```
import pandas as pd
import numpy as np
import random
num transactions = 10000
items = ['I1', 'I2', 'I3', 'I4', 'I5', 'I6', 'I7', 'I8', 'I9']
data = {'Transaction Id': ['T' + str(i) for i in range(1,
num transactions + 1)]}
df = pd.DataFrame(data)
def generate random itemset():
    num items = random.randint(3, len(items))
    return sorted(random.sample(items, num items))
df['Items'] = [generate random itemset() for in
range(num transactions)]
print(df)
     Transaction Id
                                                      Items
                      [11, 12, 13, 14, 15, 16, 17, 18, 19]
0
                 T1
1
                 T2
                                       [I1, I2, I3, I7, I8]
2
                          [11, 12, 13, 14, 15, 16, 18, 19]
                 T3
3
                 T4
                          [11, 12, 14, 15, 16, 17, 18, 19]
4
                 T5
                          [11, 13, 14, 15, 16, 17, 18, 19]
                      [I1, I2, I3, I4, I5, I6, I7, I8, I9]
9995
              T9996
              T9997
                          [I1, I2, I3, I4, I5, I6, I8, I9]
9996
9997
              T9998
                                       [12, 13, 15, 16, 19]
                                               [I1, I2, I5]
9998
              T9999
9999
             T10000
                      [11, 12, 13, 14, 15, 16, 17, 18, 19]
[10000 \text{ rows } \times 2 \text{ columns}]
df.to csv("NIT Transaction1.csv",index=False)
from itertools import combinations
df.rename(columns={'Transaction
Id':'TId','Items':'Item Ids'},inplace=True)
msp = 1000
flattened list = [item for sublist in df['Item Ids'].values.tolist()
for item in sublist]
ids = sorted(list(set(flattened list)))
itemset=pd.DataFrame(columns=['Itemset','Count'])
for i in range(len(ids)):
    itemset.loc[i] = [ids[i],df['Item Ids'].apply(lambda x: ids[i] in
x).sum()]
print('C1: ')
print(itemset)
```

```
print('L1: ')
itemset[itemset['Count']>=msp]
C1:
  Itemset
           Count
0
            6623
       I1
1
       12
            6625
2
       13
            6614
3
       I4
            6738
4
       I5
            6649
5
            6632
       16
6
       I7
            6673
7
       18
            6672
8
       I9
            6636
L1:
  Itemset Count
0
       I1
            6623
1
       12
            6625
2
       13
            6614
3
       14
            6738
4
       15
            6649
5
       16
            6632
6
       I7
            6673
7
            6672
       18
8
       I9
            6636
i=2
while True:
    ids=list(combinations(ids, i))
    itemset1=pd.DataFrame(columns=['Itemset','Count'])
    for j in range(len(ids)):
        itemset1.loc[j] = [ids[j],df['Item Ids'].apply(lambda x:
all(element in x for element in ids[j])).sum()]
    print(f'C{i}\n',itemset1)
    itemset1=itemset1[itemset1['Count']>=2]
    print(f'L{i}\n',itemset1)
    ids=list(set([element for tup in
itemset1['Itemset'].values.tolist() for element in tup]))
    if itemset1.empty:
        break
    itemset=itemset1
    i+=1
C2
      Itemset
               Count
0
    (I1, I2)
                4684
    (I1, I3)
                4655
1
2
    (I1, I4)
               4722
3
    (I1, I5)
               4687
```

```
(I1, I6)
                 4715
4
5
    (I1, I7)
                 4668
6
    (I1, I8)
                 4731
7
    (I1, I9)
                 4673
8
    (I2, I3)
                 4652
    (I2, I4)
9
                 4733
10
    (12, 15)
                 4709
11
    (12, 16)
                 4641
                 4717
12
    (I2, I7)
13
    (I2, I8)
                 4717
    (I2, I9)
14
                 4694
15
    (I3, I4)
                 4748
    (I3, I5)
                 4663
16
17
    (I3, I6)
                 4705
18
    (I3, I7)
                 4695
19
    (I3, I8)
                 4720
20
    (I3, I9)
                 4656
    (14, 15)
21
                 4759
22
    (14, 16)
                 4722
    (14, 17)
23
                 4751
    (I4, I8)
24
                 4782
    (I4, I9)
                 4730
25
26
    (15, 16)
                 4650
27
    (15, 17)
                 4705
28
    (15, 18)
                 4722
29
    (15, 19)
                 4629
30
    (16, 17)
                 4696
31
    (16, 18)
                 4716
32
                 4707
    (16, 19)
33
    (17, 18)
                 4710
34
