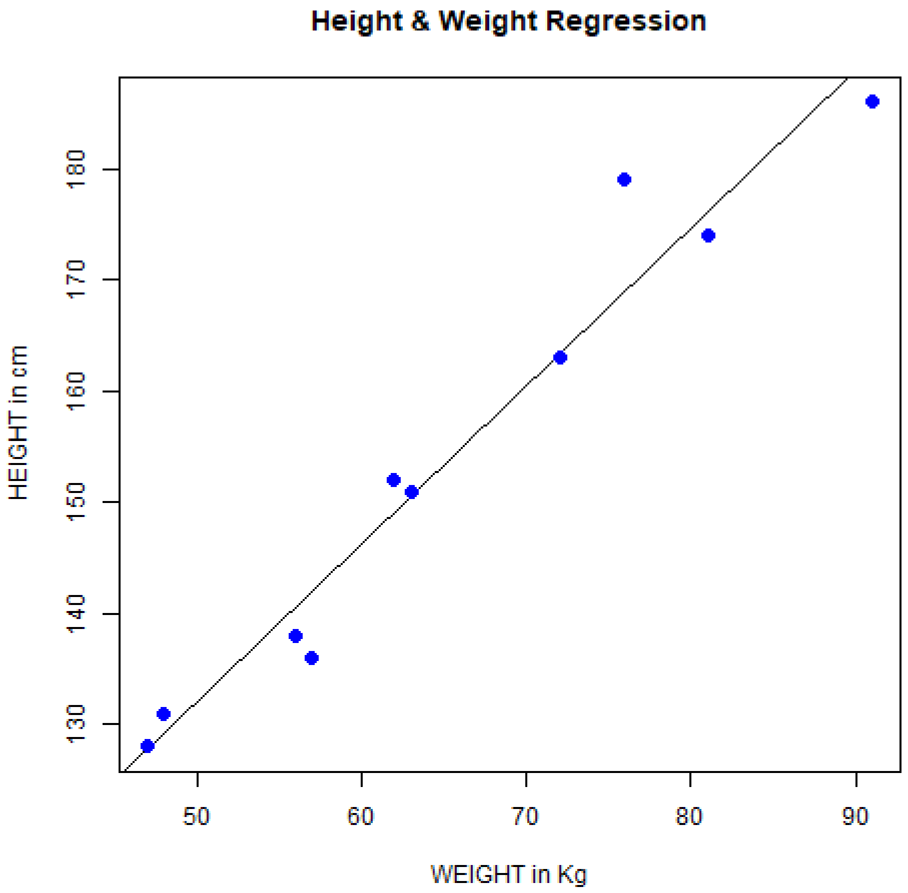
Practical 7:

A. Perform linear regression for prediction

Using R tools

```
> x <-c(151,174,138,186,128,136,179,163,152,131)
> y <-c(63,81,56,91,47,57,76,72,62,48)
> relation <-lm(y~x)
> print(relation)

Call:
lm(formula = y ~ x)

Coefficients:
(Intercept)           x
  -38.4551      0.6746

> print(summary(relation))

Call:
lm(formula = y ~ x)

Residuals:
   Min      1Q  Median      3Q     Max
-6.3002 -1.6629  0.0412  1.8944  3.9775

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -38.45509    8.04901  -4.778  0.00139 **
x            0.67461    0.05191  12.997 1.16e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.253 on 8 degrees of freedom
Multiple R-squared:  0.9548,    Adjusted R-squared:  0.9491
F-statistic: 168.9 on 1 and 8 DF,  p-value: 1.164e-06

> a <-data.frame(x=170)
> result <- predict(relation,a)
> print(result)
      1
76.22869
> png(file= "linearregression.png")
> plot(y,x,col="blue",main= "Height & Weight
Regression",abline(lm(x~y)0,cex=1.3,pch=16,xlab="WEIGHT in Kg",ylab="HEIGHT in cm")
Error: unexpected numeric constant in "plot(y,x,col="blue",main= "Height & Weight
Regression",abline(lm(x~y)0"
> plot(y,x,col="blue",main= "Height & Weight
Regression",abline(lm(x~y)0,cex=1.3,pch=16,xlab="WEIGHT in Kg",ylab="HEIGHT in cm")
```

```
Error: unexpected numeric constant in "plot(y,x,col="blue",main= "Height & Weight
Regression",abline(lm(x~y)0"
> plot(y,x,col="blue",main= "Height & Weight
Regression",abline(lm(x~y)),cex=1.3,pch=16,xlab="WEIGHT in Kg",ylab="HEIGHT in cm")
> dev.off()
null device
          1
> plot(y,x,col="blue",main= "Height & Weight
Regression",abline(lm(x~y)),cex=1.3,pch=16,xlab="WEIGHT in Kg",ylab="HEIGHT in cm")
> plot(y,x,col="blue",main= "Height & Weight
Regression",abline(lm(x~y)),cex=1.3,pch=16,xlab="WEIGHT in Kg",ylab="HEIGHT in cm")
>
```



