

Projet data maining

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Objectis

L'objectif de ce projet est de métriser l'API de twitter pour l'extraction des tweets ainsi que la bibliothèque NLP (natural language processing) avec NLTK en Python ce projet nous permet d'appliquer les principes de nettoyage nos tweets.

Partie 1: téléchargement des Tweets

Dans cette partie on a commencé par le téléchargement des Tweets à partir de Twitter en utilisant l'API de twitter

- consumer_key
- consumer_secret
- access_token
- access_token_secret

In [14]:

```
import pandas as pd
import tweepy as tw
import matplotlib.pyplot as plt

consumer_key = "Tippg04Ns8bfIZtE3uMprKEym"
consumer_secret = "qHjBkD4CBX67rHPenKu96c7W5Tsv59t9BGBVsm0pXM0oLatOS8"
access_token= "1328070400136400905-ZOCtds4L0DD3LqMJ2r9rZHSyAi75Xu"
access_token_secret = "qX3pBBD42A1dAZDPXx2DGcH0T0hcr4e5Oxw40YwR9wTnc"

auth = tw.OAuthHandler(consumer_key, consumer_secret)
auth.set_access_token(access_token, access_token_secret)
api = tw.API(auth,wait_on_rate_limit=True,wait_on_rate_limit_notify=True, compression=True)
e)
```

cette cellule nous permet de telecharger 10000 tweets sous forme un fichier csv et on a marque le '#' pour que nous pouvons avoir tous les types de tweets.

In []:

```
search_words = '#'
date = "2020-11-14" # choose any date with the format "yyyy-mm-dd"
tab = []
tweets = tw.Cursor(api.search,q=search_words,lang="en",since=date).items(10000)
for tweet in tweets:
    #print(tweet.id,tweet.user.screen_name,tweet.created_at,tweet.text,len(tweet.text))
    tab.append([tweet.id,tweet.user.screen_name,tweet.created_at,tweet.text,len(tweet.text)])
df = pd.DataFrame(tab).to_csv('tweets',index=False,header=['ID','User','Date','Tweet','Len'])
```

ici on va afficher notre fichier csv et le nombre des lignes et colonnes dans nos datasets

In [2]:

```
df = pd.read_csv('tweets.csv')
# Affichage de la taille du dataset (n_lignes and n_colonnes)
print("shape ", df.shape)
df.head(10)
```

```
shape (8997, 1)
```

```
Out[2]:
```

	text
0	There's more! We'll also be testing sharing Tw...
1	Oh snap! 📸\n\nSharing Tweets directly to your ...
2	@levantinepali a stamp of approval https://t.c...
3	2020 in one word
4	@Astro_AJC this is what cuffing season means t...
5	@un3asyy 2 is also cute
6	@DeePeeArts you're all amazing
7	RT @shesooosaddity: if you had a twitter befor...
8	@CloudNaii 40404
9	@issahairplug drink water replaced good morning

on remarque que on a 8997 non null c est à dire qu on a pas des lignes manquants.

```
In [3]:
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8997 entries, 0 to 8996
Data columns (total 1 columns):
 #   Column  Non-Null Count  Dtype
---  -
 0   text    8997 non-null      object
dtypes: object(1)
memory usage: 70.4+ KB
```

Partie 2: Prétraitement des tweets

Dans cette partie, on va éliminer le texte inutile des a l'aide de bibliothèque re tweets tels que les emoticons,symbols & pictographs,chinese char,mentions (@),hyperlinks ..

```
In [4]:
```

```
import re
for index, row in df.iterrows():
    row = row['text']
    txt0 = re.sub(r"http\S+", "", row)
    txt1 = re.sub(r"#\S+", "", txt0)
    txt2 = re.sub(r"@S+", "", txt1)
    txt3 = re.sub(r"\n+", "", txt2)
    txt4 = re.sub(r"RT+", "", txt3)
    txt5 = re.sub("hhh+", "", txt4)
    txt6 = re.sub('[0-9]+', '', txt5)
    txt7 = re.sub(r'https?:\/\/\S+', '', txt6)
    txt8 = re.sub('@[A-Za-z0-9]+', '', txt7)
    txt9 = re.sub(r'RT[\s]+', '', txt8)
    emoji_pattern = re.compile("[
        u"\U0001F600-\U0001F64F"
        u"\U0001F300-\U0001F5FF"
        u"\U0001F680-\U0001F6FF"
        u"\U0001F1E0-\U0001F1FF"
        u"\U00002500-\U00002BEF"
        u"\U00002702-\U000027B0"
        u"\U00002702-\U000027B0"
        u"\U000024C2-\U0001F251"
        u"\U0001f926-\U0001f937"
```

```

u"\U00010000-\U0010ffff"
u"\u2640-\u2642"
u"\u2600-\u2B55"
u"\u200d"
u"\u23cf"
u"\u23e9"
u"\u231a"
u"\ufe0f"
u"\u3030"
"]+", flags=re.UNICODE)
txt10 = re.sub(emoji_pattern, "", txt9)
df.loc[index, 'text'] =txt10

```

notre cleaning datasets

In [5]:

```
df.head(20)
```

Out[5]:

	text
0	There's more! We'll also be testing sharing Tw...
1	Oh snap! Sharing Tweets directly to your Snapc...
2	a stamp of approval
3	in one word
4	this is what cuffing season means to us
5	is also cute
6	you're all amazing
7	if you had a twitter before rt this
8	
9	drink water replaced good morning
10	we're taking oomf to the Fleets
11	remember "I dedicate my th Tweet to:____"
12	they're tourists
13	proof you're doing it right
14	some of you hating...but we see you Fleeting
15	That thing you didn't Tweet but wanted to but ...
16	this is art
17	aren't we all six feet
18	this Tweet just graduated with honors
19	saw it, love it, can't wait for the wedding p...

Partie 3: Traitement des tweets : NLP (Natural LanguageProcessing)

defintion:

Le traitement automatique du Langage Naturel est un des domaines de recherche les plus actifs en science des données actuellement. Il a pour but d'extraire des informations et une signification d'un contenu textuel.

1.Tokenisation

2.Remove stopwords

3.Stemming and Lemmitization

In [16]:

```
import nltk
nltk.download('stopwords')

[nltk_data] Downloading package stopwords to
[nltk_data] C:\Users\21650\AppData\Roaming\nltk_data...
[nltk_data] Package stopwords is already up-to-date!
```

Out[16]:

True

dans cette partie on a utulieser le stemmer de la bibliothèque nltk, dabord on va diviser chaque ligne de notre datasets en des mots et à l aide de stopwords et stemmer qui reduite les mots au mot racine.

In [7]:

```
from nltk.stem.porter import PorterStemmer
from nltk.corpus import stopwords
ps = PorterStemmer()
stemed_dataset=[]
for i in range(0,df.shape[0]):
    stemmed_array=df['text'][i].split()
    stemmed=[ps.stem(word) for word in stemmed_array if not word in set
(stopwords.words('english'))]
    stemmed=' '.join(stemmed)
    stemed_dataset.append(stemmed)
print(stemed_dataset[0:10])
```

```
['there' more! we'll also test share tweet IG stori small % keep eye', '
Oh snap! share tweet directli snapchat stori easier ever. roll today ios
!', 'stamp approv', 'one word', 'cuf season mean us', 'also cute', 'amaz
', 'twitter rt', '', 'drink water replac good morn']
```

In [8]:

```
from sklearn.feature_extraction.text import CountVectorizer
cv = CountVectorizer()
nltk=cv.fit_transform(stemed_dataset)
print(nltk)
```

```
(0, 2366) 1
(0, 1516) 1
(0, 2621) 1
(0, 1362) 1
(0, 68) 1
(0, 2348) 1
(0, 2070) 1
(0, 2497) 1
(0, 1169) 1
(0, 2243) 1
(0, 2132) 1
(0, 1263) 1
(0, 801) 1
```

```

(1, 2070) 1
(1, 2497) 1
(1, 2243) 1
(1, 1625) 1
(1, 2142) 1
(1, 637) 1
(1, 2143) 1
(1, 700) 1
(1, 765) 1
(1, 1958) 1
(1, 2417) 1
(1, 1214) 1
: :
(8987, 2070) 1
(8987, 2728) 1
(8989, 992) 1
(8989, 95) 1
(8989, 385) 1
(8990, 630) 1
(8990, 2405) 1
(8990, 1572) 1
(8991, 2361) 1
(8991, 2389) 1
(8991, 1511) 1
(8992, 2549) 1
(8992, 2731) 1
(8992, 1565) 1
(8993, 2497) 1
(8993, 2507) 2
(8993, 2604) 2
(8993, 2550) 1
(8993, 1309) 1
(8993, 2546) 2
(8993, 224) 1
(8993, 226) 1
(8993, 2554) 1
(8994, 2477) 1
(8995, 865) 1

```

Partie 4: Classification des tweets

In [9]:

```

from sklearn.cluster import KMeans
wcscs=[]

```

on va utiliser l'algorithme K-Means pour classer les Tweets en 1-30 classes similaires

In [10]:

```

for i in range(1,30):
    Kmeans=KMeans(n_clusters=i,init='k-means++',max_iter=300,n_init=10,
random_state=0,verbose=True)
    Kmeans.fit(nltk)
    wcscs.append(Kmeans.inertia_)

```

Initialisation complete

Initialization complete
Iteration 0, inertia 57907.0
Iteration 1, inertia 31119.734355896333
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 75863.0
Iteration 1, inertia 31119.734355896333
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 58105.0
Iteration 1, inertia 31119.734355896333
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 58303.0
Iteration 1, inertia 31119.734355896333
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 57955.0
Iteration 1, inertia 31119.734355896333
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 92545.0
Iteration 1, inertia 31119.734355896333
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 31460.0
Iteration 1, inertia 31119.734355896333
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 58043.0
Iteration 1, inertia 31119.734355896333
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 49312.0
Iteration 1, inertia 31119.734355896333
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 58417.0
Iteration 1, inertia 31119.734355896333
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 57525.0
Iteration 1, inertia 30926.72988272984
Iteration 2, inertia 30923.769029098927
Converged at iteration 2: strict convergence.
Initialization complete
Iteration 0, inertia 49165.0
Iteration 1, inertia 31071.524714749463
Iteration 2, inertia 30937.920410917683
Iteration 3, inertia 30874.204121288814
Iteration 4, inertia 30845.704566375705
Iteration 5, inertia 30820.94014582701
Iteration 6, inertia 30367.02301373021
Iteration 7, inertia 30185.797315374155
Iteration 8, inertia 30183.354246227045
Converged at iteration 8: strict convergence.
Initialization complete
Iteration 0, inertia 57500.0

Iteration 0, inertia 57539.0
Iteration 1, inertia 30900.31090456637
Iteration 2, inertia 30880.955425841927
Converged at iteration 2: strict convergence.
Initialization complete
Iteration 0, inertia 58147.0
Iteration 1, inertia 30972.669891038262
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 56735.0
Iteration 1, inertia 30183.8185698932
Iteration 2, inertia 30183.354246227045
Converged at iteration 2: strict convergence.
Initialization complete
Iteration 0, inertia 48992.0
Iteration 1, inertia 31082.856016265683
Iteration 2, inertia 31027.278626412084
Iteration 3, inertia 30966.961546666782
Iteration 4, inertia 30827.75317034666
Iteration 5, inertia 30647.651266559868
Iteration 6, inertia 30644.485702403257
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 31442.0
Iteration 1, inertia 31101.789637535763
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 58001.0
Iteration 1, inertia 31087.11818990433
Converged at iteration 1: strict convergence.
Initialization complete
Iteration 0, inertia 49046.0
Iteration 1, inertia 30886.8433318767
Iteration 2, inertia 30862.247677793075
Iteration 3, inertia 30820.94014582701
Iteration 4, inertia 30367.02301373021
Iteration 5, inertia 30185.797315374155
Iteration 6, inertia 30183.354246227045
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 58076.0
Iteration 1, inertia 30966.910984112674
Iteration 2, inertia 30954.164801702354
Iteration 3, inertia 30927.275825726734
Iteration 4, inertia 30729.09025416451
Iteration 5, inertia 30226.073500974897
Iteration 6, inertia 30183.354246227045
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 48866.0
Iteration 1, inertia 30735.820940793976
Iteration 2, inertia 30192.81833105476
Iteration 3, inertia 30188.928845937826
Iteration 4, inertia 30188.85698990832
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 49075.0