    (I7, I9)
                 4690
35
    (18, 19)
                 4749
L2
      Itemset
                 Count
0
                 4684
    (I1, I2)
    (I1, I3)
                 4655
1
2
    (I1, I4)
                 4722
3
    (I1, I5)
                 4687
    (I1, I6)
4
                 4715
5
    (I1, I7)
                 4668
6
    (I1, I8)
                 4731
7
    (I1, I9)
                 4673
8
    (I2, I3)
                 4652
9
    (12, 14)
                 4733
10
    (I2, I5)
                 4709
    (I2, I6)
11
                 4641
12
    (I2, I7)
                 4717
13
    (I2, I8)
                 4717
14
    (12, 19)
                 4694
```

```
15
                 4748
    (I3, I4)
    (I3, I5)
                 4663
16
17
    (13, 16)
                 4705
18
    (I3, I7)
                 4695
19
    (I3, I8)
                 4720
    (I3, I9)
20
                 4656
                 4759
21
    (I4, I5)
22
    (14, 16)
                 4722
    (I4, I7)
23
                 4751
24
    (I4, I8)
                 4782
25
    (I4, I9)
                 4730
26
    (15, 16)
                 4650
27
    (15, 17)
                 4705
28
    (15, 18)
                 4722
29
    (15, 19)
                 4629
30
    (16, 17)
                 4696
31
    (16, 18)
                 4716
32
    (16, 19)
                 4707
33
    (I7, I8)
                 4710
    (17, 19)
34
                 4690
35
    (18, 19)
                 4749
C3
           Itemset
                      Count
0
    (16, 19, 13)
                      3555
    (16, 19, 15)
1
                      3475
2
                      3595
    (16, 19, 11)
    (16, 19, 14)
3
                      3570
4
    (16, 19, 18)
                      3594
                       . . .
    (I1, I2, I7)
79
                      3533
80
    (I4, I8, I2)
                      3602
    (14, 18, 17)
81
                      3585
82
    (I4, I2, I7)
                      3591
    (18, 12, 17)
83
                      3573
[84 rows x 2 columns]
L3
           Itemset
                      Count
    (16, 19, 13)
                      3555
0
    (16, 19, 15)
                      3475
1
2
    (I6, I9, I1)
                      3595
    (16, 19, 14)
3
                      3570
4
    (16, 19, 18)
                      3594
                       . . .
    (I1, I2, I7)
                      3533
79
80
    (I4, I8, I2)
                      3602
81
    (I4, I8, I7)
                      3585
82
    (I4, I2, I7)
                      3591
    (18, 12, 17)
83
                      3573
```

```
[84 rows \times 2 columns]
C4
                Itemset
                           Count
     (16, 19, 13, 15)
                          2782
     (16, 19, 13, 11)
                          2851
1
2
     (16, 19, 13, 14)
                          2856
3
     (16, 19, 13, 18)
                          2884
     (16, 19, 13, 12)
4
                          2841
     (I1, I4, I8, I2)
                          2882
121
     (I1, I4, I8, I7)
                          2858
122
123
     (I1, I4, I2, I7)
                          2851
     (I1, I8, I2, I7)
124
                          2841
125
     (14, 18, 12, 17)
                          2879
[126 rows x 2 columns]
L4
                Itemset
                           Count
     (16, 19, 13, 15)
                          2782
     (I6, I9, I3, I1)
                          2851
1
     (16, 19, 13, 14)
2
                          2856
3
     (16, 19, 13, 18)
                          2884
4
     (16, 19, 13, 12)
                          2841
                            . . .
     (I1, I4, I8, I2)
                          2882
121
                           2858
122
     (I1, I4, I8, I7)
     (I1, I4, I2, I7)
123
                           2851
124
     (I1, I8, I2, I7)
                          2841
125
     (14, 18, 12, 17)
                          2879
[126 rows x 2 columns]
C5
                     Itemset
                               Count
     (16, 19, 13, 15, 11)
                               2327
     (16, 19, 13, 15, 14)
1
                               2335
2
     (16, 19, 13, 15, 18)
                               2368
     (16, 19, 13, 15, 12)
3
                               2329
4
     (16, 19, 13, 15, 17)
                               2327
                                . . .
