DATA MINING MIDTERM PROJECT

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Programming language: Python

Amazon.csv

A Beginner’s Guide,Java: The Complete Reference,Java For Dummies,Android Programming: The Big Nerd Ranch,

A Beginner’s Guide,Java: The Complete Reference,Java For Dummies,,

A Beginner’s Guide,Java: The Complete Reference,Java For Dummies,Android Programming: The Big Nerd Ranch,Head First Java 2nd Edition

Android Programming: The Big Nerd Ranch,Head First Java 2nd Edition,Beginning Programming with Java,,

Android Programming: The Big Nerd Ranch,Beginning Programming with Java, Java 8 Pocket Guide,,

A Beginner’s Guide,Android Programming: The Big Nerd Ranch,Head First Java 2nd Edition,,

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Java: The Complete Reference,Java For Dummies,Android Programming: The Big Nerd Ranch,,

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Beginning Programming with Java,Java 8 Pocket Guide,C++ Programming in Easy Steps,,

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A Beginner’s Guide,Java: The Complete Reference,Java For Dummies,HTML and CSS: Design and Build Websites,

A Beginner’s Guide,Java: The Complete Reference,Java For Dummies,Java 8 Pocket Guide,HTML and CSS: Design and Build Websites

Java For Dummies,Android Programming: The Big Nerd Ranch,Head First Java 2nd Edition,,

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Head First Java 2nd Edition,Beginning Programming with Java,Java 8 Pocket Guide,,

Android Programming: The Big Nerd Ranch,Head First Java 2nd Edition,,,

A Beginner’s Guide,"Java: The Complete Reference, Java For Dummies",,,U

BESTBUY.CSV

Desk Top, Printer, Flash Drive, Microsoft Office, Speakers, Anti-Virus

Lab Top,Flash Drive,Microsoft Office,Lab Top Case,Anti-Virus,,,,,

Lab Top,Printer,Flash Drive,Microsoft Office,Anti-Virus,Lab Top Case,External Hard-Drive,,,

Lab Top,Printer,Flash Drive,Anti-Virus,External Hard-Drive,Lab Top Case,,,,

Lab Top,Flash Drive,Lab Top Case,Anti-Virus,,,,,,

Lab Top,Printer,Flash Drive,Microsoft Office,,,,,,

Desk Top,Printer,Flash Drive,Microsoft Office,,,,,,

Lab Top,External Hard-Drive,Anti-Virus,,,,,,,

Desk Top,Printer,Flash Drive,Microsoft Office,Lab Top Case,Anti-Virus,Speakers,External Hard-Drive,,

Digital Camera,Lab Top,Desk Top,Printer,Flash Drive,Microsoft Office,Lab Top Case,Anti-Virus,External Hard-Drive,Speakers

Lab Top,Desk Top,Lab Top Case,External Hard-Drive,Speakers,Anti-Virus,,,,

Digital Camera,Lab Top,Lab Top Case,External Hard-Drive,Anti-Virus,Speakers,,,,

Digital Camera,Speakers,,,,,,,,

Digital Camera,Desk Top,Printer,Flash Drive,Microsoft Office,,,,,

Printer,Flash Drive,Microsoft Office,Anti-Virus,Lab Top Case,Speakers,External Hard-Drive,,,

Digital Camera,Flash Drive,Microsoft Office,Anti-Virus,Lab Top Case,External Hard-Drive,Speakers,,,

Digital Camera,Lab Top,Lab Top Case,,,,,,,

Digital Camera,Lab Top Case,Speakers,,,,,,,

Digital Camera,Lab Top,Printer,Flash Drive,Microsoft Office,Speakers,Lab Top Case,Anti-Virus,,

Digital Camera,Lab Top,Speakers,Anti-Virus,Lab Top Case,,,,

KMART.CSV

Decorative Pillows,"Quilts

",Embroidered Bedspread,,,,

Embroidered Bedspread,"Shams","Kids Bedding

",Bedding Collections,"Bed Skirts",Bedspreads,"Sheets"