Iteration 1, inertia 30800.381527592534
Iteration 2, inertia 30612.56952908687
Iteration 3, inertia 30559.028910306817
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 48919.0
Iteration 1, inertia 30826.183713860388
Iteration 2, inertia 30802.016393356203
Iteration 3, inertia 30752.089336798093
Iteration 4, inertia 30366.65169638676
Iteration 5, inertia 30162.198887623603
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 48056.0
Iteration 1, inertia 30137.93291924264
Iteration 2, inertia 30126.718149189324
Iteration 3, inertia 30125.275898076452
Iteration 4, inertia 30125.191774763298
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 56206.0
Iteration 1, inertia 29560.609690249177
Iteration 2, inertia 29405.047928625743
Iteration 3, inertia 29281.8704360774
Iteration 4, inertia 29271.165660156967
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 47164.0
Iteration 1, inertia 30146.972153117655
Iteration 2, inertia 30096.659924952735
Iteration 3, inertia 30053.070944775372
Iteration 4, inertia 29846.000581586908
Iteration 5, inertia 29736.540448312
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 30442.0
Iteration 1, inertia 29919.477877878453
Iteration 2, inertia 29880.64236609799
Converged at iteration 2: strict convergence.
Initialization complete
Iteration 0, inertia 48792.0
Iteration 1, inertia 30937.61383136612
Iteration 2, inertia 30881.88127652262
Iteration 3, inertia 30765.68133679973
Iteration 4, inertia 30756.94491656288
Iteration 5, inertia 30745.860080784216
Iteration 6, inertia 30738.23586964951
Iteration 7, inertia 30421.7487010747
Iteration 8, inertia 30141.69160611538
Iteration 9, inertia 30071.45094085618
Iteration 10, inertia 30071.19408922307
Converged at iteration 10: strict convergence.
Initialization complete
Iteration 0, inertia 40321.0
Iteration 1, inertia 30969.51464663111
Iteration 2, inertia 30857.434366822312
Iteration 3, inertia 30249.281254751033

Iteration 4, inertia 30116.710052764465
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 40181.0
Iteration 1, inertia 31035.01174647277
Iteration 2, inertia 30985.881516487218
Iteration 3, inertia 30827.305495725173
Iteration 4, inertia 30770.606562001503
Iteration 5, inertia 30339.011882479896
Iteration 6, inertia 30163.592569165405
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 40015.0
Iteration 1, inertia 30696.003105737807
Iteration 2, inertia 30153.95383781222
Iteration 3, inertia 30147.16938321752
Iteration 4, inertia 30146.06385133208
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 49038.0
Iteration 1, inertia 30750.197613070733
Iteration 2, inertia 30525.5907479954
Iteration 3, inertia 30447.601297029436
Iteration 4, inertia 30424.941093587488
Iteration 5, inertia 30153.126201772906
Iteration 6, inertia 29841.559498355407
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 40037.0
Iteration 1, inertia 30806.022838731522
Iteration 2, inertia 30780.817387731684
Iteration 3, inertia 30730.939870829097
Iteration 4, inertia 30345.54835373154
Iteration 5, inertia 30141.078440234247
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 39969.0
Iteration 1, inertia 30061.401748489352
Iteration 2, inertia 30042.921248899038
Iteration 3, inertia 30036.037637926405
Iteration 4, inertia 30035.473080646167
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 54964.0
Iteration 1, inertia 29500.29006773315
Iteration 2, inertia 29478.831485499366
Iteration 3, inertia 29478.776896060488
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 46036.0
Iteration 1, inertia 29234.891846251958
Iteration 2, inertia 29184.53933082128
Iteration 3, inertia 29141.11657901479
Iteration 4, inertia 28928.14230403791
Iteration 5, inertia 28825.10695420028
Converged at iteration 5: strict convergence.
Initialization complete

Iteration 0, inertia 30415.0
Iteration 1, inertia 29892.68680856392
Iteration 2, inertia 29853.85114676366
Converged at iteration 2: strict convergence.
Initialization complete
Iteration 0, inertia 47466.0
Iteration 1, inertia 30256.935321051944
Iteration 2, inertia 30160.107504335094
Iteration 3, inertia 30048.694248666827
Iteration 4, inertia 30044.85008387988
Iteration 5, inertia 30035.411484375436
Iteration 6, inertia 30028.818737787664
Iteration 7, inertia 30025.99180792095
Iteration 8, inertia 29882.4642577538
Iteration 9, inertia 29450.432186876933
Iteration 10, inertia 29376.58695316153
Iteration 11, inertia 29375.957625313706
Iteration 12, inertia 29375.7866928412
Converged at iteration 12: strict convergence.
Initialization complete
Iteration 0, inertia 40261.0
Iteration 1, inertia 30827.022400551876
Iteration 2, inertia 30711.619076731993
Iteration 3, inertia 30107.558041709905
Iteration 4, inertia 29971.194430491312
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 40148.0
Iteration 1, inertia 30982.811580239293
Iteration 2, inertia 30933.691750601807
Iteration 3, inertia 30775.13315912627
Iteration 4, inertia 30718.457464757503
Iteration 5, inertia 30286.932647244823
Iteration 6, inertia 30111.472994611715
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 39868.0
Iteration 1, inertia 30528.14168476724
Iteration 2, inertia 29979.30933519321
Iteration 3, inertia 29972.52453611591
Iteration 4, inertia 29971.41898768996
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 40209.0
Iteration 1, inertia 30645.51220806219
Iteration 2, inertia 30420.812572618703
Iteration 3, inertia 30343.1150211968
Iteration 4, inertia 30320.61799373605
Iteration 5, inertia 30078.41453384849
Iteration 6, inertia 29741.699781295072
Iteration 7, inertia 29740.949643013555
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 39042.0
Iteration 1, inertia 29899.369814109123
Iteration 2, inertia 29871.27015106006
Iteration 3, inertia 29824.45450297178

Iteration 3, inertia 29462.288250161928
Iteration 4, inertia 29251.034263020418
Iteration 5, inertia 29250.46160306655
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 31220.0
Iteration 1, inertia 30619.4102598656
Iteration 2, inertia 30512.254494401444
Iteration 3, inertia 30471.86905064531
Iteration 4, inertia 30471.388997642694
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 31060.0
Iteration 1, inertia 29929.52029395196
Iteration 2, inertia 29816.19866241819
Iteration 3, inertia 29804.159873271095
Iteration 4, inertia 29802.442893025152
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 45909.0
Iteration 1, inertia 29126.922221855173
Iteration 2, inertia 29069.21665833725
Iteration 3, inertia 29025.74866855848
Iteration 4, inertia 28816.883442316488
Iteration 5, inertia 28717.01077145157
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 30376.0
Iteration 1, inertia 29854.158995070396
Iteration 2, inertia 29815.32317931302
Converged at iteration 2: strict convergence.
Initialization complete
Iteration 0, inertia 47283.0
Iteration 1, inertia 30155.752591749828
Iteration 2, inertia 30061.52209737645
Iteration 3, inertia 29941.8883340872
Iteration 4, inertia 29636.186805554167
Iteration 5, inertia 29179.6509417792
Iteration 6, inertia 29161.24161480578
Iteration 7, inertia 29160.843838221717
Iteration 8, inertia 29160.6699127859
Converged at iteration 8: strict convergence.
Initialization complete
Iteration 0, inertia 40216.0
Iteration 1, inertia 30595.58300236002
Iteration 2, inertia 30517.807741921704
Iteration 3, inertia 30516.98419369508
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 39974.0
Iteration 1, inertia 30808.07681932538
Iteration 2, inertia 30758.865210324322
Iteration 3, inertia 30600.183344779514
Iteration 4, inertia 30543.34020119748
Iteration 5, inertia 30114.947923661155
Iteration 6, inertia 29943.67354898981
Converged at iteration 6: strict convergence.

Converged at iteration 6: strict convergence.

Initialization complete

Iteration 0, inertia 39720.0

Iteration 1, inertia 30441.43539208355

Iteration 2, inertia 29890.760631334368

Iteration 3, inertia 29882.805119535475

Iteration 4, inertia 29880.430834134833

Iteration 5, inertia 29873.72638150394

Iteration 6, inertia 29865.93908658502

Iteration 7, inertia 29864.506908427647

Converged at iteration 7: strict convergence.

Initialization complete

Iteration 0, inertia 40143.0

Iteration 1, inertia 30579.540726009614

Iteration 2, inertia 30356.796508806925

Iteration 3, inertia 30277.15824588249

Iteration 4, inertia 30254.676471289386

Iteration 5, inertia 30012.48079362973

Iteration 6, inertia 29675.74442064823

Iteration 7, inertia 29674.994282366708

Converged at iteration 7: strict convergence.

Initialization complete

Iteration 0, inertia 38929.0

Iteration 1, inertia 29769.647468137176

Iteration 2, inertia 29741.616616989846

Iteration 3, inertia 29694.82567704248

Iteration 4, inertia 29333.583198168326

Iteration 5, inertia 29122.219217801146

Iteration 6, inertia 29120.905301219907

Converged at iteration 6: strict convergence.

Initialization complete

Iteration 0, inertia 31196.0

Iteration 1, inertia 30503.522508125036

Iteration 2, inertia 30359.60675243237

Iteration 3, inertia 30319.221165153773

Iteration 4, inertia 30318.7411109475

Converged at iteration 4: strict convergence.

Initialization complete

Iteration 0, inertia 31038.0

Iteration 1, inertia 29878.166810910083

Iteration 2, inertia 29604.948933569798

Iteration 3, inertia 29516.9039859278

Iteration 4, inertia 29515.186701755487

Converged at iteration 4: strict convergence.

Initialization complete

Iteration 0, inertia 38081.0

Iteration 1, inertia 28961.072873642934

Iteration 2, inertia 28887.539987456847

Iteration 3, inertia 28844.085165603094

Iteration 4, inertia 28645.382282218714

Iteration 5, inertia 28542.01286981926

Converged at iteration 5: strict convergence.

Initialization complete

Iteration 0, inertia 30343.0

Iteration 1, inertia 29751.35918310557

Iteration 2, inertia 29682.51283448551

Converged at iteration 2: strict convergence.

Initialization complete
Iteration 0, inertia 47057.0
Iteration 1, inertia 29945.872944572668
Iteration 2, inertia 29841.589354008225
Iteration 3, inertia 29445.950676277713
Iteration 4, inertia 28985.050273492947
Iteration 5, inertia 28966.395106099128
Iteration 6, inertia 28965.984216548062
Iteration 7, inertia 28965.808622098888
Converged at iteration 7: strict convergence.

Initialization complete
Iteration 0, inertia 40195.0
Iteration 1, inertia 30568.991842123327
Iteration 2, inertia 30488.39535315194
Iteration 3, inertia 30471.68826710664
Iteration 4, inertia 30467.80545205331
Converged at iteration 4: strict convergence.

Initialization complete
Iteration 0, inertia 39502.0
Iteration 1, inertia 30262.80532692645
Iteration 2, inertia 30172.80024360971
Iteration 3, inertia 30013.51223508015
Iteration 4, inertia 29958.119432577165
Iteration 5, inertia 29544.901442200226
Iteration 6, inertia 29369.503768728253
Iteration 7, inertia 29368.640227246444
Iteration 8, inertia 29368.000744834106
Iteration 9, inertia 29347.980081752838
Iteration 10, inertia 29165.832213938564
Iteration 11, inertia 29036.386336880325
Iteration 12, inertia 29031.59498632703
Converged at iteration 12: strict convergence.