121
     (15, 11, 14, 18, 17)
                               2368
122
     (15, 11, 14, 12, 17)
                               2346
     (I5, I1, I8, I2, I7)
123
                               2349
124
     (15, 14, 18, 12, 17)
                               2395
     (I1, I4, I8, I2, I7)
125
                               2383
[126 rows \times 2 columns]
L5
                     Itemset
                               Count
     (16, 19, 13, 15, 11)
                               2327
```

```
(16, 19, 13, 15, 14)
                              2335
2
     (16, 19, 13, 15, 18)
                              2368
3
     (16, 19, 13, 15, 12)
                              2329
     (16, 19, 13, 15, 17)
4
                              2327
                                . . .
     (I5, I1, I4, I8, I7)
                              2368
121
122
     (15, 11, 14, 12, 17)
                              2346
     (I5, I1, I8, I2, I7)
123
                              2349
124
     (15, 14, 18, 12, 17)
                              2395
125
     (I1, I4, I8, I2, I7)
                              2383
[126 rows x 2 columns]
C6
                        Itemset
                                  Count
    (16, 19, 13, 15, 11, 14)
                                  1997
    (16, 19, 13, 15, 11, 18)
1
                                  2035
    (16, 19, 13, 15, 11, 12)
                                  1996
    (16, 19, 13, 15, 11, 17)
                                  1988
4
    (16, 19, 13, 15, 14, 18)
                                  2045
                                   . . .
    (I3, I5, I1, I4, I2, I7)
79
                                  1992
80
    (13, 15, 11, 18, 12, 17)
                                  2003
    (13, 15, 14, 18, 12, 17)
81
                                  2038
    (13, 11, 14, 18, 12, 17)
                                  2030
83
    (15, 11, 14, 18, 12, 17)
                                  2025
    rows x 2 columns]
L6
                        Itemset
                                  Count
    (I6, I9, I3, I5, I1, I4)
                                  1997
    (16, 19, 13, 15, 11, 18)
                                  2035
1
    (16, 19, 13, 15, 11, 12)
                                  1996
    (16, 19, 13, 15, 11, 17)
3
                                  1988
4
    (16, 19, 13, 15, 14, 18)
                                  2045
                                   . . .
    (I3, I5, I1, I4, I2,
                                  1992
79
                           I7)
80
    (I3, I5, I1, I8, I2, I7)
                                  2003
81
    (13, 15, 14, 18, 12, 17)
                                  2038
82
    (I3, I1, I4, I8, I2, I7)
                                  2030
    (15, 11, 14, 18, 12, 17)
                                  2025
    rows x 2 columns]
[84
C7
                            Itemset
                                      Count
    (16, 19, 13, 15, 11, 14, 18)
                                      1783
    (16, 19, 13, 15, 11, 14, 12)
                                      1757
1
2
    (16, 19, 13, 15, 11, 14, 17)
                                      1733
3
    (16, 19, 13, 15, 11, 18, 12)
                                      1776
4
    (16, 19, 13, 15, 11, 18, 17)
                                      1775
    (16, 19, 13, 15, 11, 12, 17)
                                      1747
```

```
(16, 19, 13, 15, 14, 18, 12)
                                      1808
    (16, 19, 13, 15, 14, 18, 17)
7
                                      1778
    (16, 19, 13, 15, 14, 12, 17)
                                      1766
8
    (16, 19, 13, 15, 18, 12, 17)
9
                                      1795
10
    (16, 19, 13, 11, 14, 18, 12)
                                      1817
    (16, 19, 13, 11, 14, 18, 17)
                                      1798
11
    (16, 19, 13, 11, 14, 12, 17)
                                      1790
    (16, 19, 13, 11, 18, 12,
13
                               I7)
                                      1805
                                      1817
14
    (16, 19, 13, 14, 18, 12, 17)
15
    (16, 19, 15, 11, 14, 18, 12)
                                      1787
    (16, 19, 15, 11, 14, 18, 17)
                                      1764
16
17
    (16, 19, 15, 11, 14, 12, 17)
                                      1747
    (16, 19, 15, 11, 18, 12,
                               I7)
                                      1778
18
19
    (16, 19, 15, 14, 18, 12, 17)
                                      1795
20
    (16, 19, 11, 14, 18, 12, 17)
                                      1801
    (16, 13, 15, 11, 14, 18, 12)
21
                                      1779
22
    (16, 13, 15, 11, 14, 18, 17)
                                      1774
    (16, 13, 15, 11, 14, 12,
23
                               I7)
                                      1737
24
    (16, 13, 15, 11, 18, 12, 17)