Decorative Pillows,"Quilts

",Embroidered Bedspread,"Shams","Kids Bedding

",Bedding Collections,

Kids Bedding,Bedding Collections,"Sheets",Bedspreads,"Bed Skirts",,

Decorative Pillows,"Kids Bedding

",Bedding Collections,"Sheets[SEP]","Bed Skirts[SEP]",Bedspreads,

Bedding Collections,Bedspreads,"Bed Skirts[SEP]","Sheets[SEP]","Shams[SEP]","Kids Bedding

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Decorative Pillows,Quilts,,,,,

"Decorative Pillows,",Quilts,Embroidered Bedspread,,,,

Bedspreads,"Bed Skirts[SEP]","Shams[SEP]","Kids Bedding

","Sheets[SEP]",,

Quilts,Embroidered Bedspread,Bedding Collections,,,,

Bedding Collections,Bedspreads,"Bed Skirts[SEP]","Kids Bedding

","Shams[SEP]",Sheets,

Decorative Pillows,Quilts,,,,,

Embroidered Bedspread,"Shams[SEP]",,,,,

Sheets,"Shams[SEP]","Bed Skirts[SEP]","Kids Bedding

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Decorative Pillows,Quilts,,,,,

Decorative Pillows,"Kids Bedding

","Bed Skirts[SEP]","Shams[SEP]",,,

Decorative Pillows,"Shams[SEP]","Bed Skirts[SEP]",,,,

Quilts,Sheets,"Kids Bedding

",,,,

Shams,"Bed Skirts[SEP]","Kids Bedding

",Sheets,,,

Decorative Pillows,Bedspreads,"Shams[SEP]",Sheets,"Bed Skirts[SEP]","Kids Bedding

",

NIKE.CSV

Running Shoe,Socks,Sweatshirts,Modern Pants,,,,,,

Running Shoe,Socks,Sweatshirts,,,,,,,

Running Shoe,Socks,Sweatshirts,Modern Pants,,,,,,

Running Shoe,Sweatshirts,Modern Pants,,,,,,,

Running Shoe,Socks,Sweatshirts,Modern Pants,Soccer Shoe,,,,,

Running Shoe,Socks,Sweatshirts,,,,,,,

Running Shoe,Socks,Sweatshirts,Modern Pants,Tech Pants,Rash Guard,Hoodies,,

Swimming Shirt,Socks,Sweatshirts,,,,,,,

Swimming Shirt,Rash Guard,Dry Fit V-Nick,Hoodies,Tech Pants,,,,,

Swimming Shirt,Rash Guard,Dry Fit V-Nick,,,,,,,

Swimming Shirt,Rash Guard,Dry Fit V-Nick,,,,,,,

Running Shoe,Swimming Shirt,Socks,Sweatshirts,Modern Pants,Soccer Shoe,Rash Guard,Hoodies,Tech Pants,Dry Fit V-Nick

Running Shoe,Swimming Shirt,Socks,Sweatshirts,Modern Pants,Soccer Shoe,Rash Guard,Tech Pants,Dry Fit V-Nick,Hoodies

Running Shoe,Swimming Shirt,Rash Guard,Tech Pants,Hoodies,Dry Fit V-Nick,,,,

Running Shoe,Swimming Shirt,Socks,Sweatshirts,Modern Pants,Dry Fit V-Nick,Rash Guard,Tech Pants,,

Swimming Shirt,Soccer Shoe,Hoodies,Dry Fit V-Nick,Tech Pants,Rash Guard,,,,

Running Shoe,Socks,,,,,,,,

"Socks,",Sweatshirts,Modern Pants,Soccer Shoe,Hoodies,Rash Guard,Tech Pants,Dry Fit V-Nick,,

Running Shoe,Swimming Shirt,Rash Guard,,,,,,,

Running Shoe,Swimming Shirt,Socks,Sweatshirts,Modern Pants,Soccer Shoe,Hoodies,Tech Pants,Rash Guard,Dry Fit V-Nick