Initialization complete
Iteration 0, inertia 39542.0
Iteration 1, inertia 30119.080606087977
Iteration 2, inertia 29566.388506170573
Iteration 3, inertia 29557.946117897944
Iteration 4, inertia 29555.52105473014
Iteration 5, inertia 29548.848235540045
Iteration 6, inertia 29541.057349623326
Iteration 7, inertia 29539.625100913185
Converged at iteration 7: strict convergence.

Initialization complete
Iteration 0, inertia 40114.0
Iteration 1, inertia 30552.448491857074
Iteration 2, inertia 30329.384129078517
Iteration 3, inertia 30249.744516752675
Iteration 4, inertia 30227.28315537297
Iteration 5, inertia 29985.295601366965
Iteration 6, inertia 29648.492685085555
Iteration 7, inertia 29647.742546804035
Converged at iteration 7: strict convergence.

Initialization complete
Iteration 0, inertia 38908.0
Iteration 1, inertia 29752.075385301952
Iteration 2, inertia 29724.041893616464
Iteration 3, inertia 29677.288480026808

Iteration 4, inertia 29315.991488321848
Iteration 5, inertia 29104.622580071922
Iteration 6, inertia 29103.30866349068
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 31178.0
Iteration 1, inertia 30485.75646494948
Iteration 2, inertia 30341.838815618263
Iteration 3, inertia 30301.453110560444
Iteration 4, inertia 30300.973055143077
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 31026.0
Iteration 1, inertia 29855.479095605435
Iteration 2, inertia 29542.493580681235
Iteration 3, inertia 29377.283443174532
Iteration 4, inertia 29332.88529559476
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 38058.0
Iteration 1, inertia 28941.392692211386
Iteration 2, inertia 28867.83940603569
Iteration 3, inertia 28824.353938762673
Iteration 4, inertia 28627.01531407184
Iteration 5, inertia 28525.176514183237
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 30321.0
Iteration 1, inertia 29724.41997951719
Iteration 2, inertia 29645.208092698962
Iteration 3, inertia 29590.523642017066
Iteration 4, inertia 29459.20536321037
Iteration 5, inertia 29396.05323773765
Iteration 6, inertia 29395.25788269763
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 46931.0
Iteration 1, inertia 29723.71802525627
Iteration 2, inertia 29623.603821971814
Iteration 3, inertia 29421.85763364066
Iteration 4, inertia 29416.673535004193
Iteration 5, inertia 29416.1348058057
Iteration 6, inertia 29413.728520266166
Iteration 7, inertia 29406.60761558895
Iteration 8, inertia 29398.663330625262
Iteration 9, inertia 29391.96585490316
Converged at iteration 9: strict convergence.
Initialization complete
Iteration 0, inertia 40152.0
Iteration 1, inertia 30572.29390376736
Iteration 2, inertia 30490.05013660264
Iteration 3, inertia 30459.939396285987
Iteration 4, inertia 30456.056575307834
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 39457.0
Iteration 1, inertia 30012.90155001016

Iteration 2, inertia 29888.67606245831
Iteration 3, inertia 29886.044122334853
Iteration 4, inertia 29884.291725816736
Iteration 5, inertia 29869.57463054838
Iteration 6, inertia 29849.437737069446
Iteration 7, inertia 29848.57828656705
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 39950.0
Iteration 1, inertia 29806.13610581505
Iteration 2, inertia 29775.96587521374
Iteration 3, inertia 29760.527665434704
Iteration 4, inertia 29756.79439132157
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 39653.0
Iteration 1, inertia 29879.16822112135
Iteration 2, inertia 29718.933446391402
Iteration 3, inertia 29485.479202607956
Iteration 4, inertia 29377.04905997881
Iteration 5, inertia 29372.439740659214
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 39083.0
Iteration 1, inertia 29465.49101944158
Iteration 2, inertia 29071.211591081537
Iteration 3, inertia 28942.06024301943
Iteration 4, inertia 28940.531541304917
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 31139.0
Iteration 1, inertia 30417.36772922588
Iteration 2, inertia 29637.04718274071
Iteration 3, inertia 29395.717193941204
Iteration 4, inertia 29393.51044689098
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 30060.0
Iteration 1, inertia 29216.858231999333
Iteration 2, inertia 29160.464362031802
Converged at iteration 2: strict convergence.
Initialization complete
Iteration 0, inertia 38796.0
Iteration 1, inertia 29426.096715360665
Iteration 2, inertia 28903.934790679687
Iteration 3, inertia 28860.503807595094
Iteration 4, inertia 28659.270789673887
Iteration 5, inertia 28554.050630177346
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 30253.0
Iteration 1, inertia 29688.058081339357
Iteration 2, inertia 29628.78532228596
Iteration 3, inertia 29580.82276464687
Iteration 4, inertia 29433.836590263327
Iteration 5, inertia 29433.025135185017
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 38404.0
Iteration 1, inertia 29360.89160861969
Iteration 2, inertia 28813.417450665034
Iteration 3, inertia 28811.34437841335
Converged at iteration 3: strict convergence.

Initialization complete
Iteration 0, inertia 38898.0
Iteration 1, inertia 29454.37452467301
Iteration 2, inertia 29360.15450695775
Iteration 3, inertia 29359.33077560307
Converged at iteration 3: strict convergence.

Initialization complete
Iteration 0, inertia 38783.0
Iteration 1, inertia 29312.5749759176
Iteration 2, inertia 28935.253294947925
Iteration 3, inertia 28934.007862916325
Iteration 4, inertia 28933.861056187743
Iteration 5, inertia 28933.686171935307
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 38912.0
Iteration 1, inertia 29189.52887970287
Iteration 2, inertia 29161.701704872998
Iteration 3, inertia 29146.289720676697
Iteration 4, inertia 29142.51149768508
Converged at iteration 4: strict convergence.

Initialization complete
Iteration 0, inertia 39579.0
Iteration 1, inertia 29834.526557942918
Iteration 2, inertia 29674.31922922055
Iteration 3, inertia 29440.869326880522
Iteration 4, inertia 29332.41751281069
Iteration 5, inertia 29327.807958810452
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 38910.0
Iteration 1, inertia 29242.593777465976
Iteration 2, inertia 28921.905455539174
Iteration 3, inertia 28807.809739113207
Iteration 4, inertia 28807.72119647742
Converged at iteration 4: strict convergence.

Initialization complete
Iteration 0, inertia 31115.0
Iteration 1, inertia 30379.699946807075
Iteration 2, inertia 29599.479117291925
Iteration 3, inertia 29358.09644596353
Iteration 4, inertia 29355.889657779633
Converged at iteration 4: strict convergence.

Initialization complete
Iteration 0, inertia 30030.0
Iteration 1, inertia 29160.007211378896
Iteration 2, inertia 29074.250027461763
Iteration 3, inertia 29044.538479992214
Iteration 4, inertia 28895.15861076
Iteration 5, inertia 28893.95654089788
Iteration 6, inertia 28893.8794122302

Converged at iteration 6: strict convergence.

Initialization complete

Iteration 0, inertia 38756.0

Iteration 1, inertia 29369.398102585677

Iteration 2, inertia 28830.821790545124

Iteration 3, inertia 28718.201402143877

Iteration 4, inertia 28451.78331702062

Iteration 5, inertia 28342.330765319864

Iteration 6, inertia 28342.094937669488

Converged at iteration 6: strict convergence.

Initialization complete

Iteration 0, inertia 30226.0

Iteration 1, inertia 29661.08354533152

Iteration 2, inertia 29601.811390065843

Iteration 3, inertia 29553.844705385352

Iteration 4, inertia 29406.85664429547

Iteration 5, inertia 29406.0451815713

Converged at iteration 5: strict convergence.

Initialization complete

Iteration 0, inertia 38298.0

Iteration 1, inertia 29293.4202854148

Iteration 2, inertia 28748.057063968445

Iteration 3, inertia 28745.980551674358

Converged at iteration 3: strict convergence.

Initialization complete

Iteration 0, inertia 38747.0

Iteration 1, inertia 29346.092985802108

Iteration 2, inertia 29337.402745848394

Iteration 3, inertia 29336.579012499184

Converged at iteration 3: strict convergence.

Initialization complete

Iteration 0, inertia 38492.0

Iteration 1, inertia 29105.874422028413

Iteration 2, inertia 28716.63516122864

Iteration 3, inertia 28713.167278748602

Iteration 4, inertia 28713.01295969581

Iteration 5, inertia 28712.835888575733

Converged at iteration 5: strict convergence.

Initialization complete

Iteration 0, inertia 38822.0

Iteration 1, inertia 29103.146709743985

Iteration 2, inertia 29075.318100330136

Iteration 3, inertia 29059.90482287662

Iteration 4, inertia 29056.126581886558

Converged at iteration 4: strict convergence.

Initialization complete

Iteration 0, inertia 39540.0

Iteration 1, inertia 29801.824506444398

Iteration 2, inertia 29637.362357334758

Iteration 3, inertia 29403.91731097644

Iteration 4, inertia 29295.467054986097

Iteration 5, inertia 29290.857462166732

Converged at iteration 5: strict convergence.

Initialization complete

Iteration 0, inertia 38651.0

Iteration 1, inertia 28977.945593728495

Iteration 2, inertia 28665.820372182963

Iteration 2, inertia 28553.024598586693
Iteration 3, inertia 28553.024598586693
Iteration 4, inertia 28552.935837239384
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 30167.0
Iteration 1, inertia 29469.238883228314
Iteration 2, inertia 28786.173799950302
Iteration 3, inertia 28567.310876382275
Iteration 4, inertia 28561.204406172248
Iteration 5, inertia 28560.704069329022
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 30010.0
Iteration 1, inertia 29140.699601707194
Iteration 2, inertia 29054.93929166475
Iteration 3, inertia 29025.23140916762
Iteration 4, inertia 28875.85153477392
Iteration 5, inertia 28874.649456742005
Iteration 6, inertia 28874.57232807432
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 38716.0
Iteration 1, inertia 29238.611331223805
Iteration 2, inertia 28701.350971276635
Iteration 3, inertia 28594.06060885177
Iteration 4, inertia 28333.89169541858
Iteration 5, inertia 28216.34129202633
Iteration 6, inertia 28216.105239355144
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 30203.0
Iteration 1, inertia 29611.194303750763
Iteration 2, inertia 29548.290392353196
Iteration 3, inertia 29498.455042135418
Iteration 4, inertia 29326.257226904334
Iteration 5, inertia 29286.69775395154
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 37995.0
Iteration 1, inertia 29016.149411913022
Iteration 2, inertia 28490.018862552246
Iteration 3, inertia 28488.56337190275
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 38654.0
Iteration 1, inertia 29265.37948070906
Iteration 2, inertia 29256.687261135972
Iteration 3, inertia 29255.86350865328
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 38456.0
Iteration 1, inertia 29073.440430915067
Iteration 2, inertia 28684.1919693408
Iteration 3, inertia 28680.72406150504
Iteration 4, inertia 28680.569742452248
Iteration 5, inertia 28680.39267133217
Converged at iteration 5: strict convergence.

Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 38708.0
Iteration 1, inertia 28883.730848790186
Iteration 2, inertia 28840.816588450944
Iteration 3, inertia 28740.48819998202
Iteration 4, inertia 28733.967764809855
Converged at iteration 4: strict convergence.

Initialization complete
Iteration 0, inertia 39492.0
Iteration 1, inertia 29701.214312348202
Iteration 2, inertia 29510.71901123093
Iteration 3, inertia 29267.68780781527
Iteration 4, inertia 29160.61597164496
Iteration 5, inertia 29158.047117339225
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 38561.0
Iteration 1, inertia 28891.491098355888
Iteration 2, inertia 28579.38599760182
Iteration 3, inertia 28466.586782430135
Iteration 4, inertia 28466.498021082825
Converged at iteration 4: strict convergence.