                                      1757
    (16, 13, 15, 14, 18, 12, 17)
25
                                      1784
26
    (16, 13, 11, 14, 18, 12, 17)
                                      1789
27
    (16, 15, 11, 14, 18, 12,
                               I7)
                                      1763
    (19, 13, 15, 11, 14, 18, 12)
                                      1775
28
29
    (19, 13, 15, 11, 14, 18, 17)
                                      1739
30
    (19, 13, 15, 11, 14, 12, 17)
                                      1731
    (19, 13, 15, 11, 18, 12, 17)
31
                                      1756
    (19, 13, 15, 14, 18, 12,
32
                               I7)
                                      1781
33
    (19, 13, 11, 14, 18, 12, 17)
                                      1775
34
    (19, 15, 11, 14, 18, 12, 17)
                                      1763
    (13, 15, 11, 14, 18, 12, 17)
35
                                      1760
L7
                            Itemset
                                      Count
    (16, 19, 13, 15, 11, 14, 18)
                                      1783
    (16, 19, 13, 15, 11, 14, 12)
                                      1757
1
    (16, 19, 13, 15, 11, 14, 17)
                                      1733
3
    (16, 19, 13, 15, 11, 18, 12)
                                      1776
4
    (16, 19, 13, 15, 11, 18, 17)
                                      1775
5
    (16, 19, 13, 15, 11, 12, 17)
                                      1747
    (16, 19, 13, 15, 14, 18, 12)
                                      1808
6
7
    (16, 19, 13, 15, 14, 18, 17)
                                      1778
    (16, 19, 13, 15, 14, 12,
8
                               I7)
                                      1766
9
    (16, 19, 13, 15, 18, 12, 17)
                                      1795
10
    (16, 19, 13, 11, 14, 18, 12)
                                      1817
    (16, 19, 13, 11, 14, 18, 17)
                                      1798
11
12
    (16, 19, 13, 11, 14, 12, 17)
                                      1790
    (16, 19, 13, 11, 18, 12,
13
                               I7)
                                      1805
14
    (16, 19, 13, 14, 18, 12, 17)
                                      1817
    (16, 19, 15, 11, 14, 18, 12)
15
                                      1787
    (16, 19, 15, 11, 14, 18, 17)
                                      1764
```

```
(I6, I9, I5, I1, I4, I2, I7)
17
                                      1747
    (16, 19, 15, 11, 18, 12, 17)
18
                                      1778
    (16, 19, 15, 14, 18, 12,
                               I7)
                                      1795
19
    (16, 19, 11, 14, 18, 12, 17)
20
                                      1801
    (16, 13, 15, 11, 14, 18, 12)
                                      1779
21
    (16, 13, 15, 11, 14, 18, 17)
22
                                      1774
    (I6, I3, I5, I1, I4, I2, I7)
23
                                      1737
    (16, 13, 15, 11, 18, 12,
24
                               I7)
                                      1757
    (16, 13, 15, 14, 18, 12, 17)
25
                                      1784
26
    (16, 13, 11, 14, 18, 12,
                                      1789
                               I7)
    (16, 15, 11, 14, 18, 12, 17)
27
                                      1763
28
    (19, 13, 15, 11, 14, 18, 12)
                                      1775
    (19, 13, 15, 11, 14, 18,
29
                               I7)
                                      1739
    (19, 13, 15, 11, 14, 12, 17)
30
                                      1731
31
    (19, 13, 15, 11, 18, 12,
                               I7)
                                      1756
    (19, 13, 15, 14, 18, 12,
                               I7)
32
                                      1781
33
    (19, 13, 11, 14, 18, 12,
                               I7)
                                      1775
    (19, 15, 11, 14, 18, 12, 17)
                                      1763
35
    (13, 15, 11, 14, 18, 12, 17)
                                      1760
C8
                               Itemset
                                         Count
   (16, 19, 13, 15, 11, 14, 18, 12)
                                         1589
   (16, 19, 13, 15, 11, 14, 18, 17)
1
                                         1566
2
   (16, 19, 13, 15, 11, 14, 12, 17)
                                         1554
   (16, 19, 13, 15, 11, 18, 12, 17)
3
                                         1578
   (16, 19, 13, 15, 14, 18, 12, 17)
4
                                         1600
5
   (16, 19, 13, 11, 14, 18, 12, 17)
                                         1606
6
   (16, 19, 15, 11, 14, 18, 12, 17)
                                         1574
7
   (16, 13, 15, 11, 14, 18, 12, 17)
                                         1567
   (19, 13, 15, 11, 14, 18, 12, 17)
8
                                         1558
L8
                               Itemset
                                         Count
   (16, 19, 13, 15, 11, 14, 18, 12)
                                         1589
   (16, 19, 13, 15, 11, 14, 18, 17)
                                         1566
1
   (16, 19, 13, 15, 11, 14, 12, 17)
                                         1554
3
   (16, 19, 13, 15, 11, 18, 12, 17)
                                         1578
4
   (16, 19, 13, 15, 14, 18, 12, 17)
                                         1600
5
   (16, 19, 13, 11, 14, 18, 12, 17)
                                         1606
   (16, 19, 15, 11, 14, 18, 12, 17)
6
                                         1574
7
   (16, 13, 15, 11, 14, 18, 12, 17)
                                         1567
   (19, 13, 15, 11, 14, 18, 12, 17)
                                         1558
C9
                                   Itemset
                                             Count
   (16, 19, 13, 15, 11, 14, 18, 12, 17)
                                             1419
                                   Itemset
                                             Count
   (16, 19, 13, 15, 11, 14, 18, 12, 17)
                                             1419
C10
 Empty DataFrame
```

```
Columns: [Itemset, Count]
Index: []
L10
Empty DataFrame
Columns: [Itemset, Count]
Index: []
implied combinations = []
for tup in itemset['Itemset'].values.tolist():
    for a, b in combinations(tup, 2):
        for c in tup:
            if c != a and c != b:
                implied combinations.append((a, b, c))
association df=pd.DataFrame(columns=['Rule','Confidence'])
for i in range(len(implied combinations)):
    tuple=implied combinations[i]
    association df.loc[len(association df.index)]=[f'{tuple[:2]} ->
{tuple[-1]}',
    round(df['Item Ids'].apply(lambda x: all(element in x for element
in tuple)).sum()*100/df['Item Ids'].apply(lambda x: all(element in x
for element in tuple[:2])).sum(),2)]
    association df.loc[len(association df.index)]=[f'{tuple[-1]} ->
{tuple[:2]}',
    round(df['Item Ids'].apply(lambda x: all(element in x for element
in tuple)).sum()*100/df['Item Ids'].apply(lambda x: tuple[-1] in
x).sum(),2)1
print("All Possible Association rules: ")
association df
All Possible Association rules:
                   Rule
                         Confidence
0
     ('I6', 'I9') -> I3
                              75.53
     I3 -> ('I6',
1
                  'I9')
                              53.75
2
     ('I6', 'I9') -> I5
                              73.83
     I5 -> ('I6', 'I9')
3
                              52.26
4
     ('I6', 'I9') -> I1
                              76.38
                                 . . .
    I1 -> ('I2', 'I7')
499
                              53.34
    ('I2', 'I7') -> I4
500
                              76.13
    I4 -> ('I2', 'I7')
501
                              53.29
    ('I2', 'I7') -> I8
502
                              75.75
503 I8 -> ('I2', 'I7')
                              53.55
[504 rows x 2 columns]
print(association df)
association df.to csv("Allassocitation.csv",index=False)
```

```
Rule
                           Confidence
     ('I6', 'I9') -> I3
0
                                75.53
1
     I3 -> ('I6', 'I9')
                                 53.75
     ('16', '19') -> 15
2
                                73.83
     I5 -> ('I6', 'I9')
3
                                52.26
     ('I6', 'I9') -> I1
4
                                76.38
                                   . . .
499
     I1 -> ('I2', 'I7')
                                 53.34
    ('I2', 'I7') -> I4
500
                                76.13
501
    I4 -> ('I2', 'I7')
                                53.29
    ('I2', 'I7') -> I8
502
                                75.75
503
     18 -> ('I2', 'I7')
                                53.55
[504 rows x 2 columns]
print("Final Association Rules: ")
print(association df[association df['Confidence']>70])
association df[association_df['Confidence']>70].to_csv('AcceptedAssoci
ated.csv',index=False)
Final Association Rules:
                    Rule Confidence
     ('I6', 'I9') -> I3
0
                                75.53
     ('I6',
2
            'I9') -> I5
                                73.83
     ('I6', 'I9') -> I1
4
                                76.38
     ('I6',
6
            'I9') -> I4
                                75.84
8
     ('I6', 'I9') -> I8
                                76.35
     ('I2', 'I7') -> I3
494
                                74.79
     ('I2',
             'I7') -> I5
                                75.20
496
    ('I2', 'I7') -> I1
('I2', 'I7') -> I4
('I2', 'I7') -> I8
498
                                74.90
500
                                76.13
502
                                75.75
[252 rows x 2 columns]
```