Practical 8:

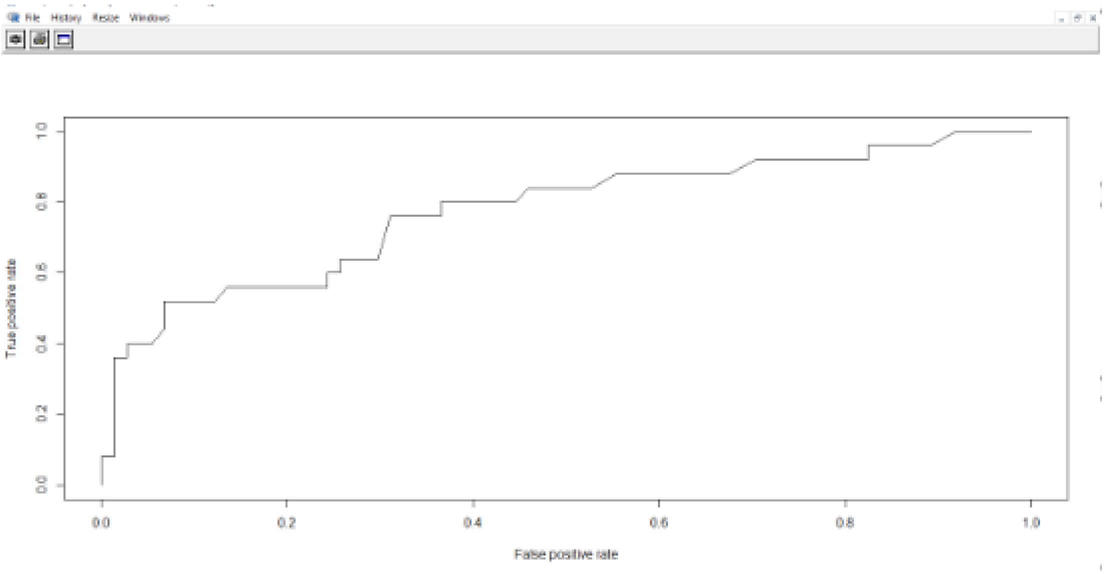
A. Perform Logistic regression
   Using RTools

```
> quality <- read.csv('C:/Users/Gauri/Downloads/quality.csv')
> str(quality)
'data.frame':   131 obs. of  14 variables:
 $ MemberID            : int  1 2 3 4 5 6 7 8 9 10 ...
 $ InpatientDays       : int  0 1 0 0 8 2 16 2 2 4 ...
 $ ERVisits            : int  0 1 0 1 2 0 1 0 1 2 ...
 $ OfficeVisits        : int  18 6 5 19 19 9 8 8 4 0 ...
 $ Narcotics           : int  1 1 3 0 3 2 1 0 3 2 ...
 $ DaysSinceLastERVisit: num  731 411 731 158 449 ...
 $ Pain                : int  10 0 10 34 10 6 4 5 5 2 ...
 $ TotalVisits         : int  18 8 5 20 29 11 25 10 7 6 ...
 $ ProviderCount       : int  21 27 16 14 24 40 19 11 28 21 ...
 $ MedicalClaims       : int  93 19 27 59 51 53 40 28 20 17 ...
 $ ClaimLines          : int  222 115 148 242 204 156 261 87 98 66 ...
 $ StartedOnCombination: logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
 $ AcuteDrugGapSmall   : int  0 1 5 0 0 4 0 0 0 0 ...
 $ PoorCare            : int  0 0 0 0 0 1 0 0 1 0 ...
> table(quality$PoorCare)

 0  1
98 33
> 98/131
[1] 0.7480916
> install.packages("caTools")
Installing package into 'C:/Users/Gauri/Documents/R/win-library/4.1'
(as 'lib' is unspecified)
--- Please select a CRAN mirror for use in this session --- (Select Canada NS / Canada US)
also installing the dependency 'bitops'

trying URL 'https://cran.utstat.utoronto.ca/bin/windows/contrib/4.1/bitops_1.0-7.zip'
Content type 'application/zip' length 42557 bytes (41 KB)
downloaded 41 KB

trying URL 'https://cran.utstat.utoronto.ca/bin/windows/contrib/4.1/caTools_1.18.2.zip'
Content type 'application/zip' length 316382 bytes (308 KB)
downloaded 308 KB

package 'bitops' successfully unpacked and MD5 sums checked
package 'caTools' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\Gauri\AppData\Local\Temp\RtmpQjbOOR\downloaded_packages
> library(caTools)
```

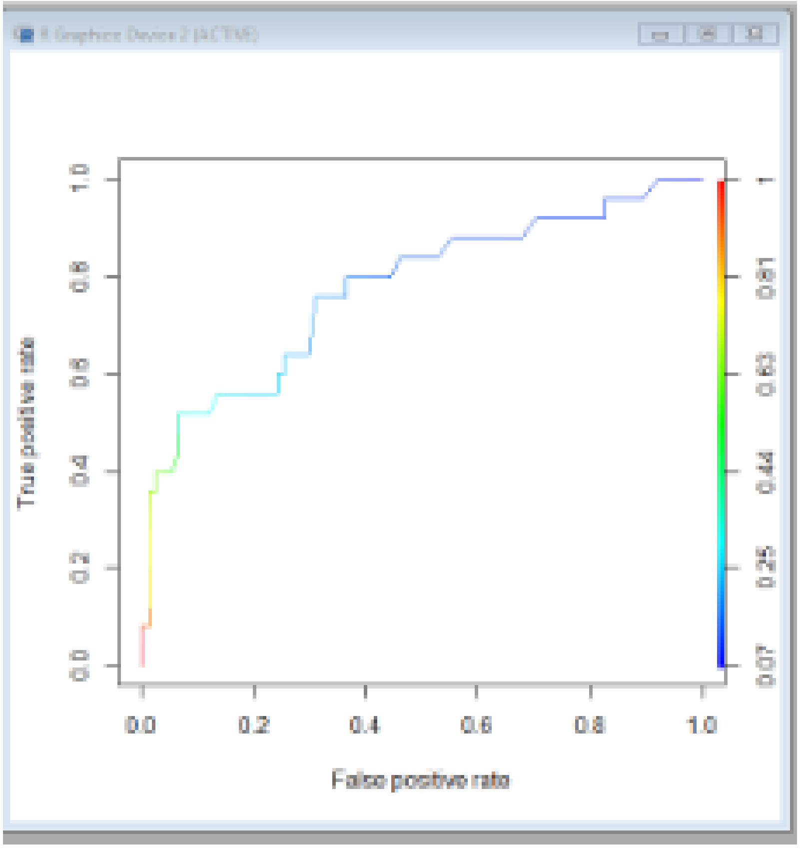
```
Warning message:
package ‘caTools’ was built under R version 4.1.3
> set.seed(88)
> split = sample.split(quality$PoorCare, SplitRatio = 0.75)
> split
  [1]  TRUE  TRUE  TRUE  TRUE FALSE  TRUE FALSE  TRUE FALSE FALSE  TRUE FALSE
 [13]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
 [25] FALSE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE
 [37] FALSE  TRUE  TRUE  TRUE FALSE FALSE  TRUE  TRUE FALSE  TRUE FALSE  TRUE
 [49] FALSE  TRUE  TRUE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
 [61]  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE
 [73]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE
 [85]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE
 [97]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE FALSE
[109]  TRUE FALSE FALSE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE
[121] FALSE  TRUE  TRUE FALSE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE FALSE
> qualityTrain = subset(quality, split == TRUE)
> qualityTest = subset(quality, split == FALSE)
> nrow(qualityTrain)
[1] 99
> nrow(qualityTest)
[1] 32
> QualityLog = glm(PoorCare ~ OfficeVisits + Narcotics,data=qualityTrain, family=binomial)
> summary(QualityLog)

Call:
glm(formula = PoorCare ~ OfficeVisits + Narcotics, family = binomial,
    data = qualityTrain)

Deviance Residuals:
     Min        1Q    Median        3Q       Max
-2.06303  -0.63155  -0.50503  -0.09689   2.16686

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -2.64613    0.52357  -5.054 4.33e-07 ***
OfficeVisits  0.08212    0.03055   2.688  0.00718 **
Narcotics     0.07630    0.03205   2.381  0.01728 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 111.888  on 98  degrees of freedom
Residual deviance:  89.127  on 96  degrees of freedom
AIC: 95.127

Number of Fisher Scoring iterations: 4
```

```
> predictTrain = predict(QualityLog, type="response")
> summary(predictTrain)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
0.06623 0.11912 0.15967 0.25253 0.26765 0.98456 
> tapply(predictTrain, qualityTrain$PoorCare, mean)
        0         1 
0.1894512 0.4392246 
> table(qualityTrain$PoorCare, predictTrain > 0.5)
   
    FALSE TRUE
  0    70    4
  1    15   10
> 10/25
[1] 0.4
> 70/74
[1] 0.9459459
> table(qualityTrain$PoorCare, predictTrain > 0.2)
   
    FALSE TRUE
  0    54   20
  1     9   16
> 16/25
[1] 0.64
> 54/74
[1] 0.7297297
> install.packages("ROCR")
Installing package into ‘C:/Users/Gauri/Documents/R/win-library/4.1’
(as ‘lib’ is unspecified)
also installing the dependencies ‘gtools’, ‘gplots’

trying URL 'https://cran.utstat.utoronto.ca/bin/windows/contrib/4.1/gtools_3.9.2.zip'
Content type 'application/zip' length 366977 bytes (358 KB)
downloaded 358 KB

trying URL 'https://cran.utstat.utoronto.ca/bin/windows/contrib/4.1/gplots_3.1.1.zip'
Content type 'application/zip' length 603166 bytes (589 KB)
downloaded 589 KB

trying URL 'https://cran.utstat.utoronto.ca/bin/windows/contrib/4.1/ROCR_1.0-11.zip'
Content type 'application/zip' length 454019 bytes (443 KB)
downloaded 443 KB

package ‘gtools’ successfully unpacked and MD5 sums checked
package ‘gplots’ successfully unpacked and MD5 sums checked
package ‘ROCR’ successfully unpacked and MD5 sums checked

The downloaded binary packages are in
```

C:\Users\Gauri\AppData\Local\Temp\RtmpQjbOOR\downloaded_packages
> library(ROCR)
Warning message:
package ‘ROCR’ was built under R version 4.1.3
> ROCRpred = prediction(predictTrain, qualityTrain$PoorCare)
> ROCRperf = performance(ROCRpred, "tpr", "fpr")



> plot(ROCRperf)
> plot(ROCRperf, colorize=TRUE)
> plot(ROCRperf, colorize=TRUE, print.cutoffs.at=seq(0,1,by=0.1), text.adj=c(-0.2,1.7))



Practical 9:

A. Perform testing of hypothesis using Z-test

```
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:

```
     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]
0.6651614730255063
accept null hypothesis
```