Initialization complete
Iteration 0, inertia 30065.0
Iteration 1, inertia 29424.03451263699
Iteration 2, inertia 28744.8093207267
Iteration 3, inertia 28528.735098967853
Iteration 4, inertia 28519.59894381942
Iteration 5, inertia 28503.07916278795
Iteration 6, inertia 28484.27649407041
Iteration 7, inertia 28478.64452342403
Converged at iteration 7: strict convergence.

Initialization complete
Iteration 0, inertia 29989.0
Iteration 1, inertia 29120.23636531745
Iteration 2, inertia 29034.473564460157
Iteration 3, inertia 29004.7699971258
Iteration 4, inertia 28855.389597045727
Iteration 5, inertia 28854.187506268256
Iteration 6, inertia 28854.110377600562
Converged at iteration 6: strict convergence.

Initialization complete
Iteration 0, inertia 38651.0
Iteration 1, inertia 29183.43938070784
Iteration 2, inertia 28647.279125710058
Iteration 3, inertia 28540.03333207352
Iteration 4, inertia 28280.888465968732
Iteration 5, inertia 28164.253502282758
Iteration 6, inertia 28164.0170051254
Converged at iteration 6: strict convergence.

Initialization complete
Iteration 0, inertia 30179.0
Iteration 1, inertia 29587.51037394232
Iteration 2, inertia 29524.607839960976
Iteration 3, inertia 29474.783953271683
Iteration 4, inertia 29302.584150746625
Iteration 5, inertia 29266.881166888887

Iteration 5, inertia 29263.02446963307
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 37464.0
Iteration 1, inertia 28624.11054254852
Iteration 2, inertia 28074.45432258545
Iteration 3, inertia 28072.58327136691
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 30167.0
Iteration 1, inertia 29263.320692563946
Iteration 2, inertia 29254.62837343024
Iteration 3, inertia 29253.804619778515
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 38401.0
Iteration 1, inertia 29000.295748274257
Iteration 2, inertia 28504.025056425577
Iteration 3, inertia 28447.538914654775
Iteration 4, inertia 28444.974758776756
Iteration 5, inertia 28444.794231007403
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 38463.0
Iteration 1, inertia 28748.39429554738
Iteration 2, inertia 28720.62446873379
Iteration 3, inertia 28705.1764764665
Iteration 4, inertia 28701.397953489108
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 38632.0
Iteration 1, inertia 29245.574968666155
Iteration 2, inertia 29050.134321193127
Iteration 3, inertia 28828.08329031356
Iteration 4, inertia 28720.325422883277
Iteration 5, inertia 28717.755731608202
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 38415.0
Iteration 1, inertia 28770.422491558667
Iteration 2, inertia 28454.252814291784
Iteration 3, inertia 28343.793587917953
Iteration 4, inertia 28343.035064481835
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 30055.0
Iteration 1, inertia 29414.044053919526
Iteration 2, inertia 28734.830369642157
Iteration 3, inertia 28518.74903465583
Iteration 4, inertia 28509.61296973814
Iteration 5, inertia 28493.09316968471
Iteration 6, inertia 28474.290499458377
Iteration 7, inertia 28468.658528811993
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 29917.0
Iteration 1, inertia 28890.638750105343

Iteration 2, inertia 28340.682696651238
Iteration 3, inertia 28327.276936830218
Iteration 4, inertia 28182.669449011508
Iteration 5, inertia 28179.271409773235
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 38594.0
Iteration 1, inertia 29130.030278621256
Iteration 2, inertia 28593.849972456108
Iteration 3, inertia 28486.610089077363
Iteration 4, inertia 28227.470041270393
Iteration 5, inertia 28110.830545906792
Iteration 6, inertia 28110.594048749437
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 30067.0
Iteration 1, inertia 29512.508727941866
Iteration 2, inertia 29427.3774131203
Iteration 3, inertia 29285.16779821554
Iteration 4, inertia 29111.699313908444
Iteration 5, inertia 29071.991631790224
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 36720.0
Iteration 1, inertia 28087.123546566967
Iteration 2, inertia 27995.234231439026
Iteration 3, inertia 27944.094810407027
Iteration 4, inertia 27943.183014451257
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 30115.0
Iteration 1, inertia 29197.41572265786
Iteration 2, inertia 29183.33729649057
Iteration 3, inertia 29182.485914067525
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 38311.0
Iteration 1, inertia 28913.970433692848
Iteration 2, inertia 28420.18253856177
Iteration 3, inertia 28363.694514993145
Iteration 4, inertia 28361.129089702463
Iteration 5, inertia 28360.94830311678
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 38431.0
Iteration 1, inertia 28702.468988827743
Iteration 2, inertia 28674.629110038655
Iteration 3, inertia 28659.179244881
Iteration 4, inertia 28655.400657384656
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 38441.0
Iteration 1, inertia 29087.41263747846
Iteration 2, inertia 28867.746114147183
Iteration 3, inertia 28580.763750001915
Iteration 4, inertia 28345.403648743686
Iteration 5, inertia 28344.77394984403

Converged at iteration 5: strict convergence.

Initialization complete

Iteration 0, inertia 30105.0

Iteration 1, inertia 28901.82561904363

Iteration 2, inertia 28485.340782976305

Iteration 3, inertia 28304.28578312736

Iteration 4, inertia 28302.76814404606

Converged at iteration 4: strict convergence.

Initialization complete

Iteration 0, inertia 29908.0

Iteration 1, inertia 29359.659486050055

Iteration 2, inertia 28717.235973596817

Iteration 3, inertia 28501.14858401892

Iteration 4, inertia 28492.013091464894

Iteration 5, inertia 28475.493410299758

Iteration 6, inertia 28456.690737867968

Iteration 7, inertia 28451.058767221584

Converged at iteration 7: strict convergence.

Initialization complete

Iteration 0, inertia 29865.0

Iteration 1, inertia 28836.226538321906

Iteration 2, inertia 28320.87524238149

Converged at iteration 2: strict convergence.

Initialization complete

Iteration 0, inertia 38522.0

Iteration 1, inertia 29079.673644172035

Iteration 2, inertia 28547.578631856522

Iteration 3, inertia 28440.40290115292

Iteration 4, inertia 28181.353149453313

Iteration 5, inertia 28064.648475204875

Iteration 6, inertia 28064.411749819337

Converged at iteration 6: strict convergence.

Initialization complete

Iteration 0, inertia 30031.0

Iteration 1, inertia 29476.64418622569

Iteration 2, inertia 29391.5016065698

Iteration 3, inertia 29249.590565281953

Iteration 4, inertia 29079.151269816044

Iteration 5, inertia 29039.43239777525

Converged at iteration 5: strict convergence.

Initialization complete

Iteration 0, inertia 36642.0

Iteration 1, inertia 28012.135577363544

Iteration 2, inertia 27920.247147494574

Iteration 3, inertia 27869.107248682252

Iteration 4, inertia 27868.19545272648

Converged at iteration 4: strict convergence.

Initialization complete

Iteration 0, inertia 30064.0

Iteration 1, inertia 29029.056745755606

Iteration 2, inertia 28740.395903104887

Iteration 3, inertia 28738.992944924983

Converged at iteration 3: strict convergence.

Initialization complete

Iteration 0, inertia 38161.0

Iteration 1, inertia 28767.001037190275

Iteration 2, inertia 28273.19913744943

Iteration 3, inertia 28216.709947339295
Iteration 4, inertia 28214.14452204861
Iteration 5, inertia 28213.963735462923
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 38150.0
Iteration 1, inertia 28493.657756415636
Iteration 2, inertia 28468.694024034503
Iteration 3, inertia 28455.110055338755
Iteration 4, inertia 28448.98163273171
Iteration 5, inertia 28448.339332875887
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 38411.0
Iteration 1, inertia 29060.439205610983
Iteration 2, inertia 28840.774544084266
Iteration 3, inertia 28553.803691246412
Iteration 4, inertia 28318.439636745017
Iteration 5, inertia 28317.809928849805
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 30072.0
Iteration 1, inertia 28831.721563559593
Iteration 2, inertia 28286.339024013683
Iteration 3, inertia 28050.540697196935
Iteration 4, inertia 28049.639604160406
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29887.0
Iteration 1, inertia 29338.947697962667
Iteration 2, inertia 28696.548160044033
Iteration 3, inertia 28480.450453852485
Iteration 4, inertia 28471.315423576038
Iteration 5, inertia 28454.795823343884
Iteration 6, inertia 28435.993148689107
Iteration 7, inertia 28430.361178042724
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 29817.0
Iteration 1, inertia 28788.5055274124
Iteration 2, inertia 28273.08223652837
Converged at iteration 2: strict convergence.
Initialization complete
Iteration 0, inertia 37720.0
Iteration 1, inertia 28592.96675915769
Iteration 2, inertia 28498.400712879476
Iteration 3, inertia 28391.169241777872
Iteration 4, inertia 28132.21204698379
Iteration 5, inertia 28015.732724719583
Iteration 6, inertia 28015.25701109539
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29965.0
Iteration 1, inertia 29434.835228138305
Iteration 2, inertia 29349.73423427344
Iteration 3, inertia 29207.823192985597
Iteration 4, inertia 29037.38389751969

Iteration 4, inertia 28997.665025478887
Iteration 5, inertia 28997.665025478887
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 36504.0
Iteration 1, inertia 27879.325232536037
Iteration 2, inertia 27787.43680266707
Iteration 3, inertia 27736.296903854745
Iteration 4, inertia 27735.385107898972
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 30043.0
Iteration 1, inertia 29008.158953882357
Iteration 2, inertia 28719.493145658038
Iteration 3, inertia 28718.090176307276
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 38065.0
Iteration 1, inertia 28635.048558163904
Iteration 2, inertia 28145.13705199014
Iteration 3, inertia 28087.527578734967
Iteration 4, inertia 28084.75794524807
Iteration 5, inertia 28084.533993972174
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 38078.0
Iteration 1, inertia 28347.326978751076
Iteration 2, inertia 28136.156732324223
Iteration 3, inertia 28023.787291085777
Iteration 4, inertia 28017.01135641386
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 38339.0
Iteration 1, inertia 28991.3362783734
Iteration 2, inertia 28725.0828609006
Iteration 3, inertia 28295.232312507476
Iteration 4, inertia 28067.411384624364
Iteration 5, inertia 28067.003609832045
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 30048.0
Iteration 1, inertia 28808.706994898548
Iteration 2, inertia 28267.841560923967
Iteration 3, inertia 28031.37146186785
Iteration 4, inertia 28030.470368831313
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29854.0
Iteration 1, inertia 29236.912470114115
Iteration 2, inertia 28563.737815216526
Iteration 3, inertia 28347.640109024975
Iteration 4, inertia 28338.50507874853
Iteration 5, inertia 28321.98547851638
Iteration 6, inertia 28303.182803861608
Iteration 7, inertia 28297.55083321522
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 28781.0

Iteration 0, inertia 29701.0
Iteration 1, inertia 28752.67492637099
Iteration 2, inertia 28237.231943269726
Converged at iteration 2: strict convergence.
Initialization complete
Iteration 0, inertia 37633.0
Iteration 1, inertia 28518.343624965997
Iteration 2, inertia 28418.59537656502
Iteration 3, inertia 28311.55096825846
Iteration 4, inertia 28055.93965826104
Iteration 5, inertia 27939.789065867964
Iteration 6, inertia 27938.461247829648
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29890.0
Iteration 1, inertia 29359.80063722169
Iteration 2, inertia 29274.700487710175
Iteration 3, inertia 29132.794706213765
Iteration 4, inertia 28962.354240118126
Iteration 5, inertia 28922.635158924848
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 36476.0
Iteration 1, inertia 27846.85544264521
Iteration 2, inertia 27731.832428513026
Iteration 3, inertia 27678.298997549136
Iteration 4, inertia 27677.379015561968
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29998.0
Iteration 1, inertia 28951.64234254456
Iteration 2, inertia 28657.005852291437
Iteration 3, inertia 28655.602806756626
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 37126.0
Iteration 1, inertia 27956.389761602484
Iteration 2, inertia 27469.69029737706
Iteration 3, inertia 27414.19088955091
Iteration 4, inertia 27413.448136653482
Iteration 5, inertia 27413.21906924477
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 37985.0
Iteration 1, inertia 28266.875667270466
Iteration 2, inertia 28055.69455429136
Iteration 3, inertia 27943.2822510199
Iteration 4, inertia 27936.50586653109
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 30453.0
Iteration 1, inertia 28981.63104056258
Iteration 2, inertia 28715.58221492294
Iteration 3, inertia 28285.75551313258
Iteration 4, inertia 28057.925706202364
Iteration 5, inertia 28057.51792407318
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 30020.0
Iteration 1, inertia 28780.95651410362
Iteration 2, inertia 28240.088780923958
Iteration 3, inertia 28003.614431760085
Iteration 4, inertia 28002.713338723548
Converged at iteration 4: strict convergence.