How to run the file: python project.py datasetname.csv minimum_support(in decimal) minimum_confidence(in decimal)

apriori.py

```python
from csv import reader
import pandas as pd

def load_data_set():
    """
    Load a sample data set
    Returns:
        A data set: A list of transactions. Each transaction contains several items.
    """
    print("Hello, Please enter which data set you need \n 1) Press 1 for Amazon \n 2) Press 2 for BestBuy \n "
          "3) Press 3 for Nike \n 4) Press 4 for KMart")
    while True:
        choice_of_data = input()
        if (choice_of_data == '1'):
            data = 'amazon.csv'
            print('User chose amazon dataset')
            break
        elif(choice_of_data == '2'):
            data = 'bestbuy.csv'
            print('User chose bestbuy dataset')
            break
        elif (choice_of_data == '3'):
            data = 'Nike.csv'
            print('User chose Nike dataset')
            break
        elif (choice_of_data == '4'):
            data = 'kmart.csv'
            print('User chose KMart dataset')
            break
```

apriori.py

```python
        else:
            print("Please enter the right one")
    with open(data, 'r') as read_obj:
        # pass the file object to reader() to get the reader object
        csv_reader = reader(read_obj)

        # Pass reader object to list() to get a list of lists
        data_set = list(csv_reader)
        for items in data_set:
            for j in range(0, len(items)):
                for items1 in items:

                    if items1 == "":
                        items.remove("")

    return data_set


def create_C1(data_set):
    """
    Create frequent candidate 1-itemset C1 by scaning data set.
    Args:
        data_set: A list of transactions. Each transaction contains several items.
    Returns:
        C1: A set which contains all frequent candidate 1-itemsets
    """
    C1 = set()
    for t in data_set:
        for item in t:
            item_set = frozenset([item])
```

```
            C1.add(item_set)
    return C1


def is_apriori(Ck_item, Lksub1):
    """
    Judge whether a frequent candidate k-itemset satisfy Apriori property.
    Args:
        Ck_item: a frequent candidate k-itemset in Ck which contains all frequent
                 candidate k-itemsets.
        Lksub1: Lk-1, a set which contains all frequent candidate (k-1)-itemsets.
    Returns:
        True: satisfying Apriori property.
        False: Not satisfying Apriori property.
    """
    for item in Ck_item:
        sub_Ck = Ck_item - frozenset([item])
        if sub_Ck not in Lksub1:
            return False
    return True


def create_Ck(Lksub1, k):
    """
    Create Ck, a set which contains all all frequent candidate k-itemsets
    by Lk-1's own connection operation.
    Args:
        Lksub1: Lk-1, a set which contains all frequent candidate (k-1)-itemsets.
        k: the item number of a frequent itemset.
    Return:
        Ck: a set which contains all all frequent candidate k-itemsets.
    """
    Ck = set()
    len_Lksub1 = len(Lksub1)
    list_Lksub1 = list(Lksub1)
    for i in range(len_Lksub1):
        for j in range(1, len_Lksub1):
            l1 = list(list_Lksub1[i])
            l2 = list(list_Lksub1[j])
            l1.sort()
            l2.sort()
            if l1[0:k-2] == l2[0:k-2]:
                Ck_item = list_Lksub1[i] | list_Lksub1[j]
                # pruning
                if is_apriori(Ck_item, Lksub1):
                    Ck.add(Ck_item)
    return Ck


def generate_Lk_by_Ck(data_set, Ck, min_support, support_data):
    """
    Generate Lk by executing a delete policy from Ck.
    Args:
        data_set: A list of transactions. Each transaction contains several items.
        Ck: A set which contains all all frequent candidate k-itemsets.
        min_support: The minimum support.
        support_data: A dictionary. The key is frequent itemset and the value is support.
    Returns:
        Lk: A set which contains all all frequent k-itemsets.
    """
```

