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Experiment no 3

1) BIN_Mean

PROGRAM:

```
# import statsmodels.api as sm

import statistics

import math

from collections import OrderedDict

x =[]

print("enter the data")

x = list(map(float, input().split()))

print("enter the number of bins")

bi = int(input())

# X_dict will store the data in sorted order

X_dict = OrderedDict()

# x_old will store the original data

x_old ={}

# x_new will store the data after binning

x_new ={}

for i in range(len(x)):


    X_dict[i]= x[i]

    x_old[i]= x[i]

x_dict = sorted(X_dict.items(), key = lambda x: x[1])

# list of lists(bins)

binn =[]

# a variable to find the mean of each bin

avrg = 0

i = 0

k = 0

num_of_data_in_each_bin = int(math.ceil(len(x)/bi))

# performing binning

for g, h in X_dict.items():
```

```
    if(i<num_of_data_in_each_bin):
        avrg = avrg + h
        i = i + 1
    elif(i == num_of_data_in_each_bin):
        k = k + 1
        i = 0
        binn.append(round(avrg / num_of_data_in_each_bin, 3))
        avrg = 0
        avrg = avrg + h
        i = i + 1
rem = len(x)% bi
if(rem == 0):
    binn.append(round(avrg / num_of_data_in_each_bin, 3))
else:
    binn.append(round(avrg / rem, 3))


# store the new value of each data
i = 0
j = 0
for g, h in X_dict.items():
    if(i<num_of_data_in_each_bin):
        x_new[g]= binn[j]
        i = i + 1
    else:
        i = 0
        j = j + 1
        x_new[g]= binn[j]
        i = i + 1
print("number of data in each bin")
print(math.ceil(len(x)/bi))
for i in range(0, len(x)):
    print('index {2} old value {0} new value {1}'.format(x_old[i], x_new[i], i))
```

OUTPUT:

```
enter the data
34 84 42 55
enter the number of bins
4
number of data in each bin
1
index 0 old value 34.0 new value 34.0
index 1 old value 84.0 new value 84.0
index 2 old value 42.0 new value 42.0
index 3 old value 55.0 new value 55.0
```

2) BIN_Median

PROGRAM:

```
# import statsmodels.api as sm
import statistics
import math
from collections import OrderedDict
x =[]
print("enter the data")
x = list(map(float, input().split()))
print("enter the number of bins")
bi = int(input())
# X_dict will store the data in sorted order
X_dict = OrderedDict()
# x_old will store the original data
x_old ={}
# x_new will store the data after binning
x_new ={}
for i in range(len(x)):
    X_dict[i]= x[i]
    x_old[i]= x[i]

x_dict = sorted(X_dict.items(), key = lambda x: x[1])


# list of lists(bins)
binn =[]
# a variable to find the mean of each bin
avrg =[]
i = 0
k = 0
num_of_data_in_each_bin = int(math.ceil(len(x)/bi))


# performing binning
for g, h in X_dict.items():
    if(i<num_of_data_in_each_bin):
        avrg.append(h)
        i = i + 1
    elif(i == num_of_data_in_each_bin):
        k = k + 1
        i = 0
```

```
        binn.append(statistics.median(avrg))
        avrg =[]
        avrg.append(h)
        i = i + 1
binn.append(statistics.median(avrg))
# store the new value of each data
i = 0
j = 0
for g, h in X_dict.items():
    if(i<num_of_data_in_each_bin):
        x_new[g]= round(binn[j], 3)
        i = i + 1
    else:
        i = 0
        j = j + 1
        x_new[g]= round(binn[j], 3)
        i = i + 1
print("number of data in each bin")
print(math.ceil(len(x)/bi))
for i in range(0, len(x)):
    print('index {2} old value {0} new value {1}'.format(x_old[i], x_new[i], i))
```

OUTPUT:

```
enter the data
111 32 53 54
enter the number of bins
5
number of data in each bin
1
index 0 old value 111.0 new value 111.0
index 1 old value 32.0 new value 32.0
index 2 old value 53.0 new value 53.0
index 3 old value 54.0 new value 54.0
```

3) BIN_Boundary

PROGRAM:

```
# import statsmodels.api as sm

import statistics

import math

from collections import OrderedDict

x =[]

print("enter the data")

x = list(map(float, input().split()))

print("enter the number of bins")
```

Aditya Basanti
201041029

```
bi = int(input())

# X_dict will store the data in sorted order

X_dict = OrderedDict()

# x_old will store the original data

x_old ={}

# x_new will store the data after binning

x_new ={}

for i in range(len(x)):

   X_dict[i]= x[i]

   x_old[i]= x[i]

x_dict = sorted(X_dict.items(), key = lambda x: x[1])

# list of lists(bins)

binn =[]

# a variable to find the mean of each bin

avrg =[]

i = 0

k = 0

num_of_data_in_each_bin = int(math.ceil(len(x)/bi))

for g, h in X_dict.items():

   if(i<num_of_data_in_each_bin):

      avrg.append(h)

      i = i + 1

   elif(i == num_of_data_in_each_bin):

      k = k + 1

      i = 0

      binn.append([min(avrg), max(avrg)])

      avrg =[]

      avrg.append(h)

      i = i + 1

binn.append([min(avrg), max(avrg)])

i = 0

j = 0
```

Aditya Basanti
201041029

```
for g, h in X_dict.items():
    if(i<num_of_data_in_each_bin):
        if(abs(h-binn[j][0]) >= abs(h-binn[j][1])):
            x_new[g]= binn[j][1]
            i = i + 1
        else:
            x_new[g]= binn[j][0]
            i = i + 1
    else:
        i = 0
        j = j + 1
        if(abs(h-binn[j][0]) >= abs(h-binn[j][1])):
            x_new[g]= binn[j][1]
        else:
            x_new[g]= binn[j][0]
    i = i + 1
print("number of data in each bin")
print(math.ceil(len(x)/bi))
for i in range(0, len(x)):
    print('index {2} old value {0} new value {1}'.format(x_old[i], x_new[i], i))
```

OUTPUT:

```
enter the data
43 53 5648 64
enter the number of bins
6
number of data in each bin
1
index 0 old value 43.0 new value 43.0
index 1 old value 53.0 new value 53.0
index 2 old value 5648.0 new value 5648.0
index 3 old value 64.0 new value 64.0
```

Aditya Basanti
201041029

Experiment no 4

PROGRAM:

```
# Naive Bayes Algorithm
import pandas as pd
import csv
def pci(data):
    class_count = [0, 0]
    for i in range(len(data)):
      if data.iloc[i, -1] == 'Yes':
           class_count[0] += 1
      else:
           class_count[1] += 1
    return class_count[0], class_count[1]
def pcix(data, x, c1, c2):
  p1, p2 = 1, 1
  count_yes = [0 for i in range(len(data.columns) - 1)]
  count_no = [0 for i in range(len(data.columns) - 1)]
  for i in range(len(data)):
        for j in range(len(data.columns) - 1):
             if data.iloc[i, j] == x[j]:
              if data.iloc[i, -1] == 'Yes':
                    count_yes[j] += 1
              else:
                  count_no[j] += 1
  for i in range(len(count_yes)):
        p1 = p1 * count_yes[i] / c1
        p2 = p2 * count_no[i] / c2
  return p1, p2
data = pd.read_csv('NB.csv')
data = data.iloc[:, 1:]
X = input('Enter tuple to classify: ')
X = X.split(',')
```

```
c1, c2 = pci(data)
p1, p2 = pcix(data, X, c1, c2)
if (p1 * c1 / len(data)) > (p2 * c2 / len(data)):
    print('Buys')
else:
    print('No Buy')
```

OUTPUT:

Enter tuple to classify: Youth , Medium, Yes, Excellent

No buy

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201041029

Experiment no 5

PROGRAM:

```
# importing libraries
import numpy as nm
import matplotlib.pyplot as mtp
import pandas as pd
import csv
dataset = pd.read_csv('Mall_customers.csv')
x = dataset.iloc[:, [3, 4]].values
#finding optimal number of clusters using the elbow method
from sklearn.cluster import KMeans
wcss_list= []  #Initializing the list for the values of WCSS
#Using for loop for iterations from 1 to 10.
for i in range(1, 11):
    kmeans = KMeans(n_clusters=i, init='k-means++', random_state= 42)
    kmeans.fit(x)
    wcss_list.append(kmeans.inertia_)
mtp.plot(range(1, 11), wcss_list)
mtp.title('The Elobw Method Graph')
mtp.xlabel('Number of clusters(k)')
mtp.ylabel('wcss_list')
mtp.show()
#training the K-means model on a dataset
kmeans = KMeans(n_clusters=5, init='k-means++', random_state= 42)
y_predict= kmeans.fit_predict(x)
#visulaizing the clusters
mtp.scatter(x[y_predict == 0, 0], x[y_predict == 0, 1], s = 100, c = 'blue', label = 'Cluster 1') #for first cluster
mtp.scatter(x[y_predict == 1, 0], x[y_predict == 1, 1], s = 100, c = 'green', label = 'Cluster 2') #for second cluster
mtp.scatter(x[y_predict== 2, 0], x[y_predict == 2, 1], s = 100, c = 'red', label = 'Cluster 3') #for third cluster
mtp.scatter(x[y_predict == 3, 0], x[y_predict == 3, 1], s = 100, c = 'cyan', label = 'Cluster 4') #for fourth cluster
```

Aditya Basanti
201041029

mtp.scatter(x[y_predict == 4, 0], x[y_predict == 4, 1], s = 100, c = 'magenta', label = 'Cluster 5') #for fifth cluster

mtp.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 300, c = 'yellow', label = 'Centroid')

mtp.title('Clusters of customers')

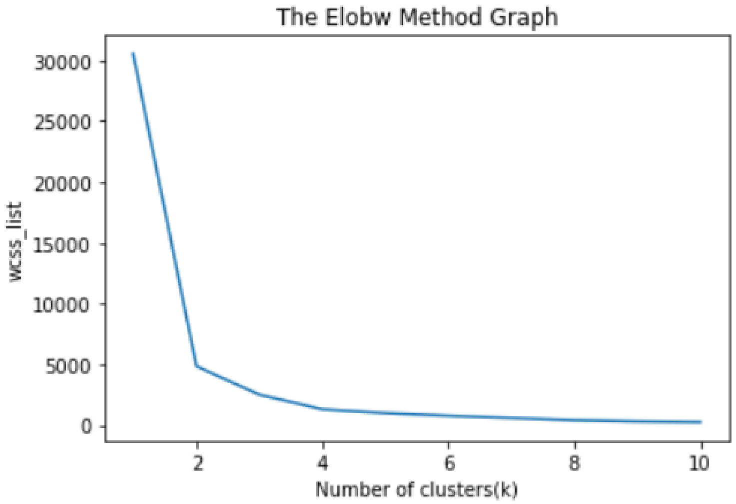
mtp.xlabel('Annual Income (k$)')

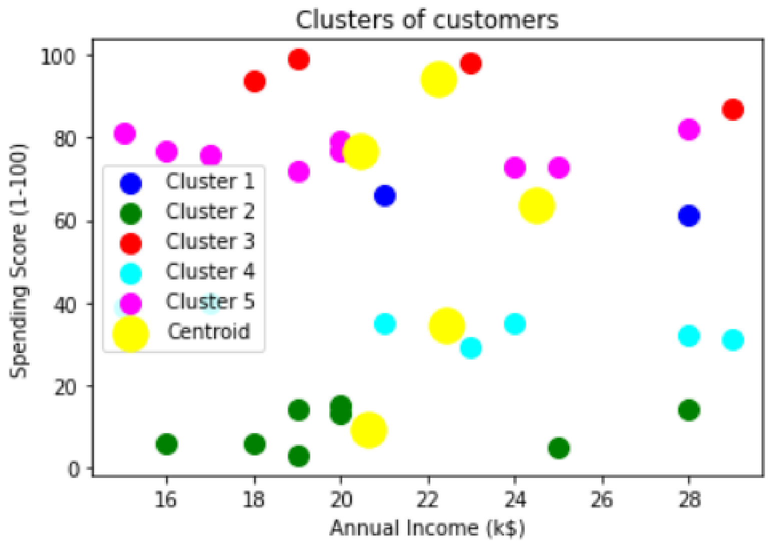
mtp.ylabel('Spending Score (1-100)')

mtp.legend()

mtp.show()

OUTPUT:

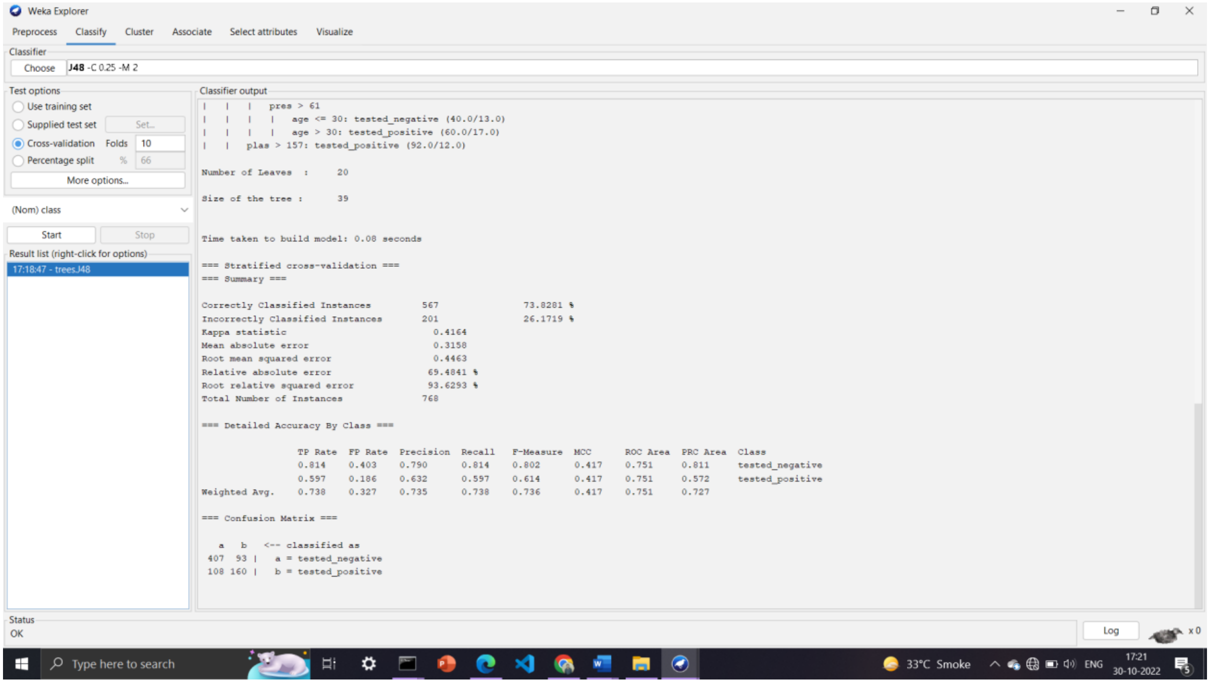


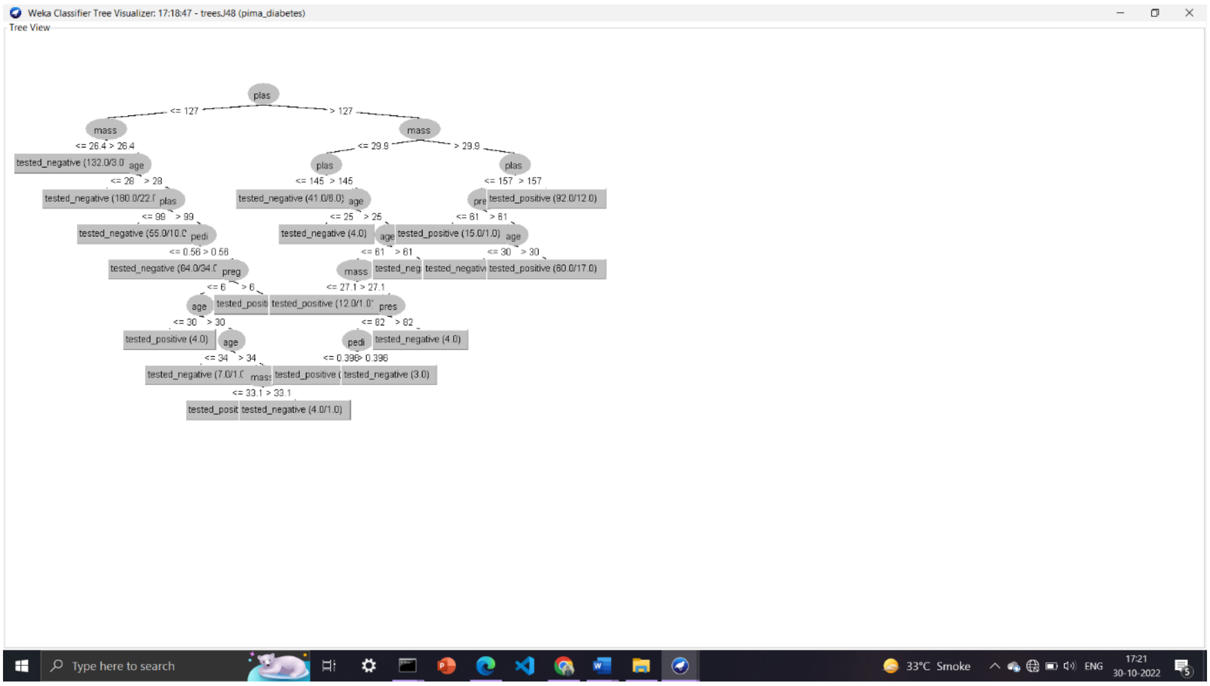


Aditya Basanti
201041029

Experiment no 6

Classification:





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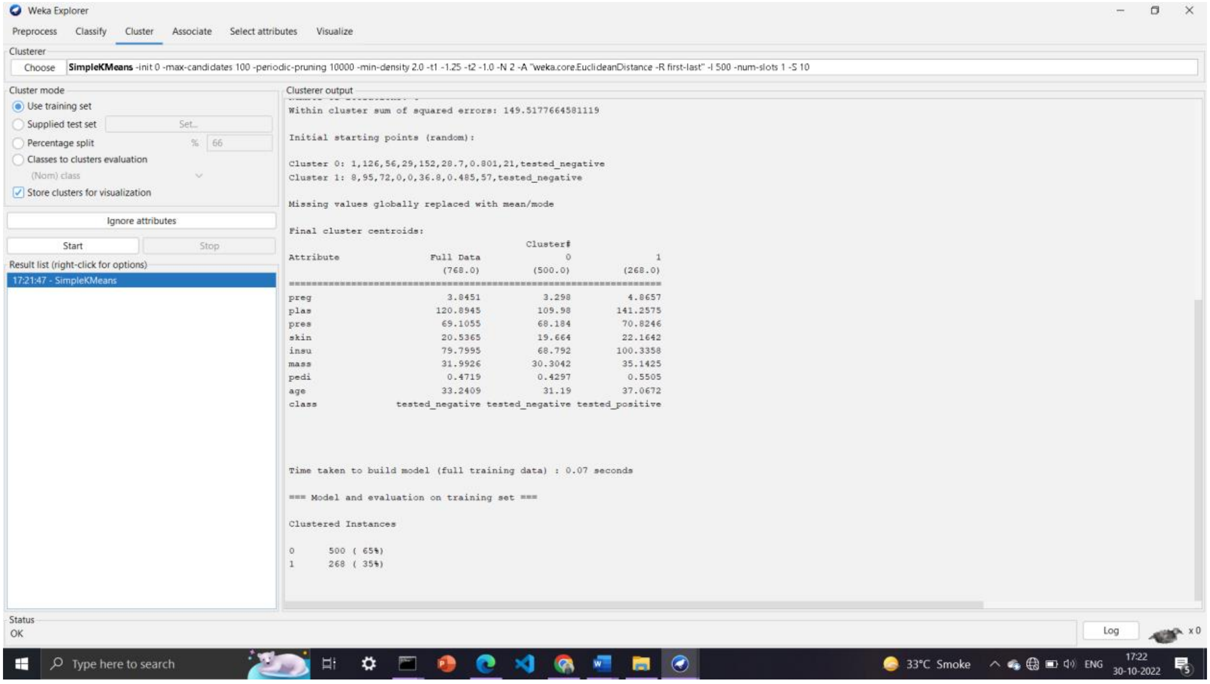
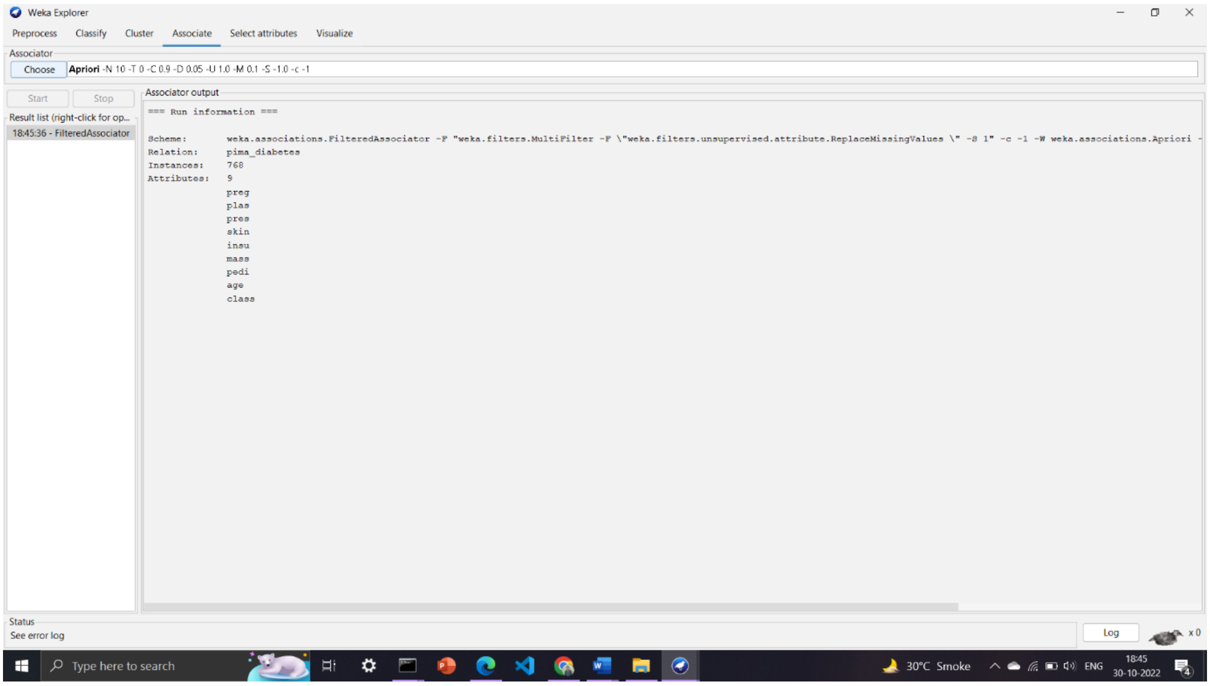
201041029

Clustering:



Association:



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201041029

Experiment no 7

PROGRAM:

```
import numpy as np

X = np.array([[8,4],[10,15],[16,12],[22,12],[30,30],[85,70],[74,80],[60,76],[65,50],[85,92]])

import matplotlib.pyplot as plt

labels = range(1,11)

plt.figure(figsize=(10,7))

plt.subplots_adjust(bottom=0.1)

plt.scatter(X[:,0],X[:,1],label='True Position')


for label,x,y in zip(labels,X[:,0],X[:,1]):
    plt.annotate(label,xy=(x,y),xytext=(-3,3),textcoords='offset points',ha='right',va='bottom')
    plt.show()
```

1) **Single Linkage**

```
from scipy.cluster.hierarchy import dendrogram,linkage

from matplotlib import pyplot as plt

linked = linkage(X,'single')

labelList = range(1,11)

plt.figure(figsize=(10,7))

dendrogram(linked,orientation='top',labels=labelList,
distance_sort='descending',show_leaf_counts=True)

plt.show()
```

2) **Complete Linkage**

```
from scipy.cluster.hierarchy import dendrogram,linkage

from matplotlib import pyplot as plt

linked = linkage(X,'complete')

labelList = range(1,11)

plt.figure(figsize=(10,7))

dendrogram(linked,orientation='top',labels=labelList,
distance_sort='descending',show_leaf_counts=True)

plt.show()
```

Aditya Basanti
201041029

3) Average Linkage

from scipy.cluster.hierarchy import dendrogram,linkage

from matplotlib import pyplot as plt

linked = linkage(X,'average')

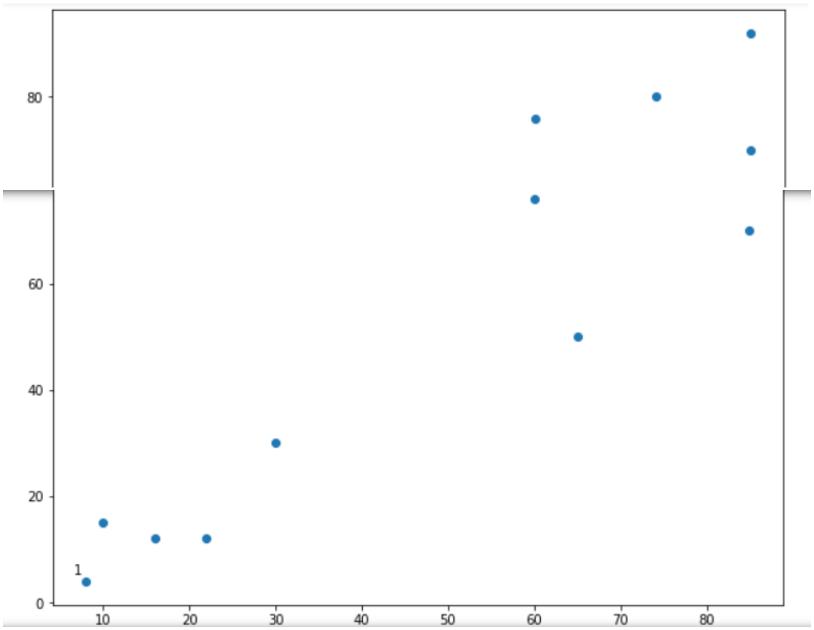
labelList = range(1,11)

plt.figure(figsize=(10,7))

dendrogram(linked,orientation='top',labels=labelList,
distance_sort='descending',show_leaf_counts=True)

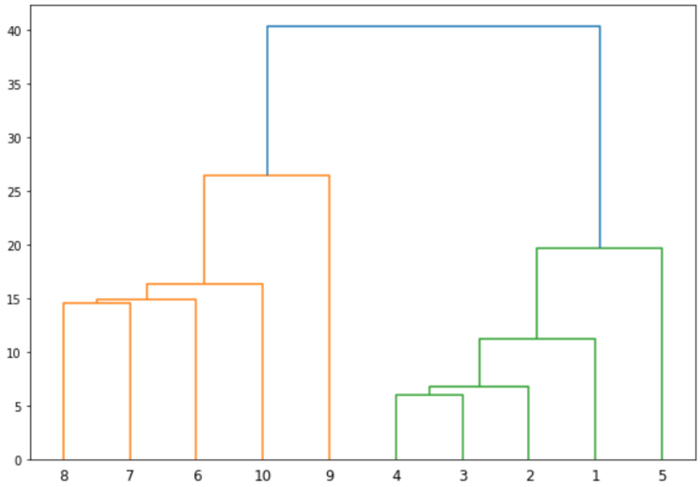
plt.show()

OUTPUT:

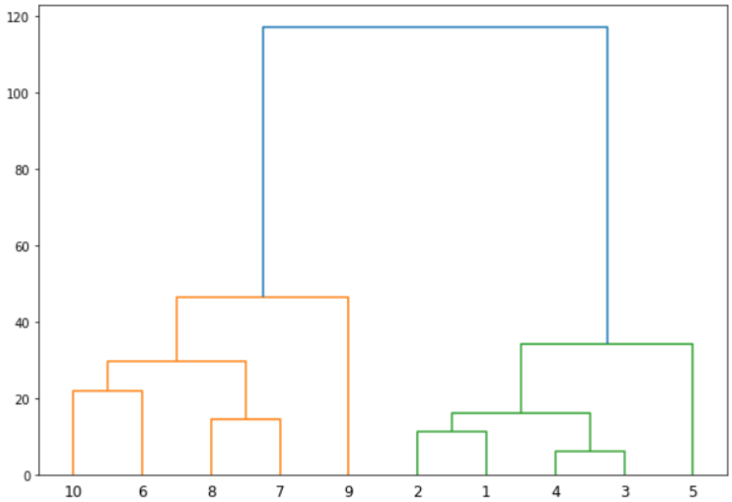


Aditya Basanti
201041029

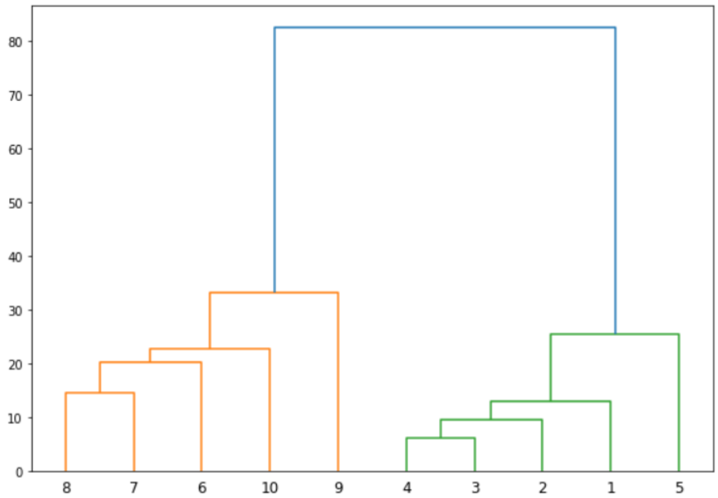
1) Single Linkage



2) Complete Linkage



3) Average Linkage



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201041029

Experiment no 8

PROGRAM:

```
data = [
['T100',['I1','I2','I5']],
['T200',['I2','I4']],
['T300',['I2','I3']],
['T400',['I1','I2','I4']],
['T500',['I1','I3']],
['T600',['I2','I3']],
['T700',['I1','I3']],
['T800',['I1','I2','I3','I5']],
['T900',['I1','I2','I3']]
]
init = []
for i in data:
for q in i[1]:
if(q not in init):
init.append(q)
init = sorted(init)
print(init)
sp = 0.4
s = int(sp*len(init))
s
from collections import Counter
c = Counter()
for i in init:
for d in data:
if(i in d[1]):
c[i]+=1
print("C1:")
for i in c:
print(str([i])+": "+str(c[i]))
```

```
print()
l = Counter()
for i in c:
if(c[i] >= s):
l[frozenset([i])]+=c[i]
print("L1:")
for i in l:
print(str(list(i))+": "+str(l[i]))
print()
pl = l
pos = 1
for count in range (2,1000):
nc = set()
temp = list(l)
for i in range(0,len(temp)):
for j in range(i+1,len(temp)):
t = temp[i].union(temp[j])
if(len(t) == count):
nc.add(temp[i].union(temp[j]))
nc = list(nc)
c = Counter()
for i in nc:
c[i] = 0
for q in data:
temp = set(q[1])
if(i.issubset(temp)):
c[i]+=1
print("C"+str(count)+":")
for i in c:
print(str(list(i))+": "+str(c[i]))
print()
l = Counter()
```

```
for i in c:
if(c[i] >= s):
l[i]+=c[i]
print("L"+str(count)+":")
for i in l:
print(str(list(i))+": "+str(l[i]))
print()
if(len(l) == 0):
break
pl = l
pos = count
print("Result: ")
print("L"+str(pos)+":")
for i in pl:
print(str(list(i))+": "+str(pl[i]))
print()
from itertools import combinations
for l in pl:
c = [frozenset(q) for q in combinations(l,len(l)-1)]
mmax = 0
for a in c:
b = l-a
ab = l
sab = 0
sa = 0
sb = 0
for q in data:
temp = set(q[1])
if(a.issubset(temp)):
sa+=1
if(b.issubset(temp)):
sb+=1
```

```
if(ab.issubset(temp)):
sab+=1
temp = sab/sa*100
if(temp > mmax):
mmax = temp
temp = sab/sb*100
if(temp > mmax):
mmax = temp
print(str(list(a))+" -> "+str(list(b))+" = "+str(sab/sa*100)+"%")
print(str(list(b))+" -> "+str(list(a))+" = "+str(sab/sb*100)+"%")
curr = 1
print("choosing:", end=' ')
for a in c:
b = l-a
ab = l
sab = 0
sa = 0
sb = 0
for q in data:
temp = set(q[1])
if(a.issubset(temp)):
sa+=1
if(b.issubset(temp)):
sb+=1
if(ab.issubset(temp)):
sab+=1
temp = sab/sa*100
if(temp == mmax):
print(curr, end = ' ')
curr += 1
temp = sab/sb*100
if(temp == mmax):
```

Aditya Basanti
201041029

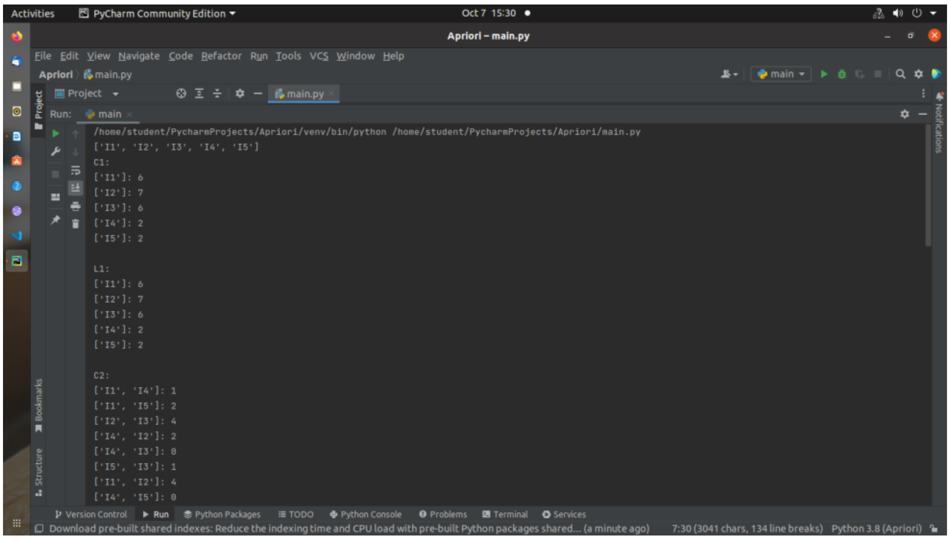
print(curr, end = ' ')

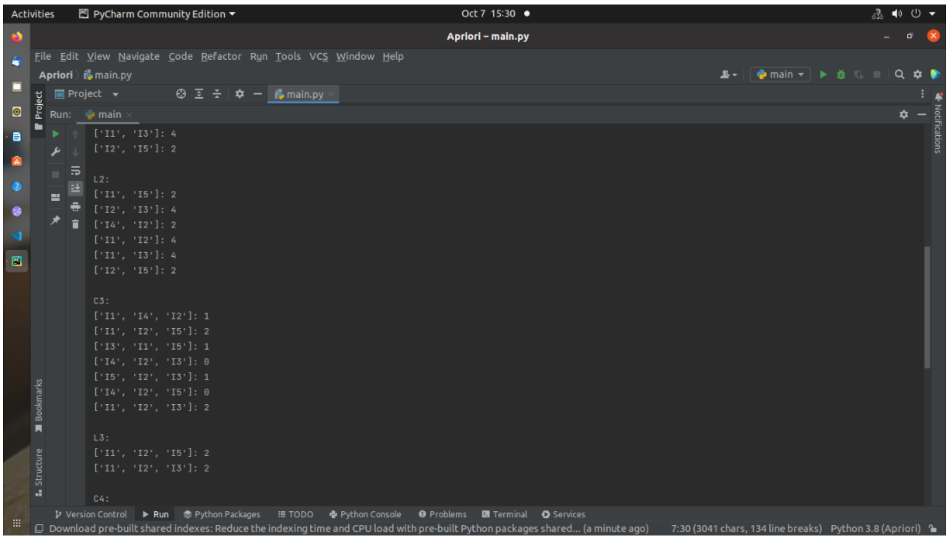
curr += 1

print()

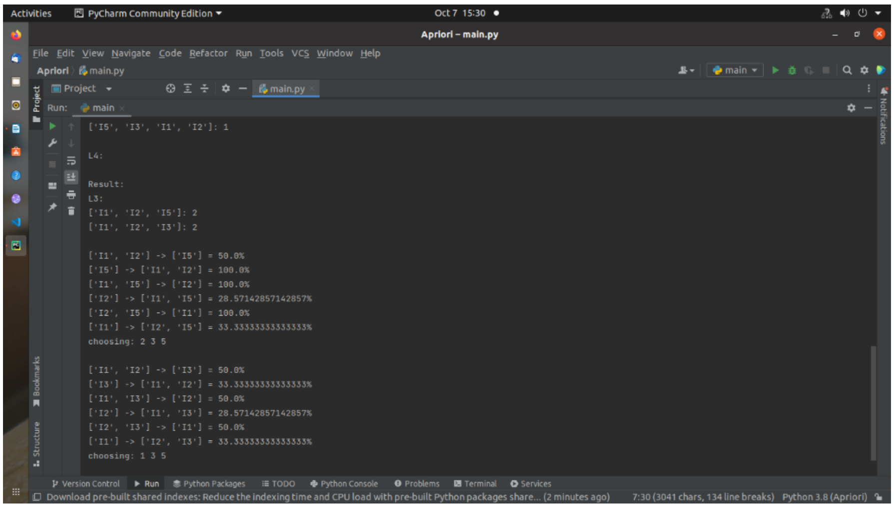
print()

OUTPUT:





Aditya Basanti
201041029



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201041029

Experiment no 9

PROGRAM:

```
import networkx as nx

import numpy as np

from numpy import array

import matplotlib.pyplot as plt

with open('./dataset/HITS.txt') as f:

   lines = f.readlines()

   G = nx.DiGraph()

for line in lines:

   t = tuple(line.strip().split(','))

   G.add_edge(*t)

   h, a = nx.hits(G, max_iter=100)

   h = dict(sorted(h.items(), key=lambda x:x[0]))

   a = dict(sorted(a.items(), key=lambda x:x[0]))

print(np.round(list(a.values()), 3))

print(np.round(list(h.values()), 3))

pr = nx.pagerank(G)

pr = dict(sorted(pr.items(), key=lambda x: x[0]))

print(np.round(list(pr.values()), 3))

sim = nx.simrank_similarity(G)

lol = [[sim[u][v] for v in sorted(sim[u])]

      for u in sorted(sim)]

sim_array = np.round(array(lol), 3)

print(sim_array)

nx.draw(G, with_labels=True, node_size=2000, edge_color='#eb4034', width=3,
font_size=16,font_weight=500, arrowsize=20, alpha=0.8)

plt.savefig("graph.png")
```

Aditya Basanti
201041029

OUTPUT:

```
[0.088 0.187 0.369 0.128 0.059 0.11  0.    0.059]
[0.043 0.144 0.03  0.187 0.268 0.144 0.154 0.03 ]
[0.241 0.137 0.218 0.24  0.077 0.035 0.019 0.034]
------------------
[[1.    0.208 0.221 0.193 0.217 0.269 0.    0.171]
 [0.208 1.    0.355 0.369 0.302 0.553 0.    0.369]
 [0.221 0.355 1.    0.242 0.4   0.325 0.    0.427]
 [0.193 0.369 0.242 1.    0.229 0.548 0.    0.244]
 [0.217 0.302 0.4   0.229 1.    0.272 0.    0.498]
 [0.269 0.553 0.325 0.548 0.272 1.    0.    0.245]
 [0.    0.    0.    0.    0.    0.    1.    0.   ]
 [0.171 0.369 0.427 0.244 0.498 0.245 0.    1.   ]]
```

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201041029

Experiment no 10

PROGRAM:

```
import networkx as nx

import matplotlib.pyplot as plt

G = nx.DiGraph()

G.add_edges_from([('A', 'D'), ('B', 'C'), ('B', 'E'), ('C', 'A'),

('D', 'C'), ('E', 'D'), ('E', 'B'), ('E', 'F'),

('E', 'C'), ('F', 'C'), ('F', 'H'), ('G', 'A'), ('G', 'C'), ('H', 'A')])

plt.figure(figsize =(10, 10))

nx.draw_networkx(G, with_labels = True)

hubs,authorities = nx.hits(G, max_iter = 50, normalized = True)

print("Hub Scores:", hubs)

print("Authority Scores:", authorities)
```

OUTPUT:

Hub Scores: {'A': 0.04642540403219997, 'D': 0.1336603752611538, 'B': 0.1576359944296732, 'C': 0.03738913224642651, 'E': 0.2588144598468665, 'F': 0.1576359944296732, 'H': 0.03738913224642651, 'G': 0.1710495075075803}
Authority Scores: {'A': 0.10864044011724336, 'D': 0.13489685434358006, 'B': 0.1143797407333645, 'C': 0.388372800387618, 'E': 0.06966521184241475, 'F': 0.1143797407333645, 'H': 0. 06966521184241475, ' G': 0.0 }