Initialization complete
Iteration 0, inertia 29822.0
Iteration 1, inertia 29207.02229538748
Iteration 2, inertia 28535.589220846694
Iteration 3, inertia 28323.722116680212
Iteration 4, inertia 28309.21112550433
Iteration 5, inertia 28292.174883629174
Iteration 6, inertia 28273.372208974397
Iteration 7, inertia 28267.74023832801
Converged at iteration 7: strict convergence.

Initialization complete
Iteration 0, inertia 29748.0
Iteration 1, inertia 28719.891425804195
Iteration 2, inertia 28204.43111030622
Converged at iteration 2: strict convergence.

Initialization complete
Iteration 0, inertia 37607.0
Iteration 1, inertia 28470.878689536297
Iteration 2, inertia 28312.65471905022
Iteration 3, inertia 28041.32085385818
Iteration 4, inertia 27783.537832186736
Iteration 5, inertia 27678.05194389623
Iteration 6, inertia 27676.712746839563
Converged at iteration 6: strict convergence.

Initialization complete
Iteration 0, inertia 29874.0
Iteration 1, inertia 29339.61328654276
Iteration 2, inertia 29254.527013530012
Iteration 3, inertia 29112.609020840755
Iteration 4, inertia 28942.180216012744
Iteration 5, inertia 28902.460692253255
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 36444.0
Iteration 1, inertia 27797.000357891073
Iteration 2, inertia 27513.72241088534
Iteration 3, inertia 27455.571786365534
Iteration 4, inertia 27453.901146408432
Iteration 5, inertia 27453.14551593913
Iteration 6, inertia 27452.57657577784
Iteration 7, inertia 27450.733046732992
Iteration 8, inertia 27450.221799822873
Converged at iteration 8: strict convergence.

Initialization complete
Iteration 0, inertia 29977.0
Iteration 1, inertia 28930.78469214183
Iteration 2, inertia 28636.143220056263
Iteration 3, inertia 28634.740163291706
Converged at iteration 3: strict convergence.

Initialization complete

Iteration 0, inertia 37042.0
Iteration 1, inertia 27881.225386617756
Iteration 2, inertia 27397.512964534642
Iteration 3, inertia 27342.317245257163
Iteration 4, inertia 27341.57463501591
Iteration 5, inertia 27341.34527179941
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 37922.0
Iteration 1, inertia 28208.624243334125
Iteration 2, inertia 28000.005660216397
Iteration 3, inertia 27888.05800523236
Iteration 4, inertia 27881.281620743554
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 30293.0
Iteration 1, inertia 28952.39695212569
Iteration 2, inertia 28698.613209766223
Iteration 3, inertia 28303.15260158007
Iteration 4, inertia 28038.231949913214
Iteration 5, inertia 28037.037792707222
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29972.0
Iteration 1, inertia 28748.386702782875
Iteration 2, inertia 28207.518969603214
Iteration 3, inertia 27971.04462043935
Iteration 4, inertia 27970.14352740281
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29786.0
Iteration 1, inertia 29166.909043851065
Iteration 2, inertia 28488.523266664353
Iteration 3, inertia 28284.5009796082
Iteration 4, inertia 28270.56721909249
Iteration 5, inertia 28253.531082006743
Iteration 6, inertia 28234.728405135
Iteration 7, inertia 28229.096434488616
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 29637.0
Iteration 1, inertia 28613.27070308284
Iteration 2, inertia 28097.872393831018
Converged at iteration 2: strict convergence.
Initialization complete
Iteration 0, inertia 37322.0
Iteration 1, inertia 28216.609104617946
Iteration 2, inertia 28103.426943988485
Iteration 3, inertia 27995.461592482385
Iteration 4, inertia 27736.981391466605
Iteration 5, inertia 27524.43661807295
Iteration 6, inertia 27516.28501167089
Iteration 7, inertia 27516.106939562986
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 29850.0
Iteration 1, inertia 29223.73862793021

Iteration 2, inertia 29101.89706728777
Iteration 3, inertia 28959.993235664828
Iteration 4, inertia 28789.564420447212
Iteration 5, inertia 28749.844693860447
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 36304.0
Iteration 1, inertia 27630.69200472727
Iteration 2, inertia 27346.223809565865
Iteration 3, inertia 27288.091821882957
Iteration 4, inertia 27286.433986034077
Iteration 5, inertia 27285.684343973375
Iteration 6, inertia 27285.13861791379
Iteration 7, inertia 27283.310395184235
Iteration 8, inertia 27282.79780973692
Converged at iteration 8: strict convergence.
Initialization complete
Iteration 0, inertia 29824.0
Iteration 1, inertia 28778.16957305098
Iteration 2, inertia 28483.523430206285
Iteration 3, inertia 28482.12036223629
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 36984.0
Iteration 1, inertia 27801.0607724812
Iteration 2, inertia 27320.86636522489
Iteration 3, inertia 27267.61477086182
Iteration 4, inertia 27266.89095260806
Iteration 5, inertia 27266.665724261955
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 37366.0
Iteration 1, inertia 27866.457871550934
Iteration 2, inertia 27656.30326668839
Iteration 3, inertia 27517.470162878028
Iteration 4, inertia 27504.33468469417
Iteration 5, inertia 27502.50111305199
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 30275.0
Iteration 1, inertia 28919.97903686411
Iteration 2, inertia 28666.19543045023
Iteration 3, inertia 28270.765921575057
Iteration 4, inertia 28005.833965656668
Iteration 5, inertia 28004.639794084116
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29921.0
Iteration 1, inertia 28698.088460373103
Iteration 2, inertia 28157.26421104273
Iteration 3, inertia 27920.78734615923
Iteration 4, inertia 27919.886253122702
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29748.0
Iteration 1, inertia 29088.675966034076
Iteration 2, inertia 28356.80229216746

Iteration 3, inertia 28088.536555214352
Iteration 4, inertia 28075.275664663863
Iteration 5, inertia 28061.187124298707
Iteration 6, inertia 28046.990290034744
Iteration 7, inertia 28042.841599205763
Iteration 8, inertia 28040.47444055882
Iteration 9, inertia 28026.919460551748
Iteration 10, inertia 27991.59151221446
Iteration 11, inertia 27955.208889249592
Converged at iteration 11: strict convergence.
Initialization complete
Iteration 0, inertia 29605.0
Iteration 1, inertia 28547.93302353699
Iteration 2, inertia 27974.352360302302
Iteration 3, inertia 27968.23549075594
Iteration 4, inertia 27968.10111417907
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 37231.0
Iteration 1, inertia 28134.3453896036
Iteration 2, inertia 28050.181190840343
Iteration 3, inertia 27967.6605696613
Iteration 4, inertia 27889.618194769282
Iteration 5, inertia 27778.10697911987
Iteration 6, inertia 27770.030635354764
Iteration 7, inertia 27769.857046550056
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 29712.0
Iteration 1, inertia 29090.92828310272
Iteration 2, inertia 28969.08672246027
Iteration 3, inertia 28827.182890837325
Iteration 4, inertia 28656.7540756197
Iteration 5, inertia 28617.03434903294
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 36271.0
Iteration 1, inertia 27588.042549589216
Iteration 2, inertia 27299.640973546564
Iteration 3, inertia 27242.37098487994
Iteration 4, inertia 27240.477939301338
Iteration 5, inertia 27240.19306772899
Iteration 6, inertia 27239.443425668287
Iteration 7, inertia 27238.89769960871
Iteration 8, inertia 27237.069476879147
Iteration 9, inertia 27236.556891431836
Converged at iteration 9: strict convergence.
Initialization complete
Iteration 0, inertia 29770.0
Iteration 1, inertia 28730.164082313408
Iteration 2, inertia 28435.478119174477
Iteration 3, inertia 28434.92621150117
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 36960.0
Iteration 1, inertia 27780.44002351685
Iteration 2, inertia 27300.42550132746

Iteration 2, inertia 27246.219233582597
Iteration 3, inertia 27247.17030982536
Iteration 4, inertia 27246.444603905584
Iteration 5, inertia 27246.219233582597
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29703.0
Iteration 1, inertia 28228.522866401152
Iteration 2, inertia 27948.56062080318
Iteration 3, inertia 27702.668185468247
Iteration 4, inertia 27634.871250702425
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 30245.0
Iteration 1, inertia 28887.167610232842
Iteration 2, inertia 28629.42930398548
Iteration 3, inertia 28240.96712127807
Iteration 4, inertia 27976.034038929138
Iteration 5, inertia 27974.839862971512
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29807.0
Iteration 1, inertia 28585.688064628037
Iteration 2, inertia 28045.08116836287
Iteration 3, inertia 27808.585245835122
Iteration 4, inertia 27807.684152798593
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29722.0
Iteration 1, inertia 29050.180532736056
Iteration 2, inertia 28316.536959030578
Iteration 3, inertia 28041.47198456691
Iteration 4, inertia 28020.899277596625
Iteration 5, inertia 27957.16588300925
Iteration 6, inertia 27899.20130249201
Iteration 7, inertia 27877.17948932531
Iteration 8, inertia 27801.263307820784
Iteration 9, inertia 27780.741204024827
Converged at iteration 9: strict convergence.
Initialization complete
Iteration 0, inertia 29581.0
Iteration 1, inertia 28523.90733306644
Iteration 2, inertia 27950.309624943857
Iteration 3, inertia 27944.19269254852
Iteration 4, inertia 27944.05831597165
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 37166.0
Iteration 1, inertia 28004.74302338474
Iteration 2, inertia 27662.920672650278
Iteration 3, inertia 27579.368655236056
Iteration 4, inertia 27501.420436442342
Iteration 5, inertia 27393.810588234923
Iteration 6, inertia 27385.35426468321
Iteration 7, inertia 27385.176063454994
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 29694.0

Iteration 0, inertia 29094.0
Iteration 1, inertia 29072.925574964127
Iteration 2, inertia 28951.085301377134
Iteration 3, inertia 28809.185532815318
Iteration 4, inertia 28638.753592831126
Iteration 5, inertia 28599.03364212116
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 36217.0
Iteration 1, inertia 27506.401717057808
Iteration 2, inertia 27218.00109079421
Iteration 3, inertia 27160.72757233719
Iteration 4, inertia 27158.834526758586
Iteration 5, inertia 27158.54965518624
Iteration 6, inertia 27157.80001312554
Iteration 7, inertia 27157.254287065964
Iteration 8, inertia 27155.426064336403
Iteration 9, inertia 27154.913478889088
Converged at iteration 9: strict convergence.
Initialization complete
Iteration 0, inertia 29749.0
Iteration 1, inertia 28676.185267892284
Iteration 2, inertia 28373.247019661776
Iteration 3, inertia 28319.258879228855
Iteration 4, inertia 28255.27365598175
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 36900.0
Iteration 1, inertia 27724.04145405941
Iteration 2, inertia 27238.062670730687
Iteration 3, inertia 27184.799153415097
Iteration 4, inertia 27184.073447495317
Iteration 5, inertia 27183.848077172333
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29679.0
Iteration 1, inertia 28189.76052250682
Iteration 2, inertia 27909.79046367561
Iteration 3, inertia 27665.267151962384
Iteration 4, inertia 27598.839682723625
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29461.0
Iteration 1, inertia 28205.92531409
Iteration 2, inertia 27961.012553846802
Iteration 3, inertia 27640.562618293734
Iteration 4, inertia 27456.08070047731
Iteration 5, inertia 27374.867381064407
Iteration 6, inertia 27374.519227411307
Iteration 7, inertia 27374.188037595497
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 29768.0
Iteration 1, inertia 28549.935558699184
Iteration 2, inertia 28009.328662434018
Iteration 3, inertia 27772.83273990627
Iteration 4, inertia 27771.931646869736
Converged at iteration 4: strict convergence.