apriori.py

```
    Lk = set()
    item_count = {}
    for t in data_set:
        for item in Ck:
            if item.issubset(t):
                if item not in item_count:
                    item_count[item] = 1
                else:
                    item_count[item] += 1
    t_num = float(len(data_set))
    for item in item_count:
        if (item_count[item] / t_num) >= min_support:
            Lk.add(item)
            support_data[item] = item_count[item] / t_num
    return Lk


def generate_L(data_set, k, min_support):
    """
    Generate all frequent itemsets.
    Args:
        data_set: A list of transactions. Each transaction contains several items.
        k: Maximum number of items for all frequent itemsets.
        min_support: The minimum support.
    Returns:
        L: The list of Lk.
        support_data: A dictionary. The key is frequent itemset and the value is support.
    """
    support_data = {}
    C1 = create_C1(data_set)
```

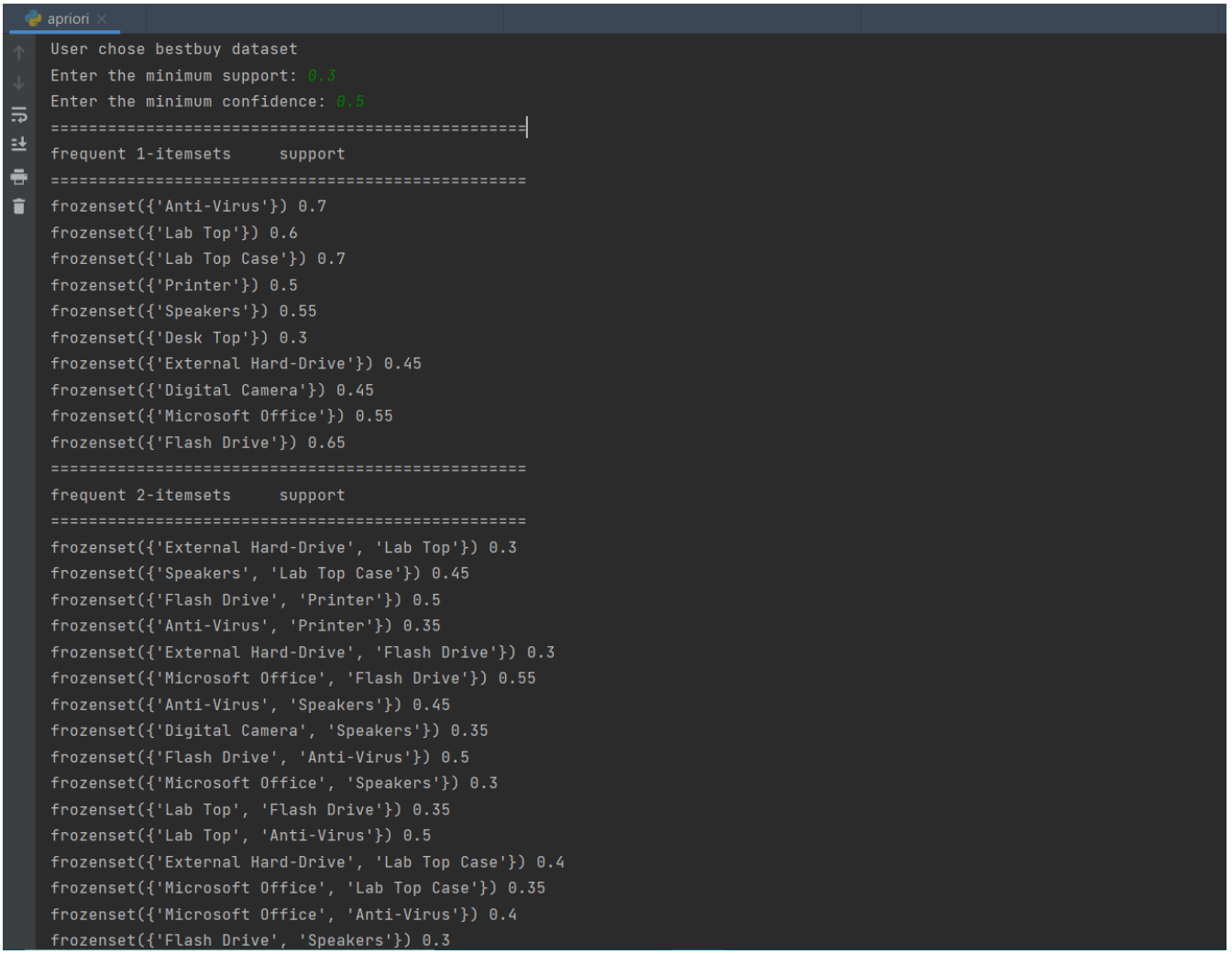
apriori.py

```
    L1 = generate_Lk_by_Ck(data_set, C1, min_support, support_data)
    Lksub1 = L1.copy()
    L = []
    L.append(Lksub1)
    for i in range(2, k+1):
        Ci = create_Ck(Lksub1, i)
        Li = generate_Lk_by_Ck(data_set, Ci, min_support, support_data)
        Lksub1 = Li.copy()
        L.append(Lksub1)
    return L, support_data


def generate_big_rules(L, support_data, min_conf):
    """
    Generate big rules from frequent itemsets.
    Args:
        L: The list of Lk.
        support_data: A dictionary. The key is frequent itemset and the value is support.
        min_conf: Minimal confidence.
    Returns:
        big_rule_list: A list which contains all big rules. Each big rule is represented
                       as a 3-tuple.
    """
    big_rule_list = []
    sub_set_list = []
    for i in range(0, len(L)):
        for freq_set in L[i]:
            for sub_set in sub_set_list:
                if sub_set.issubset(freq_set):
                    conf = support_data[freq_set] / support_data[freq_set - sub_set]
```

INPUT

OUTPUT



apriori

```
frozenset({'External Hard-Drive', 'Anti-Virus'}) 0.45
frozenset({'Digital Camera', 'Lab Top Case'}) 0.35
frozenset({'Printer', 'Lab Top Case'}) 0.3
frozenset({'Anti-Virus', 'Lab Top Case'}) 0.6
frozenset({'Lab Top', 'Lab Top Case'}) 0.5
frozenset({'External Hard-Drive', 'Speakers'}) 0.3
frozenset({'Flash Drive', 'Lab Top Case'}) 0.45
frozenset({'Microsoft Office', 'Printer'}) 0.45
================================================
frequent 3-itemsets     support
================================================
frozenset({'External Hard-Drive', 'Flash Drive', 'Lab Top Case'}) 0.3
frozenset({'Flash Drive', 'Anti-Virus', 'Printer'}) 0.35
frozenset({'External Hard-Drive', 'Anti-Virus', 'Lab Top Case'}) 0.4
frozenset({'Lab Top Case', 'Flash Drive', 'Printer'}) 0.3
frozenset({'Flash Drive', 'Microsoft Office', 'Anti-Virus'}) 0.4
frozenset({'Flash Drive', 'Anti-Virus', 'Speakers'}) 0.3
frozenset({'Microsoft Office', 'Anti-Virus', 'Speakers'}) 0.3
frozenset({'External Hard-Drive', 'Anti-Virus', 'Speakers'}) 0.3
frozenset({'Lab Top', 'Anti-Virus', 'Lab Top Case'}) 0.45
frozenset({'Microsoft Office', 'Anti-Virus', 'Printer'}) 0.3
frozenset({'Speakers', 'External Hard-Drive', 'Lab Top Case'}) 0.3
frozenset({'Microsoft Office', 'Flash Drive', 'Printer'}) 0.45
frozenset({'Flash Drive', 'Anti-Virus', 'Lab Top Case'}) 0.45
frozenset({'External Hard-Drive', 'Lab Top', 'Anti-Virus'}) 0.3
frozenset({'Microsoft Office', 'Flash Drive', 'Lab Top Case'}) 0.35
frozenset({'Lab Top Case', 'Anti-Virus', 'Speakers'}) 0.4
frozenset({'Lab Top Case', 'Anti-Virus', 'Printer'}) 0.3
frozenset({'Flash Drive', 'External Hard-Drive', 'Anti-Virus'}) 0.3
frozenset({'Microsoft Office', 'Anti-Virus', 'Lab Top Case'}) 0.35
frozenset({'Lab Top', 'Flash Drive', 'Lab Top Case'}) 0.3
frozenset({'Microsoft Office', 'Flash Drive', 'Speakers'}) 0.3
frozenset({'Lab Top Case', 'Digital Camera', 'Speakers'}) 0.3
frozenset({'Flash Drive', 'Lab Top', 'Anti-Virus'}) 0.3
Big Rules
```

apriori

```
Big Rules
frozenset({'External Hard-Drive'}) => frozenset({'Lab Top'}) conf:  0.6666666666666666
frozenset({'Lab Top'}) => frozenset({'External Hard-Drive'}) conf:  0.5
frozenset({'Speakers'}) => frozenset({'Lab Top Case'}) conf:  0.8181818181818181
frozenset({'Lab Top Case'}) => frozenset({'Speakers'}) conf:  0.6428571428571429
frozenset({'Flash Drive'}) => frozenset({'Printer'}) conf:  0.7692307692307692
frozenset({'Printer'}) => frozenset({'Flash Drive'}) conf:  1.0
frozenset({'Printer'}) => frozenset({'Anti-Virus'}) conf:  0.7
frozenset({'Anti-Virus'}) => frozenset({'Printer'}) conf:  0.5
frozenset({'External Hard-Drive'}) => frozenset({'Flash Drive'}) conf:  0.6666666666666666
frozenset({'Flash Drive'}) => frozenset({'Microsoft Office'}) conf:  0.8461538461538461
frozenset({'Microsoft Office'}) => frozenset({'Flash Drive'}) conf:  1.0
frozenset({'Speakers'}) => frozenset({'Anti-Virus'}) conf:  0.8181818181818181
frozenset({'Anti-Virus'}) => frozenset({'Speakers'}) conf:  0.6428571428571429
frozenset({'Digital Camera'}) => frozenset({'Speakers'}) conf:  0.7777777777777777
frozenset({'Speakers'}) => frozenset({'Digital Camera'}) conf:  0.6363636363636362
frozenset({'Flash Drive'}) => frozenset({'Anti-Virus'}) conf:  0.7692307692307692
frozenset({'Anti-Virus'}) => frozenset({'Flash Drive'}) conf:  0.7142857142857143
frozenset({'Microsoft Office'}) => frozenset({'Speakers'}) conf:  0.5454545454545454
frozenset({'Speakers'}) => frozenset({'Microsoft Office'}) conf:  0.5454545454545454
frozenset({'Flash Drive'}) => frozenset({'Lab Top'}) conf:  0.5384615384615384
frozenset({'Lab Top'}) => frozenset({'Flash Drive'}) conf:  0.5833333333333334
frozenset({'Lab Top'}) => frozenset({'Anti-Virus'}) conf:  0.8333333333333334
frozenset({'Anti-Virus'}) => frozenset({'Lab Top'}) conf:  0.7142857142857143
frozenset({'External Hard-Drive'}) => frozenset({'Lab Top Case'}) conf:  0.888888888888889
frozenset({'Lab Top Case'}) => frozenset({'External Hard-Drive'}) conf:  0.5714285714285715
frozenset({'Microsoft Office'}) => frozenset({'Lab Top Case'}) conf:  0.6363636363636362
frozenset({'Lab Top Case'}) => frozenset({'Microsoft Office'}) conf:  0.5
frozenset({'Microsoft Office'}) => frozenset({'Anti-Virus'}) conf:  0.7272727272727273
frozenset({'Anti-Virus'}) => frozenset({'Microsoft Office'}) conf:  0.5714285714285715
frozenset({'Speakers'}) => frozenset({'Flash Drive'}) conf:  0.5454545454545454
frozenset({'External Hard-Drive'}) => frozenset({'Anti-Virus'}) conf:  1.0
frozenset({'Anti-Virus'}) => frozenset({'External Hard-Drive'}) conf:  0.6428571428571429
frozenset({'Digital Camera'}) => frozenset({'Lab Top Case'}) conf:  0.7777777777777777
frozenset({'Lab Top Case'}) => frozenset({'Digital Camera'}) conf:  0.5
```

apriori

```
frozenset({'Printer'}) => frozenset({'Lab Top Case'}) conf:  0.6
frozenset({'Lab Top Case'}) => frozenset({'Anti-Virus'}) conf:  0.8571428571428572
frozenset({'Anti-Virus'}) => frozenset({'Lab Top Case'}) conf:  0.8571428571428572
frozenset({'Lab Top Case'}) => frozenset({'Lab Top'}) conf:  0.7142857142857143
frozenset({'Lab Top'}) => frozenset({'Lab Top Case'}) conf:  0.8333333333333334
frozenset({'External Hard-Drive'}) => frozenset({'Speakers'}) conf:  0.6666666666666666
frozenset({'Speakers'}) => frozenset({'External Hard-Drive'}) conf:  0.5454545454545454
frozenset({'Flash Drive'}) => frozenset({'Lab Top Case'}) conf:  0.6923076923076923
frozenset({'Lab Top Case'}) => frozenset({'Flash Drive'}) conf:  0.6428571428571429
frozenset({'Microsoft Office'}) => frozenset({'Printer'}) conf:  0.8181818181818181
frozenset({'Printer'}) => frozenset({'Microsoft Office'}) conf:  0.9
frozenset({'External Hard-Drive', 'Flash Drive'}) => frozenset({'Lab Top Case'}) conf:  1.0
frozenset({'Flash Drive', 'Lab Top Case'}) => frozenset({'External Hard-Drive'}) conf:  0.6666666666666666
frozenset({'External Hard-Drive', 'Lab Top Case'}) => frozenset({'Flash Drive'}) conf:  0.7499999999999999
frozenset({'External Hard-Drive'}) => frozenset({'Flash Drive', 'Lab Top Case'}) conf:  0.6666666666666666
frozenset({'Flash Drive', 'Printer'}) => frozenset({'Anti-Virus'}) conf:  0.7
frozenset({'Flash Drive', 'Anti-Virus'}) => frozenset({'Printer'}) conf:  0.7
frozenset({'Anti-Virus', 'Printer'}) => frozenset({'Flash Drive'}) conf:  1.0
frozenset({'Anti-Virus'}) => frozenset({'Flash Drive', 'Printer'}) conf:  0.5
frozenset({'Flash Drive'}) => frozenset({'Anti-Virus', 'Printer'}) conf:  0.5384615384615384
frozenset({'Printer'}) => frozenset({'Flash Drive', 'Anti-Virus'}) conf:  0.7
frozenset({'External Hard-Drive', 'Lab Top Case'}) => frozenset({'Anti-Virus'}) conf:  1.0
frozenset({'External Hard-Drive', 'Anti-Virus'}) => frozenset({'Lab Top Case'}) conf:  0.888888888888889
frozenset({'Anti-Virus', 'Lab Top Case'}) => frozenset({'External Hard-Drive'}) conf:  0.6666666666666667
frozenset({'Anti-Virus'}) => frozenset({'External Hard-Drive', 'Lab Top Case'}) conf:  0.5714285714285715
frozenset({'Lab Top Case'}) => frozenset({'External Hard-Drive', 'Anti-Virus'}) conf:  0.5714285714285715
frozenset({'External Hard-Drive'}) => frozenset({'Anti-Virus', 'Lab Top Case'}) conf:  0.888888888888889
frozenset({'Flash Drive', 'Printer'}) => frozenset({'Lab Top Case'}) conf:  0.6
frozenset({'Flash Drive', 'Lab Top Case'}) => frozenset({'Printer'}) conf:  0.6666666666666666
frozenset({'Printer', 'Lab Top Case'}) => frozenset({'Flash Drive'}) conf:  1.0
frozenset({'Printer'}) => frozenset({'Flash Drive', 'Lab Top Case'}) conf:  0.6
frozenset({'Microsoft Office', 'Flash Drive'}) => frozenset({'Anti-Virus'}) conf:  0.7272727272727273
frozenset({'Flash Drive', 'Anti-Virus'}) => frozenset({'Microsoft Office'}) conf:  0.8
frozenset({'Microsoft Office', 'Anti-Virus'}) => frozenset({'Flash Drive'}) conf:  1.0
frozenset({'Anti-Virus'}) => frozenset({'Microsoft Office', 'Flash Drive'}) conf:  0.5714285714285715
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apriori

```
frozenset({'Microsoft Office'}) => frozenset({'Flash Drive', 'Anti-Virus'}) conf:  0.7272727272727273
frozenset({'Flash Drive'}) => frozenset({'Microsoft Office', 'Anti-Virus'}) conf:  0.6153846153846154
frozenset({'Flash Drive', 'Speakers'}) => frozenset({'Anti-Virus'}) conf:  1.0
frozenset({'Flash Drive', 'Anti-Virus'}) => frozenset({'Speakers'}) conf:  0.6
frozenset({'Anti-Virus', 'Speakers'}) => frozenset({'Flash Drive'}) conf:  0.6666666666666666
frozenset({'Speakers'}) => frozenset({'Flash Drive', 'Anti-Virus'}) conf:  0.5454545454545454
frozenset({'Microsoft Office', 'Speakers'}) => frozenset({'Anti-Virus'}) conf:  1.0
frozenset({'Microsoft Office', 'Anti-Virus'}) => frozenset({'Speakers'}) conf:  0.7499999999999999
frozenset({'Anti-Virus', 'Speakers'}) => frozenset({'Microsoft Office'}) conf:  0.6666666666666666
frozenset({'Microsoft Office'}) => frozenset({'Anti-Virus', 'Speakers'}) conf:  0.5454545454545454
frozenset({'Speakers'}) => frozenset({'Microsoft Office', 'Anti-Virus'}) conf:  0.5454545454545454
frozenset({'External Hard-Drive', 'Speakers'}) => frozenset({'Anti-Virus'}) conf:  1.0
frozenset({'External Hard-Drive', 'Anti-Virus'}) => frozenset({'Speakers'}) conf:  0.6666666666666666
frozenset({'Anti-Virus', 'Speakers'}) => frozenset({'External Hard-Drive'}) conf:  0.6666666666666666
frozenset({'External Hard-Drive'}) => frozenset({'Anti-Virus', 'Speakers'}) conf:  0.6666666666666666
frozenset({'Speakers'}) => frozenset({'External Hard-Drive', 'Anti-Virus'}) conf:  0.5454545454545454
frozenset({'Lab Top', 'Lab Top Case'}) => frozenset({'Anti-Virus'}) conf:  0.9
frozenset({'Anti-Virus', 'Lab Top Case'}) => frozenset({'Lab Top'}) conf:  0.75
frozenset({'Lab Top', 'Anti-Virus'}) => frozenset({'Lab Top Case'}) conf:  0.9
frozenset({'Lab Top Case'}) => frozenset({'Lab Top', 'Anti-Virus'}) conf:  0.6428571428571429
frozenset({'Lab Top'}) => frozenset({'Anti-Virus', 'Lab Top Case'}) conf:  0.75
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```

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Process finished with exit code 0
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