Converged at iteration 4: strict convergence.

Initialization complete

Iteration 0, inertia 29659.0

Iteration 1, inertia 28987.593747983632

Iteration 2, inertia 28255.476092034565

Iteration 3, inertia 27981.812007046658

Iteration 4, inertia 27961.23009624388

Iteration 5, inertia 27897.489503061257

Iteration 6, inertia 27839.510665049966

Iteration 7, inertia 27817.47977242735

Iteration 8, inertia 27741.563082405944

Iteration 9, inertia 27721.040106816963

Converged at iteration 9: strict convergence.

Initialization complete

Iteration 0, inertia 29563.0

Iteration 1, inertia 28505.902999388538

Iteration 2, inertia 27932.288486771686

Iteration 3, inertia 27926.171491779987

Iteration 4, inertia 27926.037115203115

Converged at iteration 4: strict convergence.

Initialization complete

Iteration 0, inertia 37088.0

Iteration 1, inertia 27930.123208860798

Iteration 2, inertia 27588.37082107041

Iteration 3, inertia 27504.75061307422

Iteration 4, inertia 27426.806713138936

Iteration 5, inertia 27319.178385712134

Iteration 6, inertia 27310.72183957656

Iteration 7, inertia 27310.543638348343

Converged at iteration 7: strict convergence.

Initialization complete

Iteration 0, inertia 29547.0

Iteration 1, inertia 28925.888774789382

Iteration 2, inertia 28804.049318806992

Iteration 3, inertia 28662.15476311266

Iteration 4, inertia 28491.72163451135

Iteration 5, inertia 28452.00147375292

Converged at iteration 5: strict convergence.

Initialization complete

Iteration 0, inertia 36085.0

Iteration 1, inertia 27394.399606112987

Iteration 2, inertia 27105.976098721505

Iteration 3, inertia 27048.69860957253

Iteration 4, inertia 27046.805563993927

Iteration 5, inertia 27046.52069242158

Iteration 6, inertia 27045.77105036088

Iteration 7, inertia 27045.22532430131

Iteration 8, inertia 27043.39710157174

Iteration 9, inertia 27042.884516124424

Converged at iteration 9: strict convergence.

Initialization complete

Iteration 0, inertia 29698.0

Iteration 1, inertia 28625.643419229447

Iteration 2, inertia 28322.697219340767

Iteration 3, inertia 28268.708374745504

Iteration 4, inertia 28204.72248664129

Converged at iteration 4: strict convergence.

Initialization complete
Iteration 0, inertia 36797.0
Iteration 1, inertia 27668.957387405393
Iteration 2, inertia 27191.082499269894
Iteration 3, inertia 27135.56186424899
Iteration 4, inertia 27133.979099681415
Iteration 5, inertia 27133.29010893587
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 29502.0
Iteration 1, inertia 28424.095811431238
Iteration 2, inertia 27844.32691171047
Iteration 3, inertia 27738.25585729173
Iteration 4, inertia 27732.50395348173
Iteration 5, inertia 27717.38196445074
Iteration 6, inertia 27577.67932360453
Iteration 7, inertia 27542.317631667553
Converged at iteration 7: strict convergence.

Initialization complete
Iteration 0, inertia 28875.0
Iteration 1, inertia 27577.02243222606
Iteration 2, inertia 27466.469811558894
Iteration 3, inertia 27403.187687835933
Iteration 4, inertia 27401.064249527026
Iteration 5, inertia 27399.601438592035
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 37396.0
Iteration 1, inertia 28083.854549184354
Iteration 2, inertia 27570.293059131534
Iteration 3, inertia 27423.670903506136
Iteration 4, inertia 27409.62033892494
Converged at iteration 4: strict convergence.

Initialization complete
Iteration 0, inertia 29426.0
Iteration 1, inertia 28759.334106361446
Iteration 2, inertia 28556.570706283987
Iteration 3, inertia 27979.355482865645
Iteration 4, inertia 27793.800040901475
Iteration 5, inertia 27678.149386568624
Iteration 6, inertia 27573.4816326667
Iteration 7, inertia 27554.520048069196
Iteration 8, inertia 27554.277734015275
Converged at iteration 8: strict convergence.

Initialization complete
Iteration 0, inertia 29092.0
Iteration 1, inertia 27879.196663327995
Iteration 2, inertia 27266.56312256886
Iteration 3, inertia 27086.57256518427
Iteration 4, inertia 27048.812857484194
Iteration 5, inertia 26965.40720528205
Iteration 6, inertia 26962.17816936759
Converged at iteration 6: strict convergence.

Initialization complete
Iteration 0, inertia 29679.0
Iteration 1, inertia 28895.815773663548
Iteration 2, inertia 28741.857550888035

Iteration 3, inertia 28574.116143393254
Iteration 4, inertia 27880.442058232526
Iteration 5, inertia 27774.389937781434
Iteration 6, inertia 27764.273350242598
Iteration 7, inertia 27660.974592635146
Iteration 8, inertia 27464.90901082237
Converged at iteration 8: strict convergence.
Initialization complete
Iteration 0, inertia 29045.0
Iteration 1, inertia 28415.31004134253
Iteration 2, inertia 28186.417445937866
Iteration 3, inertia 27561.149737645443
Iteration 4, inertia 27169.460613958014
Iteration 5, inertia 26883.31018081928
Iteration 6, inertia 26881.32831193841
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29468.0
Iteration 1, inertia 27580.23973536583
Iteration 2, inertia 27335.963621078838
Iteration 3, inertia 27004.147795327186
Iteration 4, inertia 26999.104181599745
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29754.0
Iteration 1, inertia 28204.836116853767
Iteration 2, inertia 28130.560646179212
Iteration 3, inertia 28027.72821690232
Iteration 4, inertia 27898.711967230152
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29518.0
Iteration 1, inertia 28913.590642867417
Iteration 2, inertia 28327.17574942793
Iteration 3, inertia 28159.346008818746
Iteration 4, inertia 27983.137579383714
Iteration 5, inertia 27946.49919192877
Iteration 6, inertia 27946.418315348743
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29470.0
Iteration 1, inertia 28377.027949654184
Iteration 2, inertia 27790.576309417505
Iteration 3, inertia 27654.930707989373
Iteration 4, inertia 27648.420052714966
Iteration 5, inertia 27633.317551583412
Iteration 6, inertia 27493.640365956868
Iteration 7, inertia 27458.25681829889
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 28742.0
Iteration 1, inertia 27410.358697896176
Iteration 2, inertia 27238.252382805502
Iteration 3, inertia 27232.471880629273
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 37288.0

Iteration 1, inertia 27998.51997342645
Iteration 2, inertia 27479.637717838425
Iteration 3, inertia 27330.890062294384
Iteration 4, inertia 27316.83873424766
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29373.0
Iteration 1, inertia 28731.64709272199
Iteration 2, inertia 28536.293629731805
Iteration 3, inertia 28422.1178369882
Iteration 4, inertia 28361.78797060018
Iteration 5, inertia 28182.472775542577
Iteration 6, inertia 28116.394217078592
Iteration 7, inertia 28115.54246123005
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 29056.0
Iteration 1, inertia 27844.09305805754
Iteration 2, inertia 27235.41886820483
Iteration 3, inertia 27053.829731323407
Iteration 4, inertia 27016.068789027595
Iteration 5, inertia 26932.66313682546
Iteration 6, inertia 26929.434100911
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29562.0
Iteration 1, inertia 28827.109471828167
Iteration 2, inertia 28651.3712169738
Iteration 3, inertia 28362.57233414789
Iteration 4, inertia 27773.898683006704
Iteration 5, inertia 27573.953726614272
Iteration 6, inertia 27525.297434374374
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 28997.0
Iteration 1, inertia 28367.441025302913
Iteration 2, inertia 28138.64575239816
Iteration 3, inertia 27513.469744595684
Iteration 4, inertia 27121.81420601099
Iteration 5, inertia 26835.640254888676
Iteration 6, inertia 26833.658386007803
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29421.0
Iteration 1, inertia 27503.83153269334
Iteration 2, inertia 27257.55324899515
Iteration 3, inertia 26855.49435258914
Iteration 4, inertia 26782.18918221355
Iteration 5, inertia 26782.073787959675
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29720.0
Iteration 1, inertia 28097.629402574177
Iteration 2, inertia 27936.902788706688
Iteration 3, inertia 27607.659385123025
Iteration 4, inertia 27485.36594718964
Converged at iteration 4: strict convergence.

Initialization complete
Iteration 0, inertia 29492.0
Iteration 1, inertia 28865.40335384982
Iteration 2, inertia 28278.47039005092
Iteration 3, inertia 28046.162748003935
Iteration 4, inertia 27869.949774158635
Iteration 5, inertia 27833.200409292087
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 29434.0
Iteration 1, inertia 28305.426137119215
Iteration 2, inertia 27708.834456826324
Iteration 3, inertia 27573.13427986503
Iteration 4, inertia 27566.625131748046
Iteration 5, inertia 27551.53442282907
Iteration 6, inertia 27411.788750439475
Iteration 7, inertia 27376.39736153172
Converged at iteration 7: strict convergence.

Initialization complete
Iteration 0, inertia 28595.0
Iteration 1, inertia 27263.37585244467
Iteration 2, inertia 27091.269493700856
Iteration 3, inertia 27085.488879154032
Converged at iteration 3: strict convergence.

Initialization complete
Iteration 0, inertia 37238.0
Iteration 1, inertia 27935.93958199948
Iteration 2, inertia 27409.11056393242
Iteration 3, inertia 27198.192204662108
Iteration 4, inertia 27084.811504806232
Iteration 5, inertia 27081.43742988661
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 29340.0
Iteration 1, inertia 28705.79681596163
Iteration 2, inertia 28510.139454667813
Iteration 3, inertia 28395.831251622356
Iteration 4, inertia 28335.50138523433
Iteration 5, inertia 28156.186190176737
Iteration 6, inertia 28090.107631712744
Iteration 7, inertia 28089.2558758642
Converged at iteration 7: strict convergence.

Initialization complete
Iteration 0, inertia 28981.0
Iteration 1, inertia 27771.650289990135
Iteration 2, inertia 27161.876276962874
Iteration 3, inertia 26976.96505379337
Iteration 4, inertia 26937.37289495751
Iteration 5, inertia 26853.952672790834
Iteration 6, inertia 26850.723090872812
Converged at iteration 6: strict convergence.

Initialization complete
Iteration 0, inertia 29462.0
Iteration 1, inertia 28708.82904842969
Iteration 2, inertia 28542.022933788463
Iteration 3, inertia 28195.18685910356
Iteration 4, inertia 27606.07853459691

Iteration 4, inertia 27000.0700010001
Iteration 5, inertia 27410.542105952754
Iteration 6, inertia 27361.8809213439
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 28976.0
Iteration 1, inertia 28346.72067617838
Iteration 2, inertia 28117.916162850397
Iteration 3, inertia 27492.781392948742
Iteration 4, inertia 27101.139731305473
Iteration 5, inertia 26814.960114262656
Iteration 6, inertia 26812.978245381786
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29376.0
Iteration 1, inertia 27459.578235267258
Iteration 2, inertia 27214.324042082713
Iteration 3, inertia 26814.16446847734
Iteration 4, inertia 26740.859298101754
Iteration 5, inertia 26740.74390384787
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29681.0
Iteration 1, inertia 28059.858519947873
Iteration 2, inertia 27904.75806084712
Iteration 3, inertia 27572.507460494428
Iteration 4, inertia 27450.213807685584
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29339.0
Iteration 1, inertia 28712.768030396182
Iteration 2, inertia 28135.043581540296
Iteration 3, inertia 27902.7359394933
Iteration 4, inertia 27726.52296564801
Iteration 5, inertia 27689.773600781453
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29416.0
Iteration 1, inertia 28287.67182824343
Iteration 2, inertia 27691.105979886066
Iteration 3, inertia 27555.398175135888
Iteration 4, inertia 27548.889754337226
Iteration 5, inertia 27533.79921546147
Iteration 6, inertia 27394.058517594156
Iteration 7, inertia 27358.666121094768
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 28565.0
Iteration 1, inertia 27238.56013048805
Iteration 2, inertia 27067.897009989578
Iteration 3, inertia 27062.056266960222
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 29492.0
Iteration 1, inertia 28056.567510227254
Iteration 2, inertia 27431.670082140583
Iteration 3, inertia 27157.103747727873
Iteration 4, inertia 27042.056005000000

Iteration 4, inertia 27043.85609586232
Iteration 5, inertia 27040.482283687685
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29156.0
Iteration 1, inertia 28507.510169718167
Iteration 2, inertia 28314.927244683742
Iteration 3, inertia 28202.88483546645
Iteration 4, inertia 28153.140248347398
Iteration 5, inertia 28040.99968469513
Iteration 6, inertia 28040.466924606877
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 28930.0
Iteration 1, inertia 27723.064677467093
Iteration 2, inertia 27112.595861906542
Iteration 3, inertia 26928.42390231236
Iteration 4, inertia 26889.76504492919
Iteration 5, inertia 26806.34482276253
Iteration 6, inertia 26803.11524084449
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29438.0
Iteration 1, inertia 28677.93202324122
Iteration 2, inertia 28511.136301554987
Iteration 3, inertia 28164.333825073456
Iteration 4, inertia 27575.352740887454
Iteration 5, inertia 27379.71517318662
Iteration 6, inertia 27331.049845405734
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 28952.0
Iteration 1, inertia 28322.84046355177
Iteration 2, inertia 28094.048443669195
Iteration 3, inertia 27468.930458454484
Iteration 4, inertia 27077.288720407098
Iteration 5, inertia 26791.102677049003
Iteration 6, inertia 26789.12080816813
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29331.0
Iteration 1, inertia 27418.066154575332
Iteration 2, inertia 27172.666088688577
Iteration 3, inertia 26772.506515083198
Iteration 4, inertia 26699.174533329566
Iteration 5, inertia 26699.058738656757
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29627.0
Iteration 1, inertia 28005.88263079815
Iteration 2, inertia 27850.797501164798
Iteration 3, inertia 27518.54621073117
Iteration 4, inertia 27396.25105313216
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29291.0
Iteration 1, inertia 28633.501378462453
Iteration 2, inertia 28677.888888888889

Iteration 2, inertia 28055.902083944893
Iteration 3, inertia 27823.57136993752
Iteration 4, inertia 27647.371905246393
Iteration 5, inertia 27610.62046718659
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29383.0
Iteration 1, inertia 28255.179914895398
Iteration 2, inertia 27659.495545257967
Iteration 3, inertia 27522.92757625072
Iteration 4, inertia 27516.417804754998
Iteration 5, inertia 27501.3195038363
Iteration 6, inertia 27361.585924908377
Iteration 7, inertia 27326.19256099693
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 28538.0
Iteration 1, inertia 27214.613093918037
Iteration 2, inertia 27043.932501460982
Iteration 3, inertia 27038.09175843162
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 29459.0
Iteration 1, inertia 28033.609357523314
Iteration 2, inertia 27419.526337381674
Iteration 3, inertia 27209.359369644066
Iteration 4, inertia 27194.9190260204
Iteration 5, inertia 27191.97672661003
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29042.0
Iteration 1, inertia 28394.893392065136
Iteration 2, inertia 28202.344191767264
Iteration 3, inertia 28090.30593591734
Iteration 4, inertia 28040.60891130237
Iteration 5, inertia 27928.461058731118
Iteration 6, inertia 27927.928290068616
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 28901.0
Iteration 1, inertia 27665.549853939992
Iteration 2, inertia 27040.209762706236
Iteration 3, inertia 26856.80432283409
Iteration 4, inertia 26744.373038454625
Iteration 5, inertia 26651.45230172994
Iteration 6, inertia 26648.11630508674
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29378.0
Iteration 1, inertia 28585.08678914643
Iteration 2, inertia 28251.704221010597
Iteration 3, inertia 27914.97312826293
Iteration 4, inertia 27344.511655555703
Iteration 5, inertia 27166.649740987235
Iteration 6, inertia 27093.937449122997
Converged at iteration 6: strict convergence.
Initialization complete

Iteration 0, inertia 28925.0
Iteration 1, inertia 28269.777386856935
Iteration 2, inertia 27911.027012078433
Iteration 3, inertia 27331.267357010718
Iteration 4, inertia 26912.94165391475
Iteration 5, inertia 26626.203217567403
Iteration 6, inertia 26624.157266930008
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29298.0
Iteration 1, inertia 27386.687351277596
Iteration 2, inertia 27143.223186937656
Iteration 3, inertia 26743.060361056538
Iteration 4, inertia 26669.727998292754
Iteration 5, inertia 26669.612203619938
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29612.0
Iteration 1, inertia 27991.237499215214
Iteration 2, inertia 27836.291220332856
Iteration 3, inertia 27506.555068263136
Iteration 4, inertia 27384.259669320214
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29264.0
Iteration 1, inertia 28607.784898861624
Iteration 2, inertia 28040.895870927154
Iteration 3, inertia 27807.986184752328
Iteration 4, inertia 27630.69652385129
Iteration 5, inertia 27593.035706825893
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29361.0
Iteration 1, inertia 28235.37760726939
Iteration 2, inertia 27639.579735244686
Iteration 3, inertia 27503.011766237436
Iteration 4, inertia 27496.50199474172
Iteration 5, inertia 27481.403693823024
Iteration 6, inertia 27341.670114895096
Iteration 7, inertia 27306.27675098364
Converged at iteration 7: strict convergence.
Initialization complete
Iteration 0, inertia 28499.0
Iteration 1, inertia 27175.992638547643
Iteration 2, inertia 27005.313548986956
Iteration 3, inertia 26999.472699064885
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 29438.0
Iteration 1, inertia 27991.96381323911
Iteration 2, inertia 27377.889518681455
Iteration 3, inertia 27167.73316237938
Iteration 4, inertia 27153.292008040928
Iteration 5, inertia 27150.349698431026
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29009.0

Iteration 1, inertia 28362.831740282756
Iteration 2, inertia 28170.28182255078
Iteration 3, inertia 28058.243566700847
Iteration 4, inertia 28008.546542085878
Iteration 5, inertia 27896.39868951463
Iteration 6, inertia 27895.865920852135
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 28853.0
Iteration 1, inertia 27619.275244976125
Iteration 2, inertia 26995.09781533627
Iteration 3, inertia 26813.423145037093
Iteration 4, inertia 26699.714183323973
Iteration 5, inertia 26606.794453897335
Iteration 6, inertia 26603.458384070465
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29339.0
Iteration 1, inertia 28546.63194409892
Iteration 2, inertia 28213.25881411391
Iteration 3, inertia 27876.55060705759
Iteration 4, inertia 27306.127234110827
Iteration 5, inertia 27128.261098010218
Iteration 6, inertia 27055.547350201745
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 28910.0
Iteration 1, inertia 28255.262475584255
Iteration 2, inertia 27896.43426607321
Iteration 3, inertia 27317.993758785527
Iteration 4, inertia 26900.854756729983
Iteration 5, inertia 26614.121017030262
Iteration 6, inertia 26612.073386416956
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29211.0
Iteration 1, inertia 27303.002854706214
Iteration 2, inertia 27059.439191345235
Iteration 3, inertia 26659.274490099036
Iteration 4, inertia 26585.941737559016
Iteration 5, inertia 26585.825942886197
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29552.0
Iteration 1, inertia 27936.12645018607
Iteration 2, inertia 27781.107245973904
Iteration 3, inertia 27451.38652694313
Iteration 4, inertia 27329.090348349397
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29240.0
Iteration 1, inertia 28584.231778915757
Iteration 2, inertia 28017.385520564472
Iteration 3, inertia 27784.463624929816
Iteration 4, inertia 27607.180711357756
Iteration 5, inertia 27569.51942271977
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 29343.0
Iteration 1, inertia 28217.414093903124
Iteration 2, inertia 27621.628727970365
Iteration 3, inertia 27485.05189733661
Iteration 4, inertia 27478.542585388128
Iteration 5, inertia 27463.444759994065
Iteration 6, inertia 27323.714526761894
Iteration 7, inertia 27288.320123467674
Converged at iteration 7: strict convergence.

Initialization complete
Iteration 0, inertia 28466.0
Iteration 1, inertia 27146.518620340226
Iteration 2, inertia 26975.83624659567
Iteration 3, inertia 26969.995396673603
Converged at iteration 3: strict convergence.

Initialization complete
Iteration 0, inertia 29408.0
Iteration 1, inertia 27982.459837511404
Iteration 2, inertia 27357.80428212284
Iteration 3, inertia 27142.515178424495
Iteration 4, inertia 27113.336704899153
Iteration 5, inertia 27110.394372512867
Converged at iteration 5: strict convergence.

Initialization complete
Iteration 0, inertia 28991.0
Iteration 1, inertia 28344.8253239964
Iteration 2, inertia 28152.27958277397
Iteration 3, inertia 28040.240471588444
Iteration 4, inertia 27990.543359517105
Iteration 5, inertia 27878.394245596322
Iteration 6, inertia 27877.861475474638
Converged at iteration 6: strict convergence.

Initialization complete
Iteration 0, inertia 28814.0
Iteration 1, inertia 27583.706252932752
Iteration 2, inertia 26959.516469858656
Iteration 3, inertia 26777.84179955948
Iteration 4, inertia 26664.13283784635
Iteration 5, inertia 26571.215123052985
Iteration 6, inertia 26567.87878358625
Converged at iteration 6: strict convergence.

Initialization complete
Iteration 0, inertia 29273.0
Iteration 1, inertia 28518.71219060531
Iteration 2, inertia 28163.250859043612
Iteration 3, inertia 27490.789597856237
Iteration 4, inertia 27211.363635639278
Iteration 5, inertia 27178.23968199033
Iteration 6, inertia 27070.471704721975
Iteration 7, inertia 26938.32049169796
Iteration 8, inertia 26890.82188393627
Iteration 9, inertia 26888.625521722526
Iteration 10, inertia 26888.454069762454
Converged at iteration 10: strict convergence.

Initialization complete
Iteration 0, inertia 28875.0

Iteration 0, inertia 28873.0
Iteration 1, inertia 28193.671844570865
Iteration 2, inertia 27796.260781304158
Iteration 3, inertia 27263.86157760302
Iteration 4, inertia 26799.304302483448
Iteration 5, inertia 26467.1721458275
Iteration 6, inertia 26459.16489396568
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29181.0
Iteration 1, inertia 27237.416827847042
Iteration 2, inertia 26991.839462002426
Iteration 3, inertia 26594.462869058127
Iteration 4, inertia 26521.127417160562
Iteration 5, inertia 26521.011622487742
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29486.0
Iteration 1, inertia 27828.445632288855
Iteration 2, inertia 27652.23930837183
Iteration 3, inertia 27322.511138606253
Iteration 4, inertia 27200.21459566046
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29216.0
Iteration 1, inertia 28560.22799925653
Iteration 2, inertia 27993.41119178874
Iteration 3, inertia 27760.480956994696
Iteration 4, inertia 27583.196402308775
Iteration 5, inertia 27545.534527063268
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29286.0
Iteration 1, inertia 28183.9367360962
Iteration 2, inertia 27597.832375597955
Iteration 3, inertia 27462.028301488845
Iteration 4, inertia 27452.920556581896
Iteration 5, inertia 27365.579648488623
Iteration 6, inertia 27259.690927049764
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 28358.0
Iteration 1, inertia 27040.091749167565
Iteration 2, inertia 26869.414478142975
Iteration 3, inertia 26863.573450301916
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 29321.0
Iteration 1, inertia 27895.924536254417
Iteration 2, inertia 27272.80901832064
Iteration 3, inertia 27058.70527962583
Iteration 4, inertia 27029.526214860816
Iteration 5, inertia 27026.583882474533
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 28952.0
Iteration 1, inertia 28306.456932248642
Iteration 2, inertia 28112.010027501772

Iteration 2, inertia 28113.919837501775
Iteration 3, inertia 28001.8778486202
Iteration 4, inertia 27952.195087160962
Iteration 5, inertia 27840.04481200482
Iteration 6, inertia 27839.512040464328
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 28798.0
Iteration 1, inertia 27561.790411762515
Iteration 2, inertia 26936.755244062184
Iteration 3, inertia 26756.97850291372
Iteration 4, inertia 26643.272244276206
Iteration 5, inertia 26550.35355277847
Iteration 6, inertia 26547.01703782768
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29225.0
Iteration 1, inertia 28470.830174059603
Iteration 2, inertia 28121.761478694123
Iteration 3, inertia 27550.49107050619
Iteration 4, inertia 27123.92999038132
Iteration 5, inertia 26989.581513580084
Iteration 6, inertia 26904.533607964517
Iteration 7, inertia 26844.912690553032
Iteration 8, inertia 26842.044018362387
Iteration 9, inertia 26840.478332748673
Iteration 10, inertia 26840.303839736232
Converged at iteration 10: strict convergence.
Initialization complete
Iteration 0, inertia 28863.0
Iteration 1, inertia 28171.42427250923
Iteration 2, inertia 27762.26343634041
Iteration 3, inertia 27233.19991602631
Iteration 4, inertia 26803.798468648736
Iteration 5, inertia 26442.062586073513
Iteration 6, inertia 26427.30760741386
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29067.0
Iteration 1, inertia 27149.67629917256
Iteration 2, inertia 26903.600531467877
Iteration 3, inertia 26506.223938523573
Iteration 4, inertia 26432.930648566235
Iteration 5, inertia 26432.813636910305
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29465.0
Iteration 1, inertia 27807.549930698537
Iteration 2, inertia 27631.35494074823
Iteration 3, inertia 27301.62262084925
Iteration 4, inertia 27179.32449271852
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 29069.0
Iteration 1, inertia 28413.208744369615
Iteration 2, inertia 27846.42020949971
Iteration 3, inertia 27613.48271067743
Iteration 4, inertia 27426.188788748888

Iteration 4, inertia 27436.198728749932
Iteration 5, inertia 27398.53629591114
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29133.0
Iteration 1, inertia 28031.3042833061
Iteration 2, inertia 27445.22609124049
Iteration 3, inertia 27309.41461817984
Iteration 4, inertia 27300.30463886036
Iteration 5, inertia 27212.978539305986
Iteration 6, inertia 27107.088170798612
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 28343.0
Iteration 1, inertia 27027.971757330295
Iteration 2, inertia 26857.27657936062
Iteration 3, inertia 26851.43555151956
Converged at iteration 3: strict convergence.
Initialization complete
Iteration 0, inertia 29290.0
Iteration 1, inertia 27861.882212211276
Iteration 2, inertia 27238.81621236879
Iteration 3, inertia 27024.688063353486
Iteration 4, inertia 26995.508641878932
Iteration 5, inertia 26992.566289324484
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 28908.0
Iteration 1, inertia 28220.98828531097
Iteration 2, inertia 27920.0112474112
Iteration 3, inertia 27612.149109673603
Iteration 4, inertia 27558.418516046477
Iteration 5, inertia 27452.529676320122
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 28774.0
Iteration 1, inertia 27524.27559819242
Iteration 2, inertia 26899.35596052032
Iteration 3, inertia 26719.53262532337
Iteration 4, inertia 26605.840512101226
Iteration 5, inertia 26512.914802248004
Iteration 6, inertia 26509.578154608735
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29174.0
Iteration 1, inertia 28419.850962121112
Iteration 2, inertia 28068.136165396932
Iteration 3, inertia 27512.187499077623
Iteration 4, inertia 27085.626418952746
Iteration 5, inertia 26951.277942151504
Iteration 6, inertia 26866.230036535944
Iteration 7, inertia 26806.60911912446
Iteration 8, inertia 26803.740446933814
Iteration 9, inertia 26802.174761320097
Iteration 10, inertia 26802.000268307656
Converged at iteration 10: strict convergence.
Initialization complete

```

Iteration 0, inertia 28839.0
Iteration 1, inertia 28140.52334218252
Iteration 2, inertia 27731.37909199783
Iteration 3, inertia 27197.447047739603
Iteration 4, inertia 26772.989924513233
Iteration 5, inertia 26411.227614706866
Iteration 6, inertia 26396.472625391987
Converged at iteration 6: strict convergence.
Initialization complete
Iteration 0, inertia 29051.0
Iteration 1, inertia 27133.833860364302
Iteration 2, inertia 26887.762687686594
Iteration 3, inertia 26490.38615800366
Iteration 4, inertia 26417.092015228565
Iteration 5, inertia 26416.975003572636
Converged at iteration 5: strict convergence.
Initialization complete
Iteration 0, inertia 29435.0
Iteration 1, inertia 27777.526799391177
Iteration 2, inertia 27601.344396739943
Iteration 3, inertia 27271.61016354091
Iteration 4, inertia 27149.310500474912
Converged at iteration 4: strict convergence.
Initialization complete
Iteration 0, inertia 28236.0
Iteration 1, inertia 27723.292523405857
Iteration 2, inertia 27658.792198104973
Iteration 3, inertia 27540.291535702087
Iteration 4, inertia 27372.30468113089
Iteration 5, inertia 27334.642248292086
Converged at iteration 5: strict convergence.

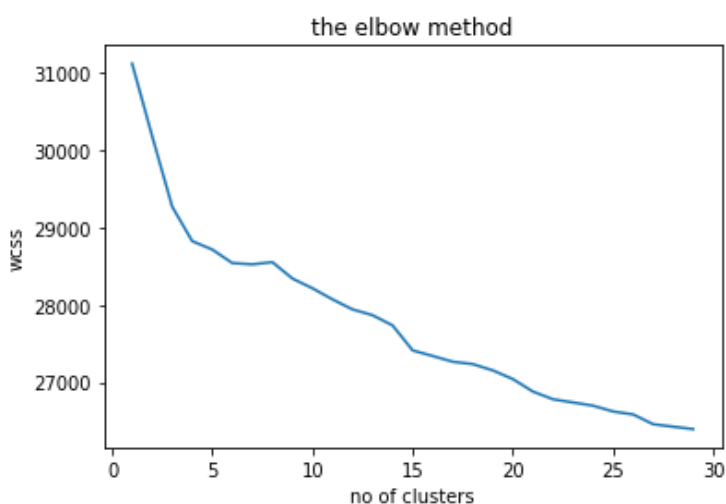
```

In [11]:

```

import matplotlib.pyplot as plt
plt.plot(range(1,30),wcss)
plt.title('the elbow method')
plt.xlabel('no of clusters')
plt.ylabel('wcss')
plt.show()

```



In [12]:

```
true k=30
```

```
Kmeans=KMeans(n_clusters=true_k,init='k-means++',n_init=1)
Kmeans.fit(nltk)
```

Out[12]:

```
KMeans(n_clusters=30, n_init=1)
```

I'afficher des différents clustering

In [13]:

```
print("Top terms per cluster:")
order_centroids = Kmeans.cluster_centers_.argsort()[:, :-1]
terms = cv.get_feature_names()
for i in range(true_k):
    print("Cluster %d:" % i)
    for ind in order_centroids[i, :10]:
        print(' %s' % terms[ind])
    print()
print("\n")
```

Top terms per cluster:

Cluster 0:

close
home
hit
some
tiny
frank
french
fren
freestylin
freeeezi

Cluster 1:

tweet
one
thi
good
the
us
gt
like
you
new

Cluster 2:

summer
calculations
happi
fri
fresh
french
fren
freestylin
freeeezi
freedom

Cluster 3:

peopl
amp
get
we
you
us
five
convers
stop
the

Cluster 4:

check
dms
da
ta
t r n y
four
freestylin
freeeezi
freedom
free

Cluster 5:

follow
you
us
love
gratitude
share
we
dm
much
do

Cluster 6:

good
outlook
morn
what
news
look
new
he
thank
know

Cluster 7:

true
power
there
we
fan
come
sksksksk
a l i d e

slide
it
curat

Cluster 8:

think
the
that
retweet
hey
morn
could
mummi
vendetta
move

Cluster 9:

love
we
tweet
see
it
share
us
for
make
timelin

Cluster 10:

bend
close
leg
could
like
build
hi
face
case
free

Cluster 11:

emoji
found
just
use
shooketh
tri
gif
from
twitter
know

Cluster 12:

get
ring
whi
retweet

fourth
fren
freestylin
freeeezi
freedom
free

Cluster 13:

anoth
one
voice
dj
khale
tiny
frank
fren
freestylin
freeeezi

Cluster 14:

you
us
it
time
that
know
day
need
one
get

Cluster 15:

fear
alreadi
uncertainti
adher
grow
social
distancing
around
pandemic
racism

Cluster 16:

like
look
feel
you
it
we
tweet
didn
say
act

Cluster 17:

that

it
tweet
retweet
read
name
they
call
coupon
befor

Cluster 18:

gif
brain
tri
keep
spin
section
freedom
fresh
french
form

Cluster 19:

dog
thought
anoth
lead
one
t i n y
freak
french
fren
freestylin

Cluster 20:

cool
t i n y
fri
french
fren
freestylin
freeeezi
freedom
free
freak

Cluster 21:

get
don
everyon
they
twitter
if
search
roll
dm
today

Cluster 22:

look
we
tweet
smile
someon
us
interrupt
tri
like
tiny

Cluster 23:

most
likely
tiny
forevermore
fren
freestylin
freeeezi
freedom
free
freak

Cluster 24:

we
ll
dm
need
deets
send
get
you
soon
yours

Cluster 25:

twitter
you
follow
want
know
friend
stan
make
love
first

Cluster 26:

insid
let
keep
say
limb
bed
recommend

form
forgotten
freestylin

Cluster 27:

sco
tu
pa
manaa
it
now
we
fourth
freeeezi
freedom

Cluster 28:

mute
gotta
away
you
tiny
freestylin
freeeezi
freedom
free
freak

Cluster 29:

you
extraordinharri
without
brilliam
person
today
tweets
phenominal
french
fren

In []: