

Midterm Project

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Programming Language: Python

Structure of Files:

The screenshot shows the PyCharm IDE interface. The project navigation bar at the top indicates 'PycharmProjects [D:\PycharmProjects] - ...\\part1.py - PyCharm (Administrator)'. The left sidebar shows a project tree with a red box highlighting the 'dataset' directory which contains several CSV files: item.csv, transaction_database1.csv, transaction_database2.csv, transaction_database3.csv, transaction_database4.csv, and transaction_database5.csv. Below the dataset directory are 'venv', 'part1.py', and 'part2.py'. The right side of the screen displays the code editor with two tabs open: 'part1.py' and 'part2.py'. The code in 'part1.py' is for the Apriori algorithm, showing functions like 'generate_candidate' and 'generate_frequent_and_support'. The code in 'part2.py' is for the Brute Force algorithm. The bottom status bar shows the time as 41:16, date as 2014/2/28, and Python version as 3.8.

In this project, dataset directory is the same level as part1.py and part2.py, which contains source code for Apriori and Brute Force algorithms, respectively. I used 6 data files to compare the running time between Apriori Algorithm and Brute Force method. 5 of these files are transaction database files, and 1 of them is for enumerating k-item sets in Brute Force method.

Data:

transaction_database1.csv

```
apple,banana,orange
beef,grape
bread,chicken
broccoli,clothes
oil,bleach
candle,conditioner
detergent,moisture
shampoo,tissue
camera,cell phone
charger,handbag
headphone,light bulb
screen protector,shoe
speaker,television
apple,banana,clothes,thermostat
apple,oil
apple,beef
apple,bread
apple,broccoli
apple,clothes
apple,grape
```

transaction_database2.csv

```
bleach,candle,beef,moisture
apple,conditioner,beef,moisture
banana,detergent,tissue
beef,moisture
bread,shampoo
broccoli,tissue
chicken,camera
clothes,cell phone
egg,charger
grape,handbag
milk,headphone
orange,light bulb
oil,screen protector
shoe,speaker
television,thermostat
detergent,moisture,beef
detergent,shampoo,bread
detergent,tissue
moisture,shampoo
moisture,tissue
```

transaction_database3.csv

```
camera,cell phone,shampoo,moisture
apple,charger
banana,handbag
beef,headphone
bread,light bulb
broccoli,screen protector
chicken,shoe
clothes,speaker
egg,television
grape,thermostat
bleach,cell phone,moisture,shampoo
milk,candle
orange,conditioner
oil,detergent
cell phone,moisture,screen protector,shampoo
cell phone,shampoo,shoe,moisture
cell phone,tissue,speaker
cell phone,television
cell phone,thermostat
charger,handbag
```

transaction_database4.csv

```
apple,bleach
clothes,camera
egg,speaker
grape,shampoo,television
milk,tissue,thermostat
orange,bleach,charger
oil,bleach,cell phone
banana,bleach,handbag
banana,candle,handbag
banana,candle,headphone
beef,candle,headphone
beef,conditioner,headphone
beef,conditioner,light bulb
bread,conditioner,light bulb
bread,detergent,light bulb
bread,detergent,screen protector
broccoli,detergent,screen protector
broccoli,moisture,screen protector
broccoli,moisture,shoe
chicken,moisture,shoe
```

transaction_database5.csv

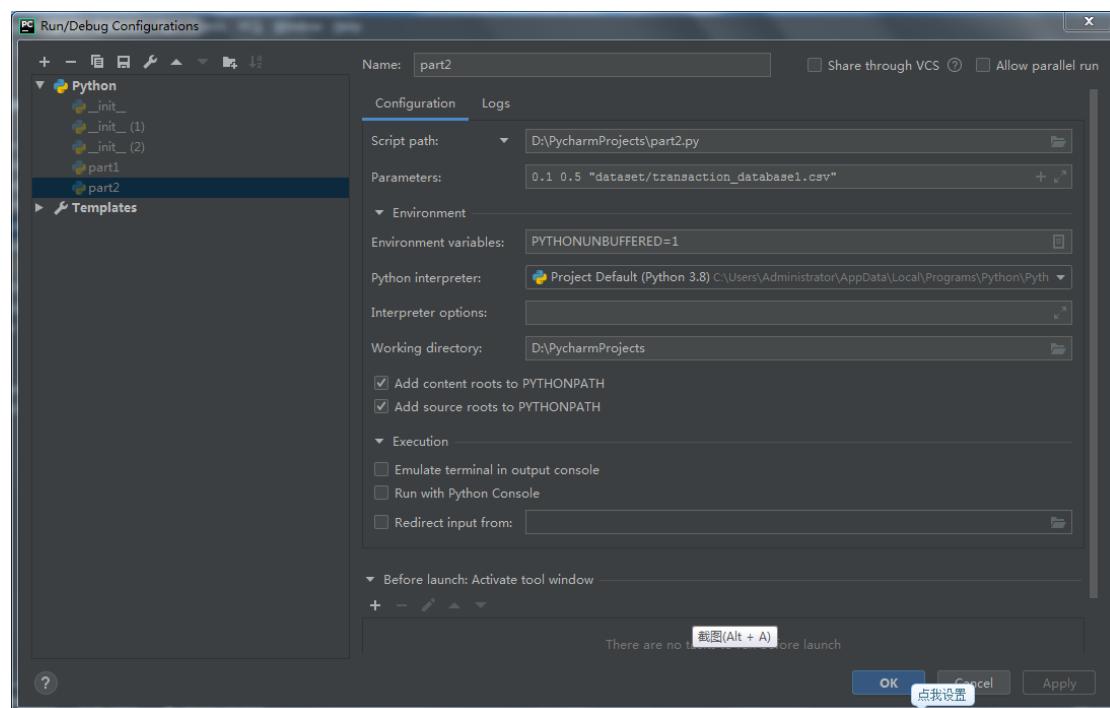
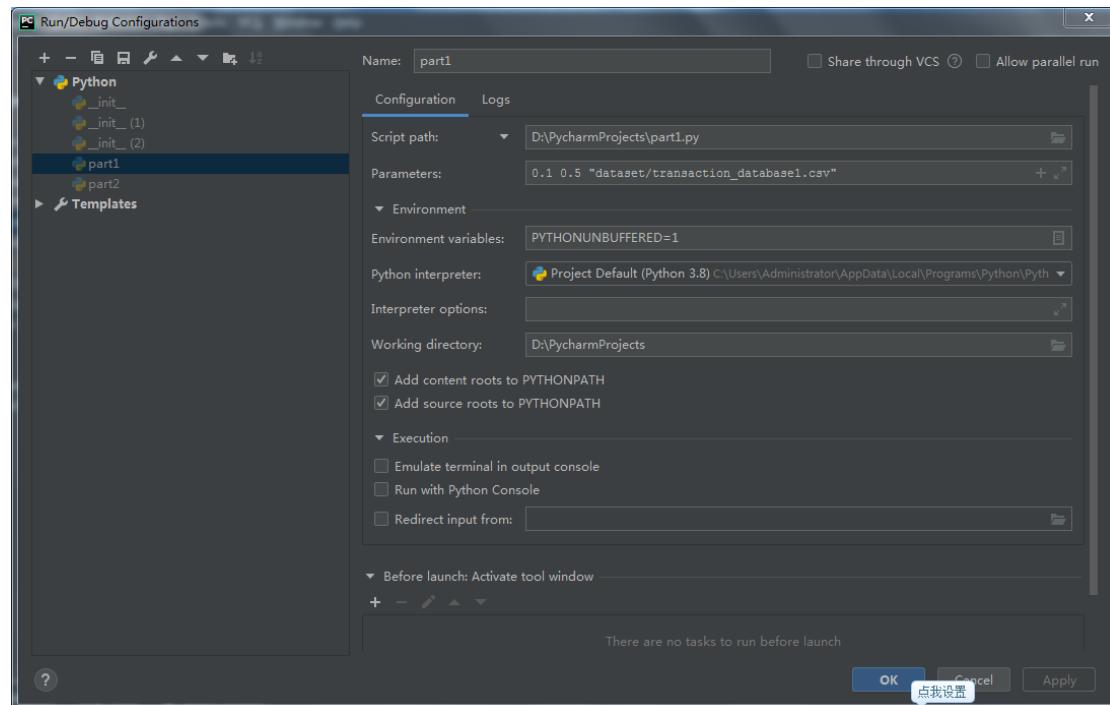
```
banana, chicken, shampoo, shoe  
beef, chicken, shampoo, speaker  
bread, clothes, shampoo, speaker  
apple, clothes, tissue, speaker  
broccoli, clothes, tissue, television  
egg, tissue, television  
egg, bleach, candle, television  
egg, bleach, candle, thermostat  
grape, bleach, candle, television  
grape, bleach, conditioner, television  
grape, conditioner, detergent, camera, cell phone  
grape, conditioner, detergent, charger, handbag  
milk, conditioner, detergent, charger, handbag  
milk, moisture, shampoo, charger, handbag  
milk, moisture, shampoo, headphone, light bulb  
orange, moisture, shampoo, headphone, light bulb  
orange, bleach, tissue, headphone, light bulb  
orange, bleach, tissue, screen protector, shoe  
oil, bleach, tissue, screen protector, shoe  
oil, bleach, candle, conditioner, screen protector, shoe
```

item.csv (This file is used in part2.py to generate all combinations of k-item sets)

```
apple, banana, beef, bread, broccoli, chicken, clothes, egg, grape, milk, orange, oil, bleach, candle, conditioner, detergent, moisture, shampoo, tissue, camera, cell phone, charger, handbag, headphone, light bulb, screen protector, shoe, speaker, television, thermostat
```

For test, I have 0.1, 0.2 for minimum support, 0.5, 0.7 for minimum confidence, as well as transaction_database1.csv, transaction_database2.csv, transaction_database3.csv, transaction_database4.csv, transaction_database5.csv.

- First, I test minimum support = 0.1, minimum confidence = 0.5, transaction_database1.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is 0.0s.

```

PycharmProjects [D:\PycharmProjects] - ...\\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects > part1.py
Project Run: part1 x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.1 0.5 dataset/transaction_database1.csv
----- INPUT TRANSACTIONS:
['apple', 'banana', 'orange']
['beef', 'grape']
['bread', 'chicken']
['broccoli', 'clothes']
['oil', 'bleach']
['candle', 'conditioner']
['detergent', 'moisture']
['shampoo', 'tissue']
['camera', 'cell phone']
['charger', 'handbag']
['headphone', 'light bulb']
['screen protector', 'shoe']
['speaker', 'television']
['apple', 'banana', 'clothes', 'thermostat']
['apple', 'oil']
['apple', 'beef']
['apple', 'bread']
['apple', 'broccoli']
['apple', 'clothes']
['apple', 'grape']

----- RULES SUPPORT CONFIDENCE:
banana => apple 0.1 1.0
clothes => apple 0.1 0.6666666666666667
----- RUNNING TIME:
0.05s
Process finished with exit code 0

```

```

PycharmProjects [D:\PycharmProjects] - ...\\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects > part1.py
Project Run: part1 x
----- INPUT TRANSACTIONS:
['bread', 'chicken']
['broccoli', 'clothes']
['oil', 'bleach']
['candle', 'conditioner']
['detergent', 'moisture']
['shampoo', 'tissue']
['camera', 'cell phone']
['charger', 'handbag']
['headphone', 'light bulb']
['screen protector', 'shoe']
['speaker', 'television']
['apple', 'banana', 'clothes', 'thermostat']
['apple', 'oil']
['apple', 'beef']
['apple', 'bread']
['apple', 'broccoli']
['apple', 'clothes']
['apple', 'grape']

----- RULES SUPPORT CONFIDENCE:
banana => apple 0.1 1.0
clothes => apple 0.1 0.6666666666666667
----- RUNNING TIME:
0.05s
Process finished with exit code 0

```

I get the running time for Brute Force is around 0.05s, slightly greater than the one for Apriori.

```

PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects > part2.py
Project Run: part2
Run: part2
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.1 0.5 dataset/transaction_database1.csv
----- INPUT TRANSACTIONS:
['apple', 'banana', 'orange']
['beef', 'grape']
['bread', 'chicken']
['broccoli', 'clothes']
['oil', 'bleach']
['candle', 'conditioner']
['detergent', 'moisture']
['shampoo', 'tissue']
['camera', 'cell phone']
['charger', 'handbag']
['headphone', 'light bulb']
['screen protector', 'shoe']
['speaker', 'television']
['apple', 'banana', 'clothes', 'thermostat']
['apple', 'oil']
['apple', 'beef']
['apple', 'bread']
['apple', 'broccoli']
['apple', 'clothes']
['apple', 'grape']

----- RULES SUPPORT CONFIDENCE:
banana => apple 0.1 1.0
clothes => apple 0.1 0.6666666666666667

----- RUNNING TIME:
32:1 LF UTF-8 4 spaces Python 3.8
Event Log Terminal
0:29 2020/2/28

```

```

PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects > part2.py
Project Run: part2
Run: part2
['bread', 'chicken']
['broccoli', 'clothes']
['oil', 'bleach']
['candle', 'conditioner']
['detergent', 'moisture']
['shampoo', 'tissue']
['camera', 'cell phone']
['charger', 'handbag']
['headphone', 'light bulb']
['screen protector', 'shoe']
['speaker', 'television']
['apple', 'banana', 'clothes', 'thermostat']
['apple', 'oil']
['apple', 'beef']
['apple', 'bread']
['apple', 'broccoli']
['apple', 'clothes']
['apple', 'grape']

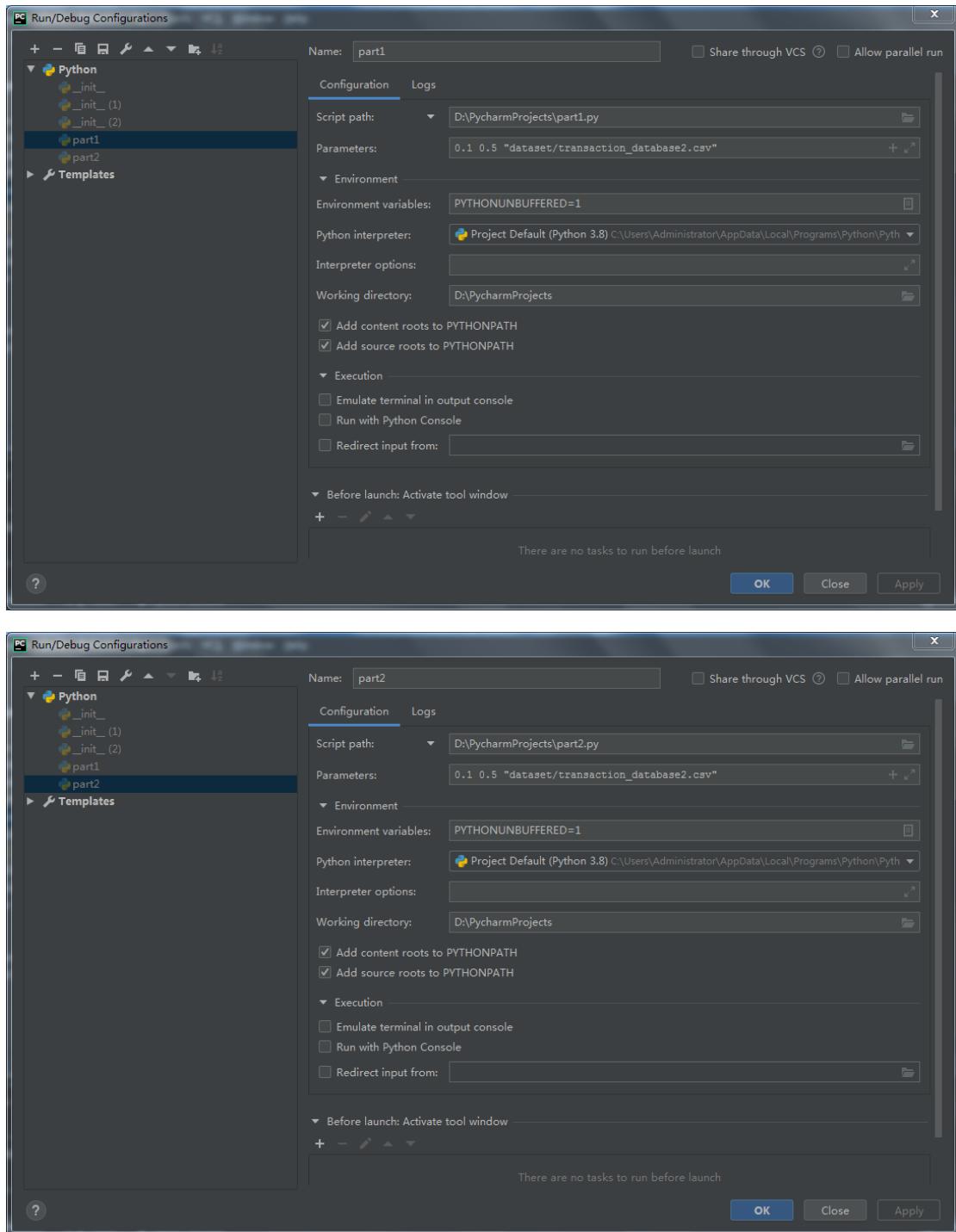
----- RULES SUPPORT CONFIDENCE:
banana => apple 0.1 1.0
clothes => apple 0.1 0.6666666666666667

----- RUNNING TIME:
0.04500269889831543s

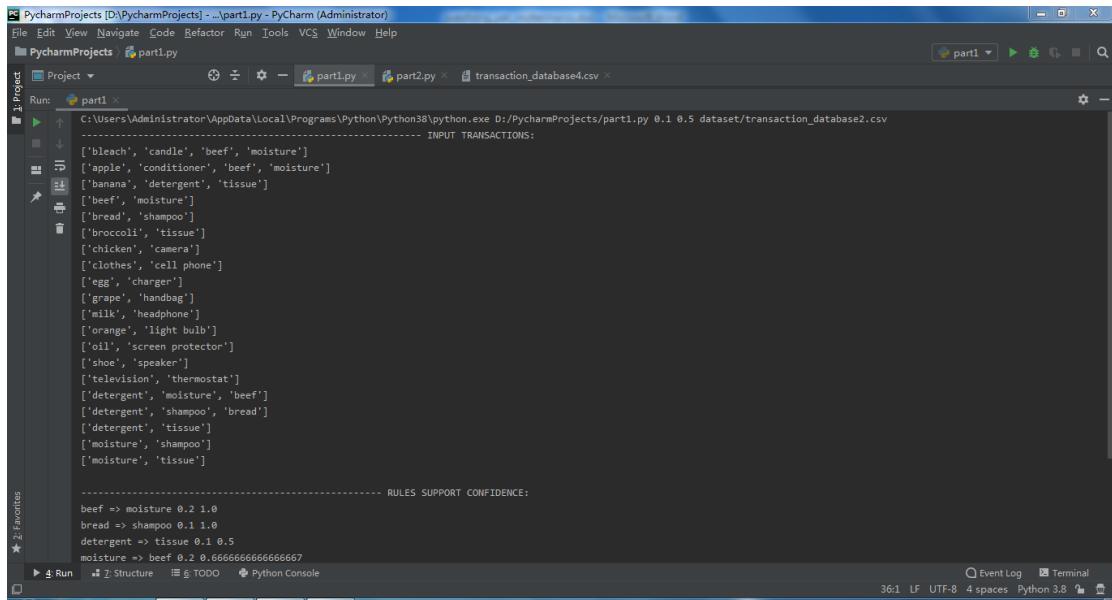
Process finished with exit code 0

```

2. Second, I test minimum support = 0.1, minimum confidence = 0.5, transaction_database2.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is 0.0s.

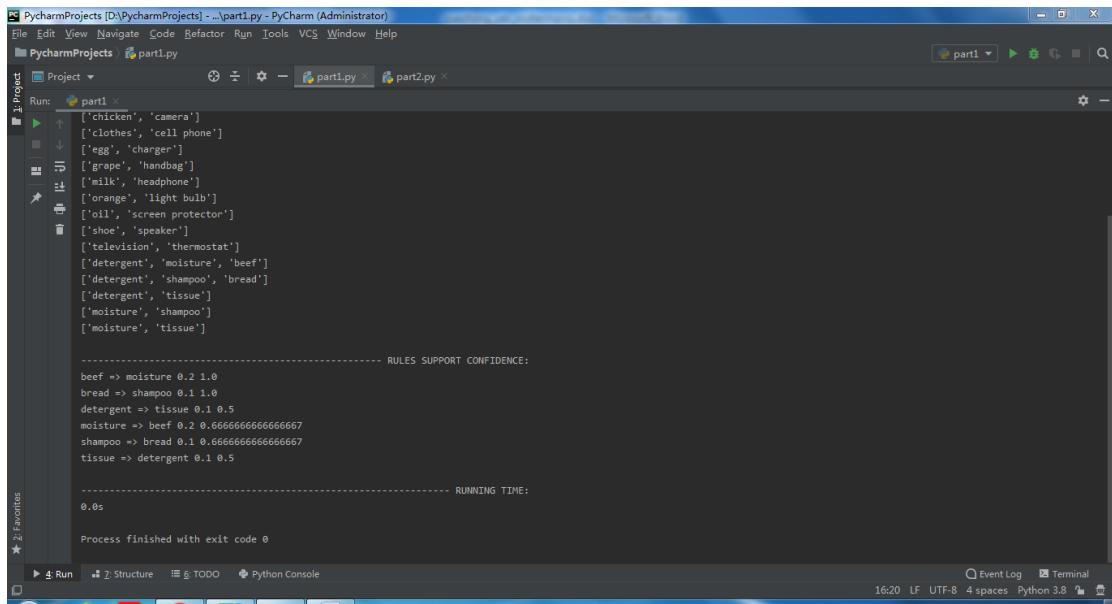


```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1 x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.1 0.5 dataset/transaction_database2.csv
----- INPUT TRANSACTIONS:
['bleach', 'candle', 'beef', 'moisture']
['apple', 'conditioner', 'beef', 'moisture']
['banana', 'detergent', 'tissue']
['beef', 'moisture']
['bread', 'shampoo']
['broccoli', 'tissue']
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0
bread => shampoo 0.1 1.0
detergent => tissue 0.1 0.5
moisture => beef 0.2 0.6666666666666667

```



```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1 x
part1 x
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0
bread => shampoo 0.1 1.0
detergent => tissue 0.1 0.5
moisture => beef 0.2 0.6666666666666667
shampoo => bread 0.1 0.6666666666666667
tissue => detergent 0.1 0.5

----- RUNNING TIME:
0.0s

Process finished with exit code 0

```

I get the running time for Brute Force is around 0.05s, slightly greater than the one for Apriori.

```

PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2 x part1.py x part2.py x transaction_database4.csv x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.1 0.5 dataset/transaction_database2.csv
----- INPUT TRANSACTIONS:
['bleach', 'candle', 'beef', 'moisture']
['apple', 'conditioner', 'beef', 'moisture']
['banana', 'detergent', 'tissue']
['beef', 'moisture']
['bread', 'shampoo']
['broccoli', 'tissue']
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0
bread => shampoo 0.1 1.0
detergent => tissue 0.1 0.5
moisture => beef 0.2 0.6666666666666667
shampoo => bread 0.1 0.6666666666666667
tissue => detergent 0.1 0.5

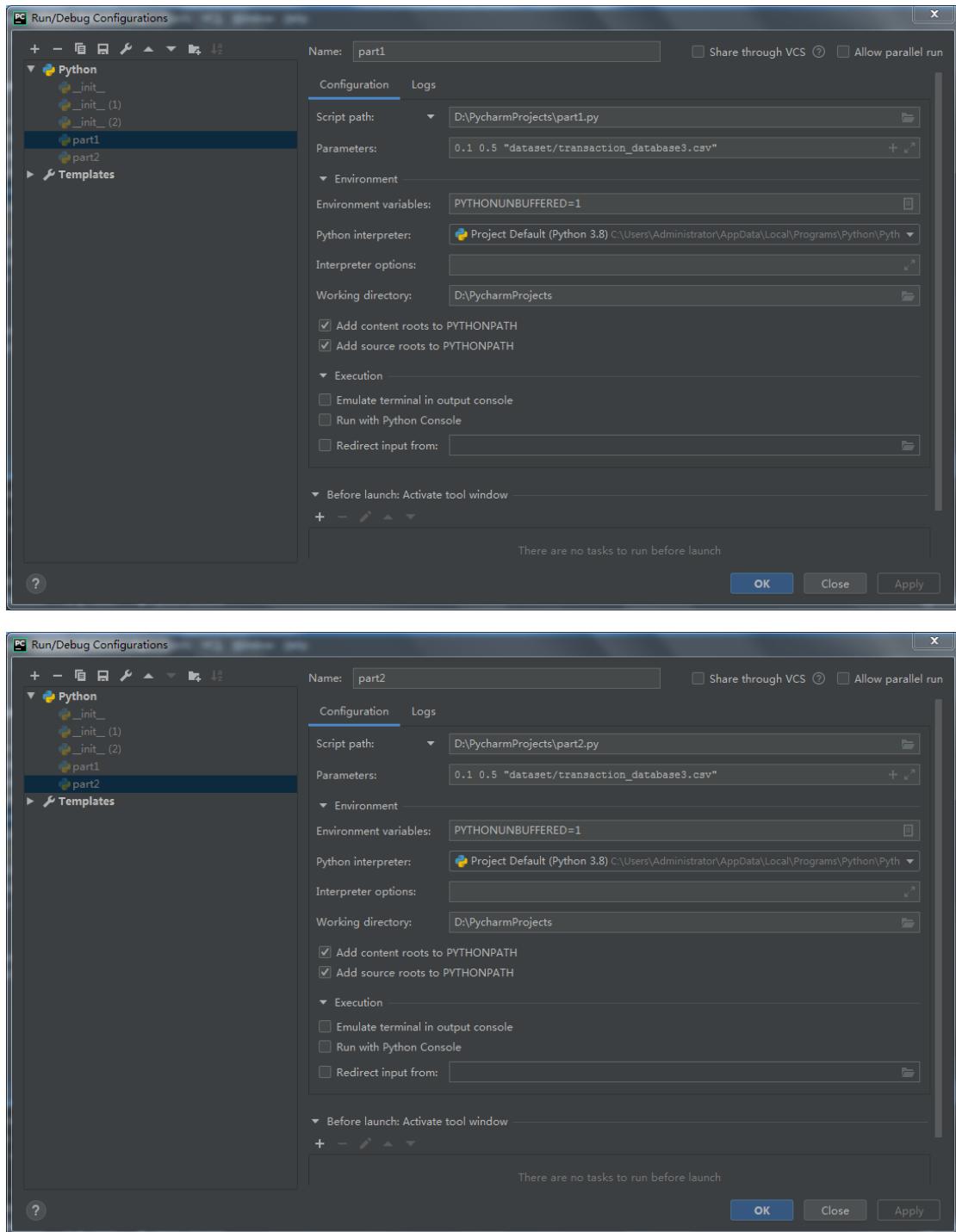
----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0
bread => shampoo 0.1 1.0
detergent => tissue 0.1 0.5
moisture => beef 0.2 0.6666666666666667
shampoo => bread 0.1 0.6666666666666667
tissue => detergent 0.1 0.5

----- RUNNING TIME:
0.04700279235839844s

Process finished with exit code 0

```

3. Third, I test minimum support = 0.1, minimum confidence = 0.5, transaction_database3.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is around 0.00s.

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.1 0.5 dataset/transaction_database3.csv
----- INPUT TRANSACTIONS:
['camera', 'cell phone', 'shampoo', 'moisture']
['apple', 'charger']
['banana', 'handbag']
['beef', 'headphone']
['bread', 'light bulb']
['broccoli', 'screen protector']
['chicken', 'shoe']
['clothes', 'speaker']
['egg', 'television']
['grape', 'thermostat']
['bleach', 'cell phone', 'moisture', 'shampoo']
['milk', 'candle']
['orange', 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

----- RULES SUPPORT CONFIDENCE:
cell phone => moisture 0.2 0.5714285714285715
cell phone => moisture,shampoo 0.2 0.5714285714285715
cell phone => shampoo 0.2 0.5714285714285715
cell phone,moisture => shampoo 0.2 1.0
----- RULES SUPPORT CONFIDENCE:
cell phone => moisture 0.2 0.5714285714285715
cell phone => moisture,shampoo 0.2 0.5714285714285715
cell phone => shampoo 0.2 0.5714285714285715
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0
moisture => shampoo 0.2 1.0
moisture,shampoo => cell phone 0.2 1.0
shampoo => cell phone 0.2 1.0
shampoo => cell phone,moisture 0.2 1.0
shampoo => moisture 0.2 1.0
----- RUNNING TIME:
0.0009999275287519531s
Process finished with exit code 0

```

I get the running time for Brute Force is around 0.33s, slightly greater than the one for Apriori.

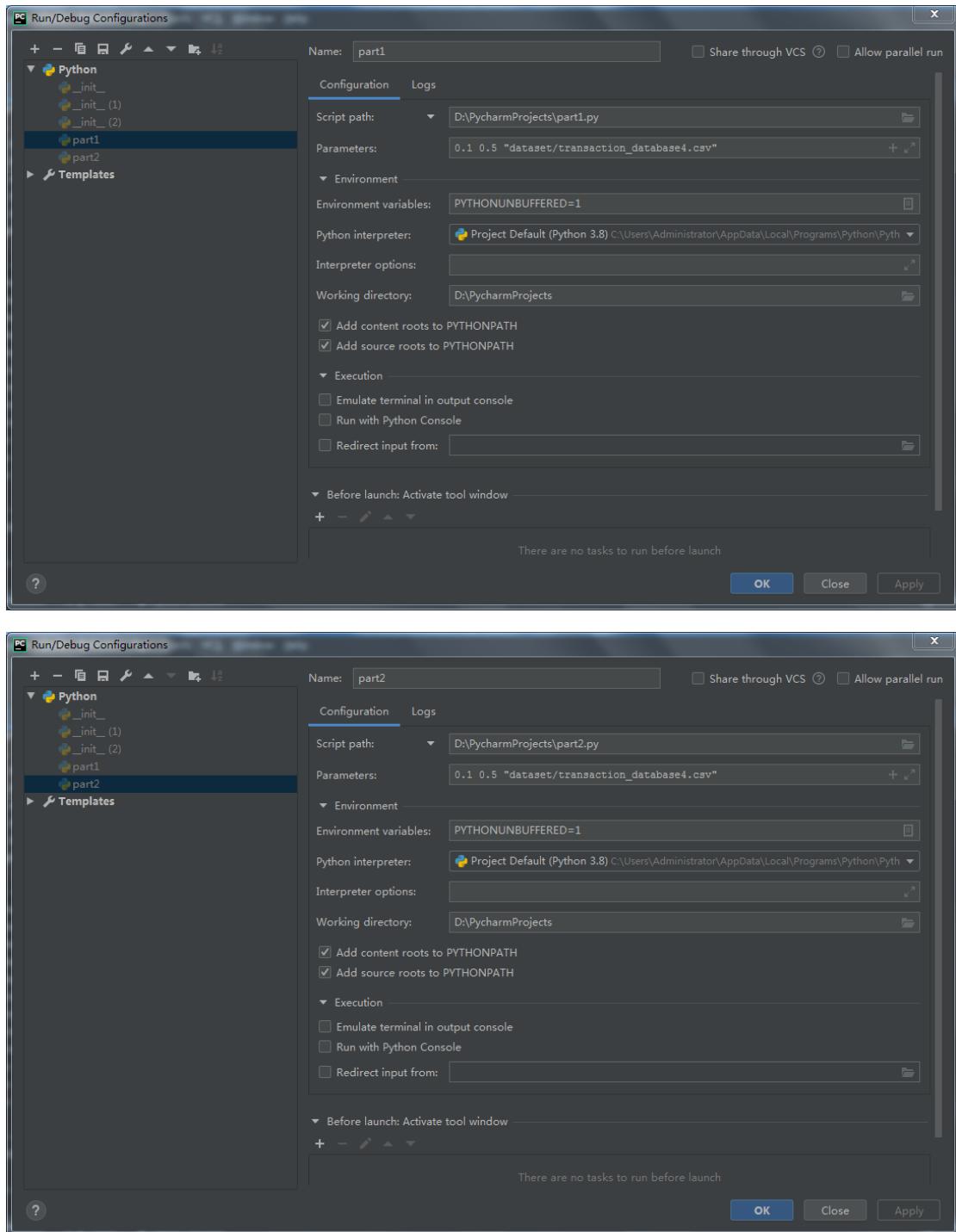
```

PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.1 0.5 dataset/transaction_database3.csv
----- INPUT TRANSACTIONS:
['camera', 'cell phone', 'shampoo', 'moisture']
['apple', 'charger']
['banana', 'handbag']
['beef', 'headphone']
['bread', 'light bulb']
['broccoli', 'screen protector']
['chicken', 'shoe']
['clothes', 'speaker']
['egg', 'television']
['grape', 'thermostat']
['bleach', 'cell phone', 'moisture', 'shampoo']
['milk', 'candle']
['orange', 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

----- RULES SUPPORT CONFIDENCE:
cell phone => moisture 0.2 0.5714285714285715
cell phone => moisture,shampoo 0.2 0.5714285714285715
cell phone => shampoo 0.2 0.5714285714285715
cell phone,moisture => shampoo 0.2 1.0
----- RULES SUPPORT CONFIDENCE:
cell phone => moisture 0.2 0.5714285714285715
cell phone => moisture,shampoo 0.2 0.5714285714285715
cell phone => shampoo 0.2 0.5714285714285715
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0
moisture => shampoo 0.2 1.0
moisture,shampoo => cell phone 0.2 1.0
shampoo => cell phone 0.2 1.0
shampoo => cell phone,moisture 0.2 1.0
shampoo => moisture 0.2 1.0
----- RUNNING TIME:
0.33101916313171387s
Process finished with exit code 0

```

4. Fourth, I test minimum support = 0.1, minimum confidence = 0.5, transaction_database4.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is 0.0s.

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1 x C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.1 0.5 dataset/transaction_database4.csv
----- INPUT TRANSACTIONS:
['apple', 'bleach']
['clothes', 'camera']
['egg', 'speaker']
['grape', 'shampoo', 'television']
['milk', 'tissue', 'thermostat']
['orange', 'bleach', 'charger']
['oil', 'bleach', 'cell phone']
['banana', 'bleach', 'handbag']
['banana', 'candle', 'handbag']
['banana', 'candle', 'headphone']
['beef', 'candle', 'headphone']
['beef', 'conditioner', 'headphone']
['beef', 'conditioner', 'light bulb']
['bread', 'conditioner', 'light bulb']
['bread', 'detergent', 'light bulb']
['bread', 'detergent', 'screen protector']
['broccoli', 'detergent', 'screen protector']
['broccoli', 'moisture', 'screen protector']
['broccoli', 'moisture', 'shoe']
['chicken', 'moisture', 'shoe']

----- RULES SUPPORT CONFIDENCE:
banana => candle 0.1 0.6666666666666667
banana => handbag 0.1 0.6666666666666667
beef => conditioner 0.1 0.6666666666666667
beef => headphone 0.1 0.6666666666666667
----- RUNNING TIME:
0.0s
Process finished with exit code 0

```

I get the running time for Brute Force is around 0.09s, slightly greater than the one for Apriori.

```

PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.1 0.5 dataset/transaction_database4.csv
----- INPUT TRANSACTIONS:
['apple', 'bleach']
['clothes', 'camera']
['egg', 'speaker']
['grape', 'shampoo', 'television']
['milk', 'tissue', 'thermostat']
['orange', 'bleach', 'charger']
['oil', 'bleach', 'cell phone']
['banana', 'bleach', 'handbag']
['banana', 'candle', 'handbag']
['banana', 'candle', 'headphone']
['beef', 'candle', 'headphone']
['beef', 'conditioner', 'headphone']
['beef', 'conditioner', 'light bulb']
['bread', 'conditioner', 'light bulb']
['bread', 'detergent', 'light bulb']
['bread', 'detergent', 'screen protector']
['broccoli', 'detergent', 'screen protector']
['broccoli', 'moisture', 'screen protector']
['broccoli', 'moisture', 'shoe']
['chicken', 'moisture', 'shoe']

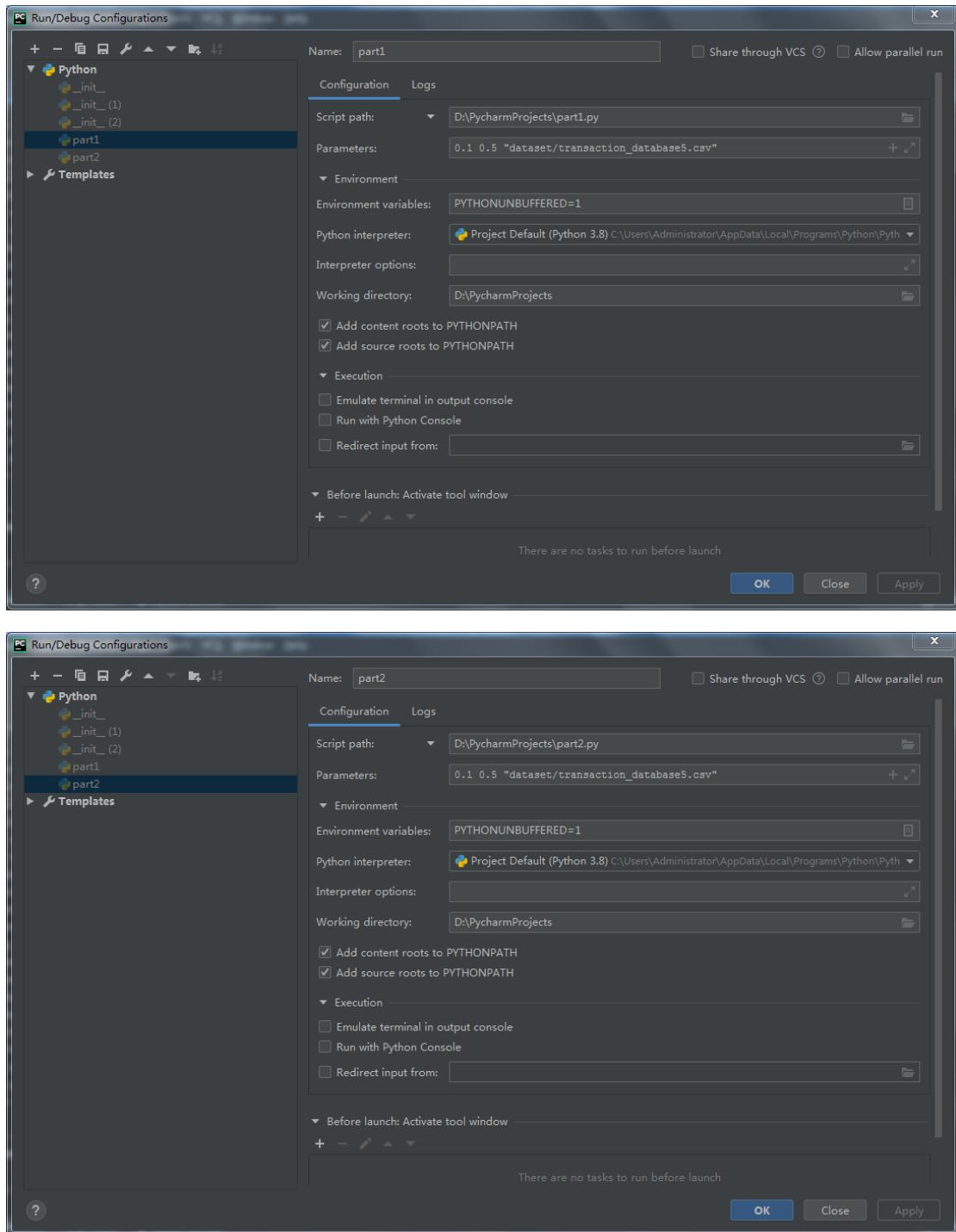
----- RULES SUPPORT CONFIDENCE:
banana => candle 0.1 0.6666666666666667
banana => handbag 0.1 0.6666666666666667
beef => conditioner 0.1 0.6666666666666667
beef => headphone 0.1 0.6666666666666667
[bread, 'conditioner', 'light bulb']
[bread, 'detergent', 'light bulb']
[bread, 'detergent', 'screen protector']
[broccoli, 'detergent', 'screen protector']
[broccoli, 'moisture', 'screen protector']
[broccoli, 'moisture', 'shoe']
[chicken, 'moisture', 'shoe']

----- RUNNING TIME:
0.09000039100646973s

Process finished with exit code 0

```

5. Fifth, I test minimum support = 0.1, minimum confidence = 0.5, transaction_database5.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is around 0.02s.

PyCharmProjects [D:\PyCharmProjects] - part1.py - PyCharm (Administrator)

```

File Edit View Navigate Code Refactor Run Tools VCS Window Help
PyCharmProjects part1.py
Project Run part1.py part2.py transaction_database4.csv
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PyCharmProjects/part1.py 0.1 0.5 dataset/transaction_database5.csv
----- INPUT TRANSACTIONS:
['banana', 'chicken', 'shampoo', 'shoe']
['beef', 'chicken', 'shampoo', 'speaker']
['bread', 'clothes', 'shampoo', 'speaker']
['apple', 'clothes', 'tissue', 'speaker']
['broccoli', 'clothes', 'tissue', 'television']
['egg', 'tissue', 'television']
['egg', 'bleach', 'candle', 'television']
['egg', 'bleach', 'candle', 'thermostat']
['grape', 'bleach', 'candle', 'television']
['grape', 'bleach', 'conditioner', 'television']
['grape', 'conditioner', 'detergent', 'camera', 'cell phone']
['grape', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'candle', 'conditioner', 'screen protector', 'shoe']

----- RULES SUPPORT CONFIDENCE:
bleach => candle 0.2 0.5
bleach,candle => egg 0.1 0.5
bleach,candle => television 0.1 0.5
bleach,egg => candle 0.1 1.0

```

Run Structure TODO Python Console

13:30 LF UTF-8 4 spaces Python 3.8

PyCharmProjects [D:\PyCharmProjects] - part1.py - PyCharm (Administrator)

```

File Edit View Navigate Code Refactor Run Tools VCS Window Help
PyCharmProjects part1.py
Project Run part1.py part2.py transaction_database4.csv
bleach,grape => television 0.1 1.0
bleach,oil => screen protector 0.1 1.0
bleach,oil => screen protector,shoe 0.1 1.0
bleach,oil => shoe 0.1 1.0
bleach,oil,screen protector => shoe 0.1 1.0
bleach,oil,shoe => screen protector 0.1 1.0
bleach,orange => tissue 0.1 1.0
bleach,screen protector => oil 0.1 0.6666666666666666
bleach,screen protector => oil,shoe 0.1 0.6666666666666666
bleach,screen protector => shoe 0.15 1.0
bleach,screen protector => shoe,tissue 0.1 0.6666666666666666
bleach,screen protector => tissue 0.1 0.6666666666666666
bleach,screen protector,shoe => tissue 0.1 0.6666666666666666
bleach,screen protector,tissue => shoe 0.1 1.0
bleach,shoe => oil 0.1 0.6666666666666666
bleach,shoe => oil,screen protector 0.1 0.6666666666666666
bleach,shoe => screen protector 0.15 1.0
bleach,shoe => screen protector,tissue 0.1 0.6666666666666666
bleach,shoe => tissue 0.1 0.6666666666666666
bleach,shoe,tissue => screen protector 0.1 1.0
bleach,television => candle 0.1 0.6666666666666666
bleach,television => grape 0.1 0.6666666666666666
bleach,tissue => orange 0.1 0.6666666666666666
bleach,tissue => screen protector 0.1 0.6666666666666666
bleach,tissue => screen protector,shoe 0.1 0.6666666666666666
bleach,tissue => shoe 0.1 0.6666666666666666
candle => bleach 0.2 1.0

```

Run Structure TODO Python Console

13:30 LF UTF-8 4 spaces Python 3.8

PyCharmProjects [D:\PyCharmProjects] - part1.py - PyCharm (Administrator)

```

File Edit View Navigate Code Refactor Run Tools VCS Window Help
PyCharmProjects part1.py
Project Run part1.py part2.py transaction_database4.csv
candle => bleach,egg 0.1 0.5
candle => bleach,television 0.1 0.5
candle => egg 0.1 0.5
candle => television 0.1 0.5
candle,egg => bleach 0.1 1.0
candle,television => bleach 0.1 1.0
charger => conditioner 0.1 0.6666666666666666
charger => conditioner,detergent 0.1 0.6666666666666666
charger => conditioner,handbag 0.1 0.6666666666666666
charger => conditioner,handbag 0.1 0.6666666666666666
charger => detergent 0.1 0.6666666666666666
charger => detergent,handbag 0.1 0.6666666666666666
charger => handbag 0.15 1.0
charger => handbag,milk 0.1 0.6666666666666666
charger => milk 0.1 0.6666666666666666
charger,conditioner => detergent 0.1 1.0
charger,conditioner => handbag 0.1 1.0
charger,conditioner,detergent => handbag 0.1 1.0
charger,conditioner,handbag => detergent 0.1 1.0
charger,detergent => conditioner,handbag 0.1 1.0
charger,detergent => handbag 0.1 1.0
charger,detergent => handbag,conditioner 0.1 1.0
charger,handbag => conditioner 0.1 0.6666666666666666
charger,handbag => detergent 0.1 0.6666666666666666
charger,handbag => milk 0.1 0.6666666666666666

```

Run Structure TODO Python Console

13:47 LF UTF-8 4 spaces Python 3.8

PyCharmProjects [D:\PyCharmProjects] - \part1.py - PyCharm (Administrator)

```

charger,handbag => milk 0.1 0.6666666666666667
charger,milk => handbag 0.1 1.0
chicken => shampoo 0.1 1.0
clothes => speaker 0.1 0.6666666666666667
clothes => tissue 0.1 0.6666666666666667
conditioner => detergent 0.15 0.6
conditioner,detergent => grape 0.1 0.6666666666666667
conditioner,detergent => charger,handbag 0.1 0.6666666666666667
conditioner,detergent => grape 0.1 0.6666666666666667
conditioner,detergent => handbag 0.1 0.6666666666666667
conditioner,detergent,handbag => charger 0.1 1.0
conditioner,grape => detergent 0.1 0.6666666666666667
conditioner,handbag => charger 0.1 1.0
conditioner,handbag => detergent 0.1 1.0
conditioner,handbag => detergent 0.1 0.6666666666666667
detergent => charger 0.1 0.6666666666666667
detergent => charger,conditioner 0.1 0.6666666666666667
detergent => charger,conditioner,handbag 0.1 0.6666666666666667
detergent => charger,handbag 0.1 0.6666666666666667
detergent => conditioner 0.15 1.0
detergent => conditioner,grape 0.1 0.6666666666666667
detergent => conditioner,handbag 0.1 0.6666666666666667
detergent => grape 0.1 0.6666666666666667
detergent => handbag 0.1 0.6666666666666667
detergent,grape => conditioner 0.1 1.0
detergent,handbag => charger 0.1 1.0
detergent,handbag => charger,conditioner 0.1 1.0

```

PyCharmProjects [D:\PyCharmProjects] - \part1.py - PyCharm (Administrator)

```

detergent,handbag => conditioner 0.1 1.0
egg => bleach 0.1 0.6666666666666667
egg => bleach,candle 0.1 0.6666666666666667
egg => candle 0.1 0.6666666666666667
egg => television 0.1 0.6666666666666667
grape => bleach 0.1 0.5
grape => bleach,television 0.1 0.5
grape => conditioner 0.15 0.7499999999999999
grape => conditioner,detergent 0.1 0.5
grape => detergent 0.1 0.5
grape => television 0.1 0.5
grape,television => bleach 0.1 1.0
handbag => charger 0.15 1.0
handbag => charger,conditioner 0.1 0.6666666666666667
handbag => charger,conditioner,detergent 0.1 0.6666666666666667
handbag => charger,detergent 0.1 0.6666666666666667
handbag => charger,milk 0.1 0.6666666666666667
handbag => conditioner 0.1 0.6666666666666667
handbag => conditioner,detergent 0.1 0.6666666666666667
handbag => detergent 0.1 0.6666666666666667
handbag => milk 0.1 0.6666666666666667
handbag,milk => charger 0.1 1.0
headphone => light_bulb 0.15 1.0
headphone => light_bulb,moisture 0.1 0.6666666666666667
headphone => light_bulb,moisture,shampoo 0.1 0.6666666666666667
headphone => light_bulb,orange 0.1 0.6666666666666667
headphone => moisture 0.1 0.6666666666666667

```

PyCharmProjects [D:\PyCharmProjects] - \part1.py - PyCharm (Administrator)

```

headphone => moisture,shampoo 0.1 0.6666666666666667
headphone => orange 0.1 0.6666666666666667
headphone => shampoo 0.1 0.6666666666666667
headphone,light_bulb => moisture 0.1 0.6666666666666667
headphone,light_bulb => shampoo 0.1 0.6666666666666667
headphone,light_bulb => orange 0.1 0.6666666666666667
headphone,light_bulb => shampoo 0.1 0.6666666666666667
headphone,light_bulb,shampoo => moisture 0.1 1.0
headphone,moisture => light_bulb,shampoo 0.1 1.0
headphone,moisture => shampoo 0.1 1.0
headphone,moisture,shampoo => light_bulb 0.1 1.0
headphone,orange => light_bulb 0.1 1.0
headphone,shampoo => light_bulb 0.1 1.0
headphone,shampoo => moisture 0.1 1.0
light_bulb => headphone 0.15 1.0
light_bulb => headphone,moisture 0.1 0.6666666666666667
light_bulb => headphone,moisture,shampoo 0.1 0.6666666666666667
light_bulb => headphone,orange 0.1 0.6666666666666667
light_bulb => headphone,shampoo 0.1 0.6666666666666667
light_bulb => moisture 0.1 0.6666666666666667
light_bulb => moisture,shampoo 0.1 0.6666666666666667
light_bulb => orange 0.1 0.6666666666666667
light_bulb => shampoo 0.1 0.6666666666666667
light_bulb,moisture => headphone 0.1 1.0
light_bulb,moisture => headphone,shampoo 0.1 1.0

```

PyCharmProjects [D:\PycharmProjects] - part1.py - PyCharm (Administrator)

File Edit View Navigate Code Refactor Run Tools VCS Window Help

PyCharmProjects part1.py

Project Run part1.py part2.py transaction_database4.csv

```

part1.x
    ↑
    light_bulb,moisture => headphone,shampoo 0.1 1.0
    light_bulb,moisture => shampoo 0.1 1.0
    light_bulb,moisture,shampoo => headphone 0.1 1.0
    light_bulb,orange => headphone 0.1 1.0
    light_bulb,shampoo => headphone 0.1 1.0
    light_bulb,shampoo => headphone,moisture 0.1 1.0
    light_bulb,shampoo => moisture 0.1 1.0
    milk => charge 0.1 0.6666666666666667
    milk => chargerb,handbag 0.1 0.6666666666666667
    milk => handbag 0.1 0.6666666666666667
    milk => moisture 0.1 0.6666666666666667
    milk => moisture,shampoo 0.1 0.6666666666666667
    milk => shampoo 0.1 0.6666666666666667
    milk,moisture => shampoo 0.1 1.0
    milk,shampoo => moisture 0.1 1.0
    moisture => headphone 0.1 0.6666666666666667
    moisture => headphone,light_bulb 0.1 0.6666666666666667
    moisture => headphone,shampoo 0.1 0.6666666666666667
    moisture => headphone,shampoo 0.1 0.6666666666666667
    moisture => light_bulb 0.1 0.6666666666666667
    moisture => light_bulb,shampoo 0.1 0.6666666666666667
    moisture => milk,shampoo 0.1 0.6666666666666667
    moisture => shampoo 0.1 0.6666666666666667
    moisture => shampoo 0.15 1.0
    moisture,shampoo => headphone 0.1 0.6666666666666667
    moisture,shampoo => headphone,light_bulb 0.1 0.6666666666666667
    moisture,shampoo => light_bulb 0.1 0.6666666666666667
    moisture,shampoo => milk 0.1 0.6666666666666667

```

Run Structure TODO Python Console

40 chars 166:41 LF UTF-8 4 spaces Python 3.8

PyCharmProjects [D:\PycharmProjects] - part1.py - PyCharm (Administrator)

File Edit View Navigate Code Refactor Run Tools VCS Window Help

PyCharmProjects part1.py

Project Run part1.py part2.py transaction_database4.csv

```

part1.x
    ↑
    oil => bleach 0.1 1.0
    oil => bleach,screen protector 0.1 1.0
    oil => bleach,screen protector,shoe 0.1 1.0
    oil => bleach,shoe 0.1 1.0
    oil => screen protector 0.1 1.0
    oil => screen protector,shoe 0.1 1.0
    oil => shoe 0.1 1.0
    oil,screen protector => bleach 0.1 1.0
    oil,screen protector => bleach,shoe 0.1 1.0
    oil,screen protector => shoe 0.1 1.0
    oil,screen protector,shoe => bleach 0.1 1.0
    oil,shoe => bleach 0.1 1.0
    oil,shoe => bleach,screen protector 0.1 1.0
    oil,shoe => screen protector 0.1 1.0
    orange => bleach 0.1 0.6666666666666667
    orange => bleach,tissue 0.1 0.6666666666666667
    orange => headphone 0.1 0.6666666666666667
    orange => headphone,light_bulb 0.1 0.6666666666666667
    orange => light_bulb 0.1 0.6666666666666667
    orange => tissue 0.1 0.6666666666666667
    orange,tissue => bleach 0.1 1.0
    screen protector => bleach 0.15 1.0
    screen protector => bleach,oil 0.1 0.6666666666666667
    screen protector => bleach,oil,shoe 0.1 0.6666666666666667
    screen protector => bleach,shoe 0.15 1.0
    screen protector => bleach,shoe,tissue 0.1 0.6666666666666667
    screen protector => bleach,tissue 0.1 0.6666666666666667
    screen protector => oil 0.1 0.6666666666666667

```

Run Structure TODO Python Console

47 chars 194:48 LF UTF-8 4 spaces Python 3.8

PyCharmProjects [D:\PycharmProjects] - part1.py - PyCharm (Administrator)

File Edit View Navigate Code Refactor Run Tools VCS Window Help

PyCharmProjects part1.py

Project Run part1.py part2.py transaction_database4.csv

```

part1.x
    ↑
    screen protector => oil,shoe 0.1 0.6666666666666667
    screen protector => shoe 0.15 1.0
    screen protector => shoe,tissue 0.1 0.6666666666666667
    screen protector => tissue 0.1 0.6666666666666667
    screen protector,shoe => bleach 0.15 1.0
    screen protector,shoe => bleach,oil 0.1 0.6666666666666667
    screen protector,shoe => bleach,tissue 0.1 0.6666666666666667
    screen protector,shoe => oil 0.1 0.6666666666666667
    screen protector,shoe => tissue 0.1 0.6666666666666667
    screen protector,shoe,tissue => bleach 0.1 1.0
    screen protector,tissue => bleach 0.1 1.0
    screen protector,tissue => shoe 0.1 1.0
    shampoo => moisture 0.15 0.5
    shoe => bleach 0.15 0.7499999999999999
    shoe => bleach,oil 0.1 0.5
    shoe => bleach,oil,screen protector 0.15 0.7499999999999999
    shoe => bleach,screen protector,tissue 0.1 0.5
    shoe => bleach,tissue 0.1 0.5
    shoe => oil 0.1 0.5
    shoe => oil,screen protector 0.1 0.5
    shoe => screen protector 0.15 0.7499999999999999
    shoe => screen protector,tissue 0.1 0.5
    shoe => tissue 0.1 0.5
    shoe,tissue => bleach 0.1 1.0
    shoe,tissue => bleach,screen protector 0.1 1.0
    shoe,tissue => screen protector 0.1 1.0

```

Run Structure TODO Python Console

46 chars 222:1 LF UTF-8 4 spaces Python 3.8

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1.py part2.py transaction_database4.csv
part1
screen protector,tissue => bleach 0.1 1.0
screen protector,tissue => bleach,shoe 0.1 1.0
screen protector,tissue => shoe 0.1 1.0
shampoo => moisture 0.15 0.5
shoe => bleach 0.15 0.7499999999999999
shoe => bleach,oil 0.1 0.5
shoe => bleach,oil,screen protector 0.1 0.5
shoe => bleach,screen protector,tissue 0.1 0.5
shoe => bleach,tissue 0.1 0.5
shoe => oil 0.1 0.5
shoe => oil,screen protector 0.1 0.5
shoe => screen protector 0.15 0.7499999999999999
shoe => screen protector,tissue 0.1 0.5
shoe => tissue 0.1 0.5
shoe,tissue => bleach 0.1 1.0
shoe,tissue => bleach,screen protector 0.1 1.0
shoe,tissue => screen protector 0.1 1.0
speaker => clothes 0.1 0.6666666666666667
speaker => shampoo 0.1 0.6666666666666667
television => bleach 0.15 0.5
tissue => bleach 0.15 0.5

----- RUNNING TIME:
0.01999999999999999 seconds

Process finished with exit code 0

```

I get the running time for Brute Force is around 4.43s, greater than the one for Apriori.

```

PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py part2.py transaction_database4.csv transaction_database5.csv
Project Run part2.py part1.py part2.py transaction_database5.csv
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.1 0.5 dataset/transaction_database5.csv
----- INPUT TRANSACTIONS:
['banana', 'chicken', 'shampoo', 'shoe']
['beef', 'chicken', 'shampoo', 'speaker']
['bread', 'clothes', 'shampoo', 'speaker']
['apple', 'clothes', 'tissue', 'speaker']
['broccoli', 'clothes', 'tissue', 'television']
['egg', 'tissue', 'television']
['egg', 'bleach', 'candle', 'television']
['egg', 'bleach', 'candle', 'thermostat']
['grape', 'bleach', 'candle', 'television']
['grape', 'bleach', 'conditioner', 'television']
['grape', 'conditioner', 'detergent', 'camera', 'cell phone']
['grape', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'candle', 'conditioner', 'screen protector', 'shoe']

----- RULES SUPPORT CONFIDENCE:
bleach => candle 0.2 0.5
bleach,candle => egg 0.1 0.5
bleach,candle => television 0.1 0.5
bleach,egg => candle 0.1 1.0

```

PyCharmProjects [D:\PyCharmProjects] - part2.py - PyCharm (Administrator)

File Edit View Navigate Code Refactor Run Tools VCS Window Help

PyCharmProjects part2.py

Project Run Favorites

```

part2.x
bleach,grape => television 0.1 1.0
bleach,oil => screen protector 0.1 1.0
bleach,oil => screen protector,shoe 0.1 1.0
bleach,oil => shoe 0.1 1.0
bleach,oil,screen protector => shoe 0.1 1.0
bleach,oil,shoe => screen protector 0.1 1.0
bleach,orange => tissue 0.1 1.0
bleach,screen protector => oil 0.1 0.6666666666666667
bleach,screen protector => oil,shoe 0.1 0.6666666666666667
bleach,screen protector => shoe 0.1 1.0
bleach,screen protector => tissue 0.1 0.6666666666666667
bleach,screen protector => oil 0.1 0.6666666666666667
bleach,screen protector,shoe => tissue 0.1 0.6666666666666667
bleach,screen protector,tissue => shoe 0.1 1.0
bleach,shoe => oil 0.1 0.6666666666666667
bleach,shoe => oil,screen protector 0.1 0.6666666666666667
bleach,shoe => screen protector 0.1 1.0
bleach,shoe => screen protector,tissue 0.1 0.6666666666666667
bleach,shoe => tissue 0.1 0.6666666666666667
bleach,shoe,tissue => screen protector 0.1 1.0
bleach,television => candle 0.1 0.6666666666666667
bleach,television => grape 0.1 0.6666666666666667
bleach,tissue => orange 0.1 0.6666666666666667
bleach,tissue => screen protector 0.1 0.6666666666666667
bleach,tissue => shoe 0.1 0.6666666666666667
candle => bleach 0.2 1.0

```

Run Structure TODO Python Console

24 chars 56:1 LF UTF-8 4 spaces Python 3.8

PyCharmProjects [D:\PyCharmProjects] - part2.py - PyCharm (Administrator)

File Edit View Navigate Code Refactor Run Tools VCS Window Help

PyCharmProjects part2.py

Project Run Favorites

```

part2.x
candle => bleach,egg 0.1 0.5
candle => bleach,television 0.1 0.5
candle => egg 0.1 0.5
candle => television 0.1 0.5
candle,egg => bleach 0.1 1.0
candle,television => bleach 0.1 1.0
charger => conditioner 0.1 0.6666666666666667
charger => conditioner,detergent 0.1 0.6666666666666667
charger => conditioner,handbag 0.1 0.6666666666666667
charger => conditioner,handbag 0.1 0.6666666666666667
charger => detergent 0.1 0.6666666666666667
charger => detergent,handbag 0.1 0.6666666666666667
charger => handbag 0.15 1.0
charger => handbag,milk 0.1 0.6666666666666667
charger => milk 0.1 0.6666666666666667
charger,conditioner => detergent 0.1 1.0
charger,conditioner => detergent,handbag 0.1 1.0
charger,conditioner => handbag 0.1 1.0
charger,conditioner,detergent => handbag 0.1 1.0
charger,conditioner,handbag => detergent 0.1 1.0
charger,detergent => conditioner 0.1 1.0
charger,detergent => handbag 0.1 1.0
charger,detergent,handbag => conditioner 0.1 1.0
charger,handbag => conditioner 0.1 0.6666666666666667
charger,handbag => conditioner,detergent 0.1 0.6666666666666667
charger,handbag => detergent 0.1 0.6666666666666667
charger,handbag => milk 0.1 0.6666666666666667

```

Run Structure TODO Python Console

46 chars 84:1 LF UTF-8 4 spaces Python 3.8

PyCharmProjects [D:\PyCharmProjects] - part2.py - PyCharm (Administrator)

File Edit View Navigate Code Refactor Run Tools VCS Window Help

PyCharmProjects part2.py

Project Run Favorites

```

part2.x
charger,milk => handbag 0.1 1.0
chicken => shampoo 0.1 1.0
clothes => speaker 0.1 0.6666666666666667
clothes => tissue 0.1 0.6666666666666667
conditioner => detergent 0.15 0.6
conditioner => grape 0.15 0.6
conditioner,detergent => charger 0.1 0.6666666666666667
conditioner,detergent => charger,handbag 0.1 0.6666666666666667
conditioner,detergent => grape 0.1 0.6666666666666667
conditioner,detergent => handbag 0.1 0.6666666666666667
conditioner,detergent,handbag => charger 0.1 1.0
conditioner,grape => detergent 0.1 0.6666666666666667
conditioner,handbag => charger 0.1 1.0
conditioner,handbag => charger,detergent 0.1 1.0
conditioner,handbag => detergent 0.1 1.0
detergent => charger 0.1 0.6666666666666667
detergent => charger,conditioner 0.1 0.6666666666666667
detergent => charger,conditioner,handbag 0.1 0.6666666666666667
detergent => charger,handbag 0.1 0.6666666666666667
detergent => conditioner 0.15 1.0
detergent => conditioner,grape 0.1 0.6666666666666667
detergent => conditioner,handbag 0.1 0.6666666666666667
detergent => grape 0.1 0.6666666666666667
detergent => handbag 0.1 0.6666666666666667
detergent,grape => conditioner 0.1 1.0
detergent,handbag => charger 0.1 1.0
detergent,handbag => charger,conditioner 0.1 1.0
detergent,handbag => conditioner 0.1 1.0

```

Run Structure TODO Python Console

40 chars 112:1 LF UTF-8 4 spaces Python 3.8

PyCharmProjects [D:\PyCharmProjects] - part2.py - PyCharm (Administrator)

File Edit View Navigate Code Refactor Run Tools VCS Window Help

PyCharmProjects part2.py

Project Run part2

```

egg => bleach 0.1 0.6666666666666667
egg => bleach,candle 0.1 0.6666666666666667
egg => candle 0.1 0.6666666666666667
egg => television 0.1 0.6666666666666667
grape => bleach 0.1 0.5
grape => bleach,television 0.1 0.5
grape => conditioner 0.15 0.7499999999999999
grape => conditioner,detergent 0.1 0.5
grape => detergent 0.1 0.5
grape => television 0.1 0.5
grape,television => bleach 0.1 1.0
handbag => charger 0.15 1.0
handbag => charger,conditioner 0.1 0.6666666666666667
handbag => charger,conditioner,detergent 0.1 0.6666666666666667
handbag => charger,detergent 0.1 0.6666666666666667
handbag => charger,milk 0.1 0.6666666666666667
handbag => conditioner 0.1 0.6666666666666667
handbag => conditioner,detergent 0.1 0.6666666666666667
handbag => detergent 0.1 0.6666666666666667
handbag => milk 0.1 0.6666666666666667
handbag,milk => charger 0.1 1.0
handbag => light bulb 0.15 1.0
headphone => light bulb,moisture 0.1 0.6666666666666667
headphone => light bulb,moisture,shampoo 0.1 0.6666666666666667
headphone => light bulb,orange 0.1 0.6666666666666667
headphone => light bulb,shampoo 0.1 0.6666666666666667
headphone => moisture 0.1 0.6666666666666667
headphone => moisture,shampoo 0.1 0.6666666666666667

```

Run Structure TODO Python Console

Event Log Terminal

52 chars 140:1 LF UTF-8 4 spaces Python 3.8

PyCharmProjects [D:\PyCharmProjects] - part2.py - PyCharm (Administrator)

File Edit View Navigate Code Refactor Run Tools VCS Window Help

PyCharmProjects part2.py

Project Run part2

```

headphone => orange 0.1 0.6666666666666667
headphone => shampoo 0.1 0.6666666666666667
headphone,light bulb => moisture 0.1 0.6666666666666667
headphone,light bulb => orange 0.1 0.6666666666666667
headphone,light bulb => shampoo 0.1 0.6666666666666667
headphone,light bulb,moisture => shampoo 0.1 1.0
headphone,light bulb,shampoo => moisture 0.1 1.0
headphone,moisture => light bulb 0.1 1.0
headphone,moisture => shampoo 0.1 1.0
headphone,moisture,shampoo => light bulb 0.1 1.0
headphone,orange => light bulb 0.1 1.0
headphone,shampoo => light bulb 0.1 1.0
headphone,shampoo => light bulb,moisture 0.1 1.0
headphone,shampoo => moisture 0.1 1.0
light bulb => headphone 0.15 1.0
light bulb => headphone,moisture 0.1 0.6666666666666667
light bulb => headphone,moisture,shampoo 0.1 0.6666666666666667
light bulb => headphone,orange 0.1 0.6666666666666667
light bulb => headphone,shampoo 0.1 0.6666666666666667
light bulb => moisture 0.1 0.6666666666666667
light bulb => moisture,shampoo 0.1 0.6666666666666667
light bulb => orange 0.1 0.6666666666666667
light bulb => shampoo 0.1 0.6666666666666667
light bulb,moisture => headphone,shampoo 0.1 1.0
light bulb,moisture => shampoo 0.1 1.0

```

Run Structure TODO Python Console

Event Log Terminal

52 chars 140:1 LF UTF-8 4 spaces Python 3.8

PyCharmProjects [D:\PyCharmProjects] - part2.py - PyCharm (Administrator)

File Edit View Navigate Code Refactor Run Tools VCS Window Help

PyCharmProjects part2.py

Project Run part2

```

light bulb,moisture => shampoo 0.1 1.0
light bulb,moisture,shampoo => headphone 0.1 1.0
light bulb,orange => headphone 0.1 1.0
light bulb,shampoo => headphone 0.1 1.0
light bulb,shampoo => moisture 0.1 1.0
light bulb,shampoo => moisture 0.1 1.0
milk => charger 0.1 0.6666666666666667
milk => charger,handbag 0.1 0.6666666666666667
milk => handbag 0.1 0.6666666666666667
milk => moisture 0.1 0.6666666666666667
milk => moisture,shampoo 0.1 0.6666666666666667
milk => shampoo 0.1 0.6666666666666667
milk,moisture => shampoo 0.1 1.0
milk,shampoo => moisture 0.1 1.0
moisture => headphone 0.1 0.6666666666666667
moisture => headphone,light bulb 0.1 0.6666666666666667
moisture => headphone,shampoo 0.1 0.6666666666666667
moisture => light bulb 0.1 0.6666666666666667
moisture => light bulb,shampoo 0.1 0.6666666666666667
moisture => milk 0.1 0.6666666666666667
moisture => milk,shampoo 0.1 0.6666666666666667
moisture => shampoo 0.15 1.0
moisture,shampoo => headphone 0.1 0.6666666666666667
moisture,shampoo => headphone,light bulb 0.1 0.6666666666666667
moisture,shampoo => light bulb 0.1 0.6666666666666667
moisture,shampoo => milk 0.1 0.6666666666666667
oil => bleach 0.1 1.0

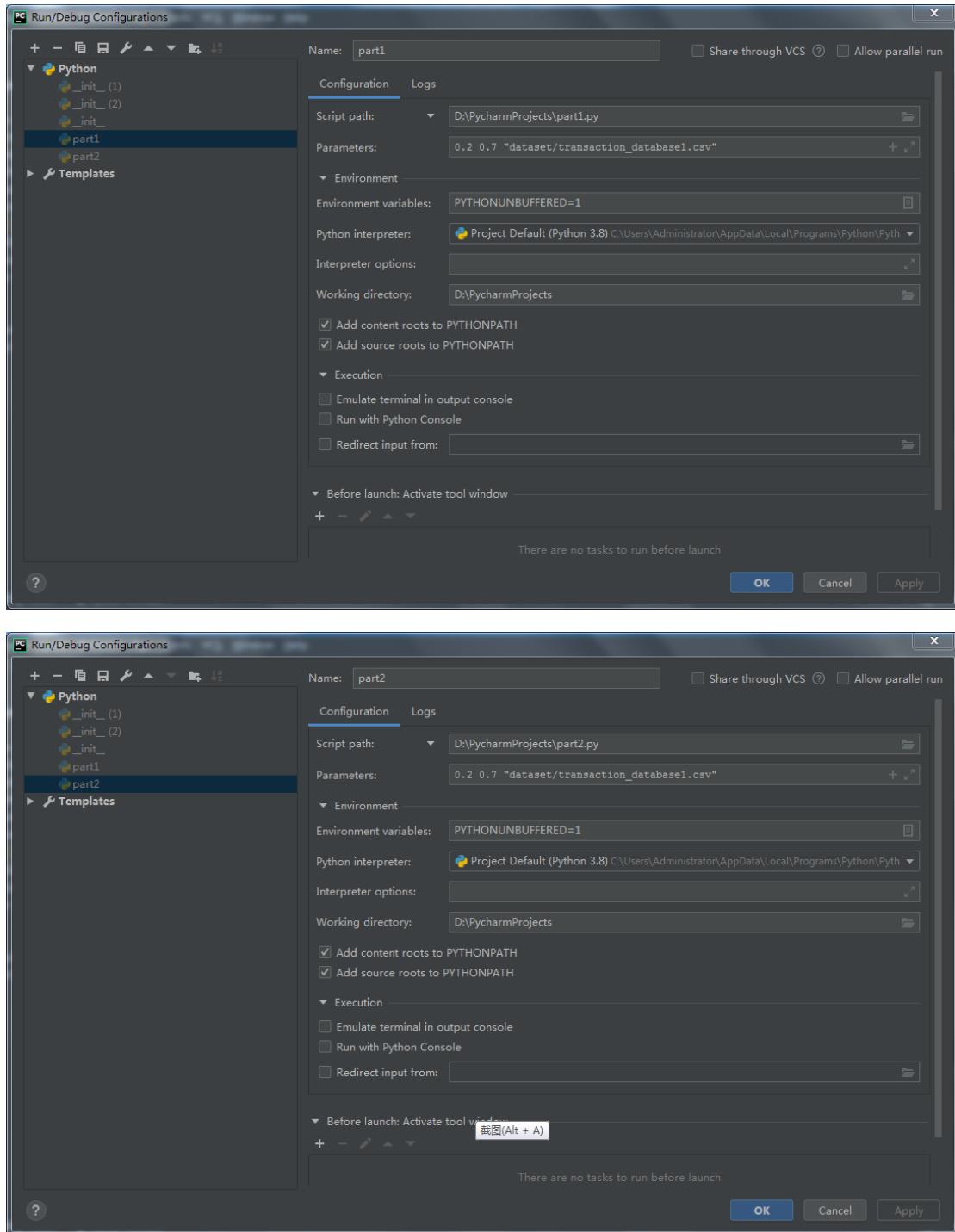
```

Run Structure TODO Python Console

Event Log Terminal

48 chars 167:1 LF UTF-8 4 spaces Python 3.8

6. Next, I test minimum support = 0.2, minimum confidence = 0.7, transaction_database1.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is around 0.0s. Here, I get no association rules because no association rules meet the requirements of minimum support and minimum confidence.

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1 x part1.py x part2.py x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.2 0.7 dataset/transaction_database1.csv
----- INPUT TRANSACTIONS:
['apple', 'banana', 'orange']
['beef', 'grape']
['bread', 'chicken']
['broccoli', 'clothes']
['oil', 'bleach']
['candle', 'conditioner']
['detergent', 'moisture']
['shampoo', 'tissue']
['camera', 'cell phone']
['charger', 'handbag']
['headphone', 'light bulb']
['screen protector', 'shoe']
['speaker', 'television']
['apple', 'banana', 'clothes', 'thermostat']
['apple', 'oil']
['apple', 'beef']
['apple', 'bread']
['apple', 'broccoli']
['apple', 'clothes']
['apple', 'grape']

----- RULES SUPPORT CONFIDENCE:
----- RUNNING TIME:
0.0s

```

I get the running time for Brute Force is 0.009999752044677734s, which is close to 0.00s. It does not show the difference between Apriori and Brute Force due to small size of association rules.

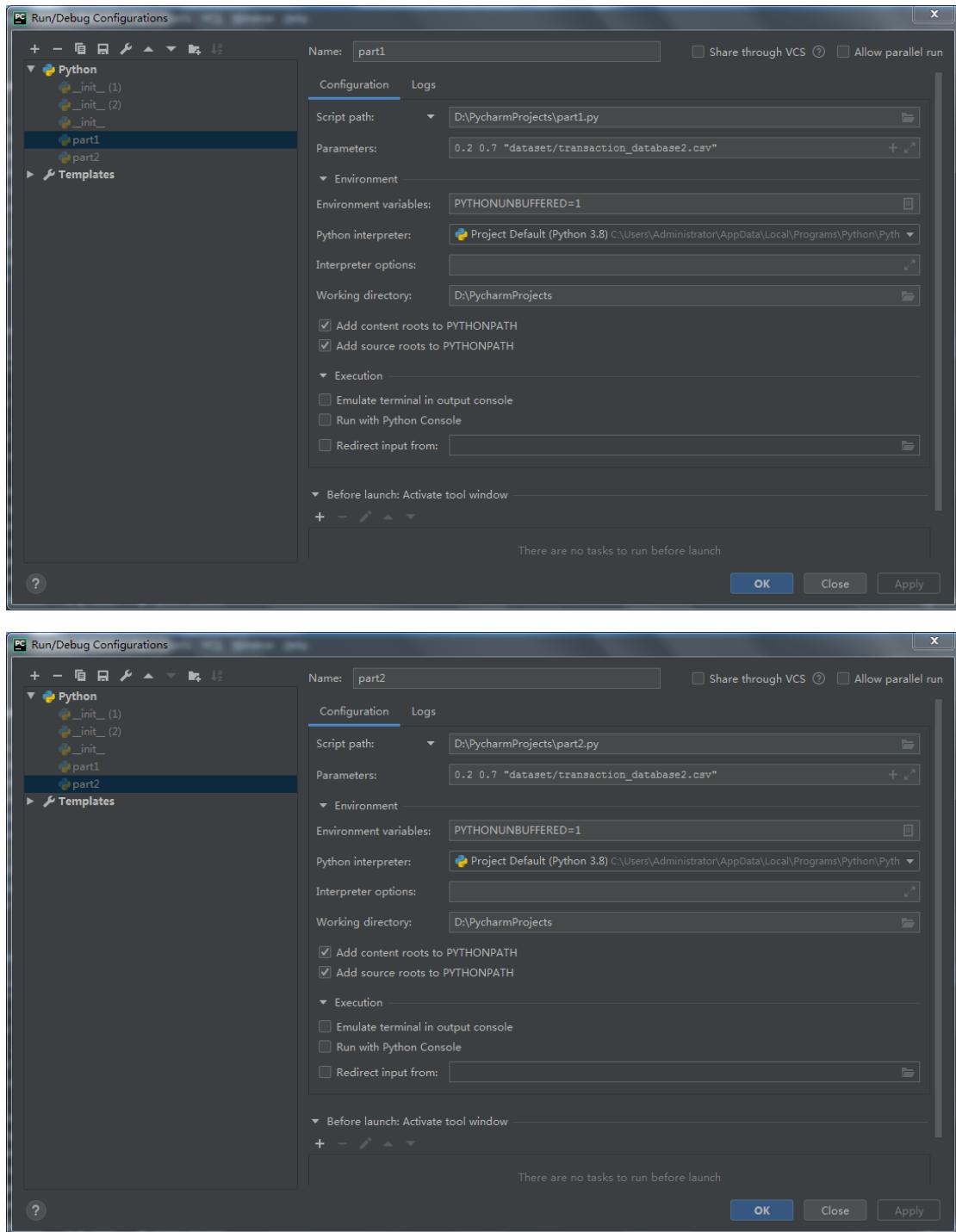
```

PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2 x part1.py x part2.py x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.2 0.7 dataset/transaction_database1.csv
----- INPUT TRANSACTIONS:
['apple', 'banana', 'orange']
['beef', 'grape']
['bread', 'chicken']
['broccoli', 'clothes']
['oil', 'bleach']
['candle', 'conditioner']
['detergent', 'moisture']
['shampoo', 'tissue']
['camera', 'cell phone']
['charger', 'handbag']
['headphone', 'light bulb']
['screen protector', 'shoe']
['speaker', 'television']
['apple', 'banana', 'clothes', 'thermostat']
['apple', 'oil']
['apple', 'beef']
['apple', 'bread']
['apple', 'broccoli']
['apple', 'clothes']
['apple', 'grape']

----- RULES SUPPORT CONFIDENCE:
----- RUNNING TIME:
0.009999752044677734s

```

7. Next, I test minimum support = 0.2, minimum confidence = 0.7, transaction_database2.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is 0.0s.

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1 x part2.py x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.2 0.7 dataset/transaction_database2.csv
----- INPUT TRANSACTIONS:
['bleach', 'candle', 'beef', 'moisture']
['apple', 'conditioner', 'beef', 'moisture']
['banana', 'detergent', 'tissue']
['beef', 'moisture']
['bread', 'shampoo']
['broccoli', 'tissue']
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0

----- RUNNING TIME:
0.0s

```

I get the running time for Brute Force is around 0.05s, which is slightly greater than that for Apriori.

```

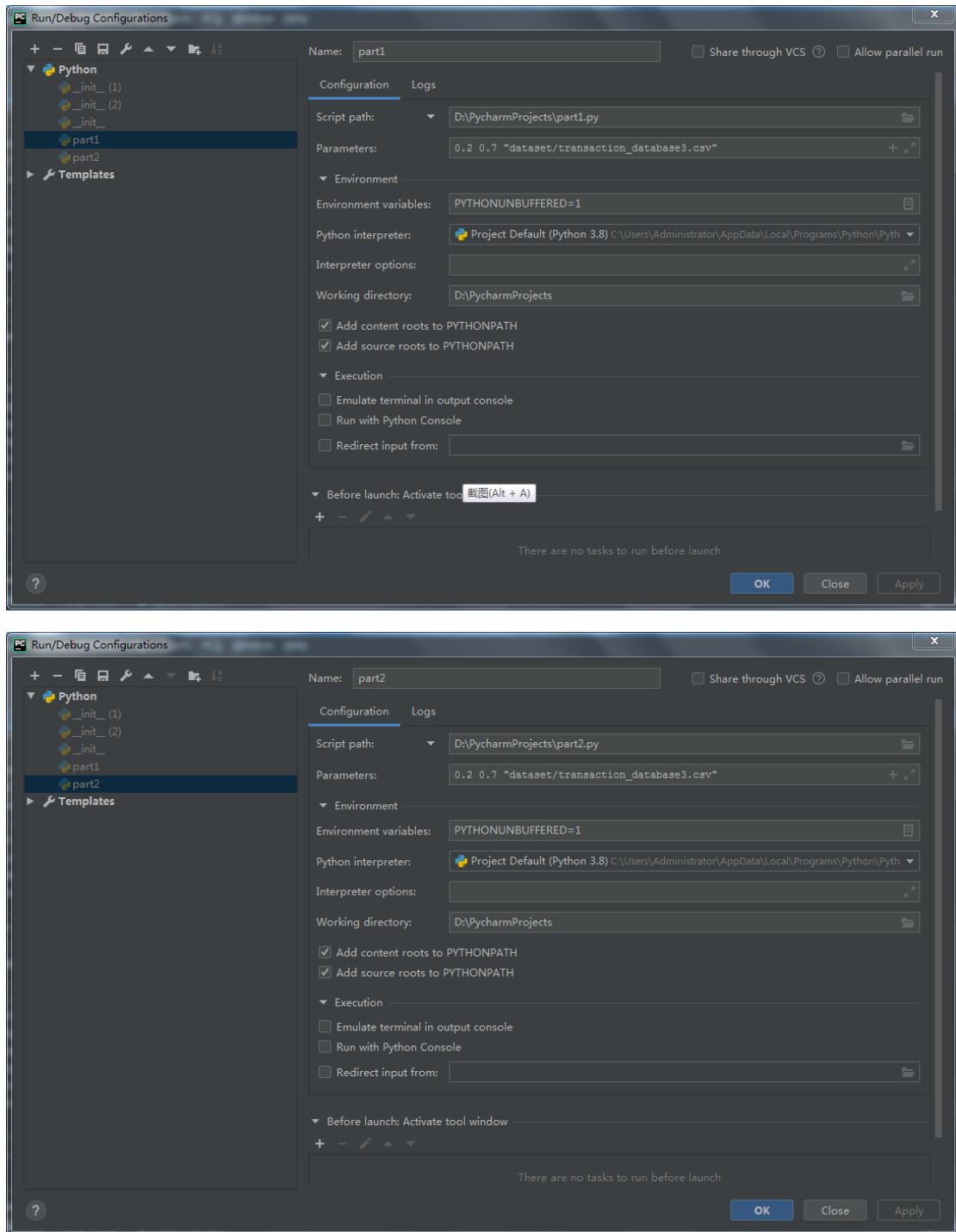
PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2 x part1.py x part2.py x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.2 0.7 dataset/transaction_database2.csv
----- INPUT TRANSACTIONS:
['bleach', 'candle', 'beef', 'moisture']
['apple', 'conditioner', 'beef', 'moisture']
['banana', 'detergent', 'tissue']
['beef', 'moisture']
['bread', 'shampoo']
['broccoli', 'tissue']
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0

----- RUNNING TIME:
0.04999995231628418s

```

8. Next, I test minimum support = 0.2, minimum confidence = 0.7, transaction_database3.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is 0.0s.

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.2 0.7 dataset/transaction_database3.csv
----- INPUT TRANSACTIONS:
['camera', 'cell phone', 'shampoo', 'moisture']
['apple', 'charger']
['banana', 'handbag']
['beef', 'headphone']
['bread', 'light bulb']
['broccoli', 'screen protector']
['chicken', 'shoe']
['clothes', 'speaker']
['egg', 'television']
['grape', 'thermostat']
['bleach', 'cell phone', 'moisture', 'shampoo']
['milk', 'candle']
['orange', 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

----- RULES SUPPORT CONFIDENCE:
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0
----- RULES SUPPORT CONFIDENCE:
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0
moisture => shampoo 0.2 1.0
moisture,shampoo => cell phone 0.2 1.0
shampoo => cell phone 0.2 1.0
shampoo => cell phone,moisture 0.2 1.0
shampoo => moisture 0.2 1.0
----- RUNNING TIME:
0.0s
Process finished with exit code 0

```

I get the running time for Brute Force is around 0.42s, which is slightly greater than that for Apriori.

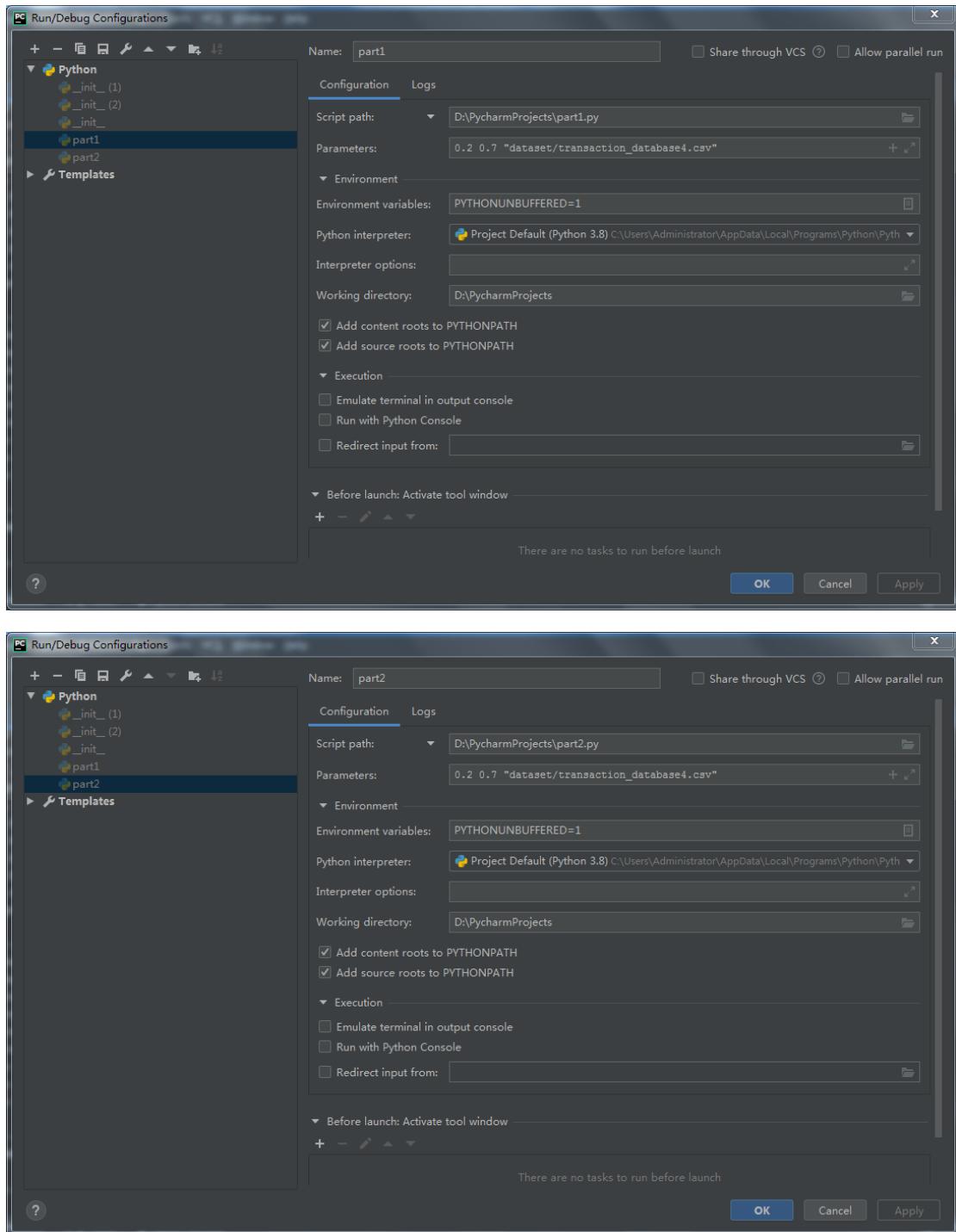
```

PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.2 0.7 dataset/transaction_database3.csv
----- INPUT TRANSACTIONS:
['camera', 'cell phone', 'shampoo', 'moisture']
['apple', 'charger']
['banana', 'handbag']
['beef', 'headphone']
['bread', 'light bulb']
['broccoli', 'screen protector']
['chicken', 'shoe']
['clothes', 'speaker']
['egg', 'television']
['grape', 'thermostat']
['bleach', 'cell phone', 'moisture', 'shampoo']
['milk', 'candle']
['orange', 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

----- RULES SUPPORT CONFIDENCE:
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0
----- RULES SUPPORT CONFIDENCE:
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0
moisture => shampoo 0.2 1.0
moisture,shampoo => cell phone 0.2 1.0
shampoo => cell phone 0.2 1.0
shampoo => cell phone,moisture 0.2 1.0
shampoo => moisture 0.2 1.0
----- RUNNING TIME:
0.42000079154968265
Process finished with exit code 0

```

9. Next, I test minimum support = 0.2, minimum confidence = 0.7, transaction_database4.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is 0.0s. No association rules meet the requirements of minimum support and minimum confidence.

```

PycharmProjects [D:\PycharmProjects] - ...\\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1 x part2.py x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.2 0.7 dataset/transaction_database4.csv
----- INPUT TRANSACTIONS:
['apple', 'bleach']
['clothes', 'camera']
['egg', 'speaker']
['grape', 'shampoo', 'television']
['milk', 'tissue', 'thermostat']
['orange', 'bleach', 'charger']
['oil', 'bleach', 'cell phone']
['banana', 'bleach', 'handbag']
['banana', 'candle', 'handbag']
['banana', 'candle', 'headphone']
['beef', 'candle', 'headphone']
['beef', 'conditioner', 'headphone']
['beef', 'conditioner', 'light bulb']
['bread', 'conditioner', 'light bulb']
['bread', 'detergent', 'light bulb']
['bread', 'detergent', 'screen protector']
['broccoli', 'detergent', 'screen protector']
['broccoli', 'moisture', 'screen protector']
['broccoli', 'moisture', 'shoe']
['chicken', 'moisture', 'shoe']

----- RULES SUPPORT CONFIDENCE:
----- RUNNING TIME:
0.0s

```

I get the running time for Brute Force is 0.0s. It does not show the difference of running time for these two algorithms due to small size of association rules.

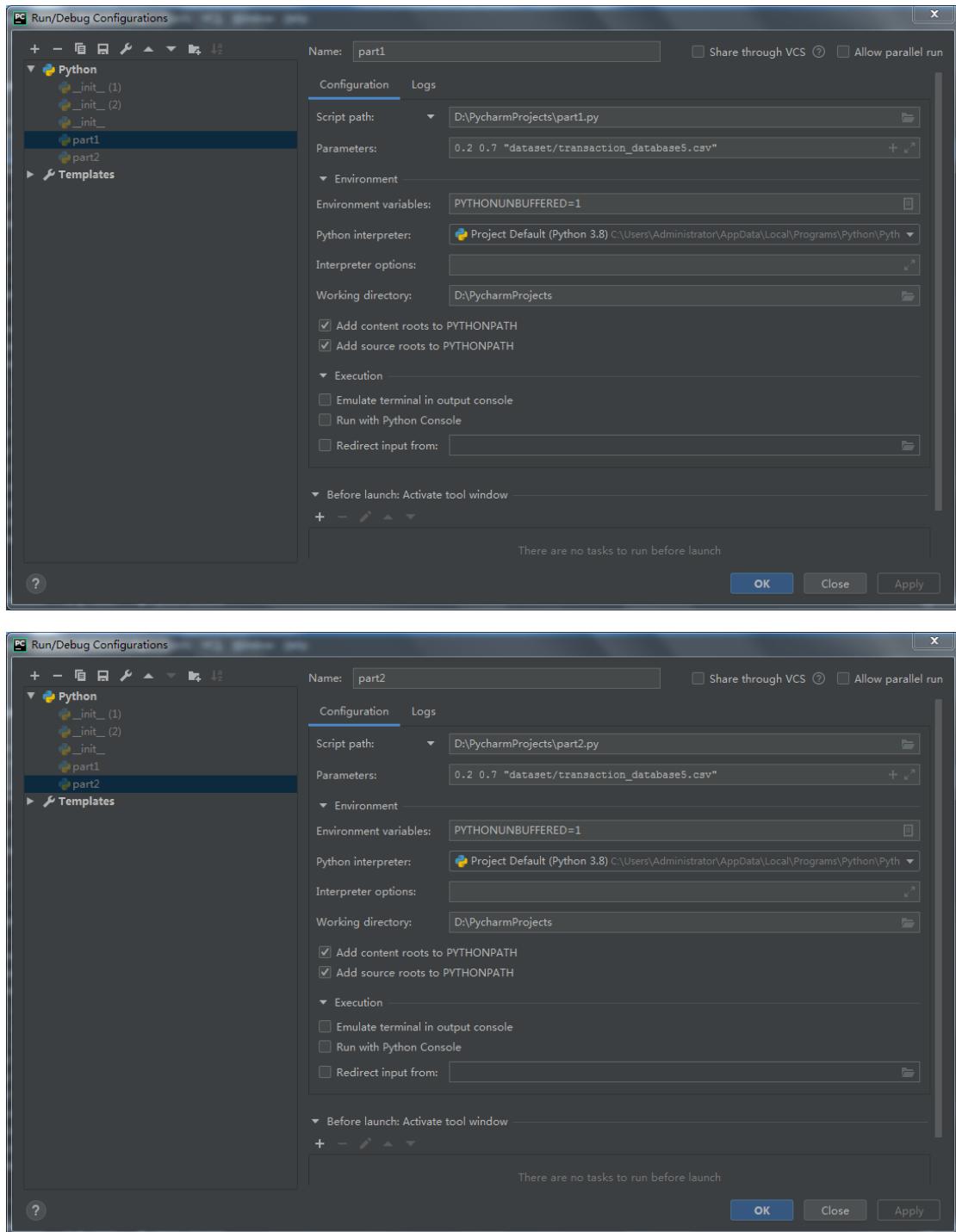
```

PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part1.py x part2.py x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.2 0.7 dataset/transaction_database4.csv
----- INPUT TRANSACTIONS:
['apple', 'bleach']
['clothes', 'camera']
['egg', 'speaker']
['grape', 'shampoo', 'television']
['milk', 'tissue', 'thermostat']
['orange', 'bleach', 'charger']
['oil', 'bleach', 'cell phone']
['banana', 'bleach', 'handbag']
['banana', 'candle', 'handbag']
['banana', 'candle', 'headphone']
['beef', 'candle', 'headphone']
['beef', 'conditioner', 'headphone']
['beef', 'conditioner', 'light bulb']
['bread', 'conditioner', 'light bulb']
['bread', 'detergent', 'light bulb']
['bread', 'detergent', 'screen protector']
['broccoli', 'detergent', 'screen protector']
['broccoli', 'moisture', 'screen protector']
['broccoli', 'moisture', 'shoe']
['chicken', 'moisture', 'shoe']

----- RULES SUPPORT CONFIDENCE:
----- RUNNING TIME:
0.0s

```

10. Next, I test minimum support = 0.2, minimum confidence = 0.7, transaction_database5.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is 0.0s.

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1.py part2.py
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.2 0.7 dataset/transaction_database5.csv
----- INPUT TRANSACTIONS:
['banana', 'chicken', 'shampoo', 'shoe']
['beef', 'chicken', 'shampoo', 'speaker']
['bread', 'clothes', 'shampoo', 'speaker']
['apple', 'clothes', 'tissue', 'speaker']
['broccoli', 'clothes', 'tissue', 'television']
['egg', 'tissue', 'television']
['egg', 'bleach', 'candle', 'television']
['egg', 'bleach', 'candle', 'thermostat']
['grape', 'bleach', 'candle', 'television']
['grape', 'bleach', 'conditioner', 'television']
['grape', 'conditioner', 'detergent', 'camera', 'cell phone']
['grape', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'candle', 'conditioner', 'screen protector', 'shoe']

----- RULES SUPPORT CONFIDENCE:
candle => bleach 0.2 1.0

----- RUNNING TIME:
0.0s

```

I get the running time for Brute Force is around 0.06s, slightly greater than the one for Apriori.

```

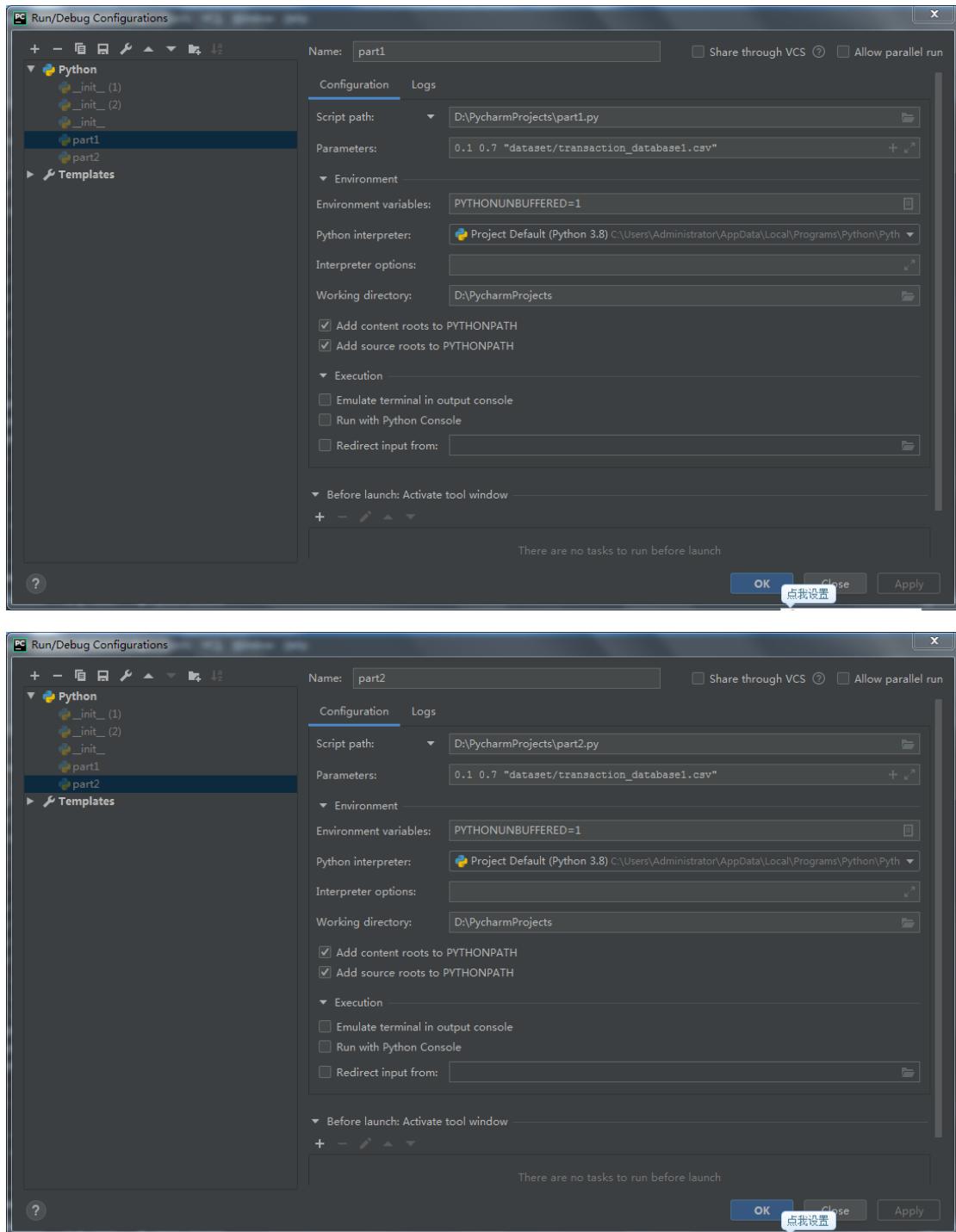
PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py part2.py
Project Run part2.py
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.2 0.7 dataset/transaction_database5.csv
----- INPUT TRANSACTIONS:
['banana', 'chicken', 'shampoo', 'shoe']
['beef', 'chicken', 'shampoo', 'speaker']
['bread', 'clothes', 'shampoo', 'speaker']
['apple', 'clothes', 'tissue', 'speaker']
['broccoli', 'clothes', 'tissue', 'television']
['egg', 'tissue', 'television']
['egg', 'bleach', 'candle', 'television']
['egg', 'bleach', 'candle', 'thermostat']
['grape', 'bleach', 'candle', 'television']
['grape', 'bleach', 'conditioner', 'television']
['grape', 'conditioner', 'detergent', 'camera', 'cell phone']
['grape', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'candle', 'conditioner', 'screen protector', 'shoe']

----- RULES SUPPORT CONFIDENCE:
candle => bleach 0.2 1.0

----- RUNNING TIME:
0.06000018119812812s

```

11. Next, I test minimum support = 0.1, minimum confidence = 0.7, transaction_database1.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is 0.0s.

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1 x part1.py part2.py
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.1 0.7 dataset/transaction_database1.csv
----- INPUT TRANSACTIONS:
['apple', 'banana', 'orange']
['beef', 'grape']
['bread', 'chicken']
['broccoli', 'clothes']
['oil', 'bleach']
['candle', 'conditioner']
['detergent', 'moisture']
['shampoo', 'tissue']
['camera', 'cell phone']
['charger', 'handbag']
['headphone', 'light bulb']
['screen protector', 'shoe']
['speaker', 'television']
['apple', 'banana', 'clothes', 'thermostat']
['apple', 'oil']
['apple', 'beef']
['apple', 'bread']
['apple', 'broccoli']
['apple', 'clothes']
['apple', 'grape']

----- RULES SUPPORT CONFIDENCE:
banana => apple 0.1 1.0

----- RUNNING TIME:
0.0s

```

I get the running time for Brute Force is around 0.06s, slightly greater than the one for Apriori.

```

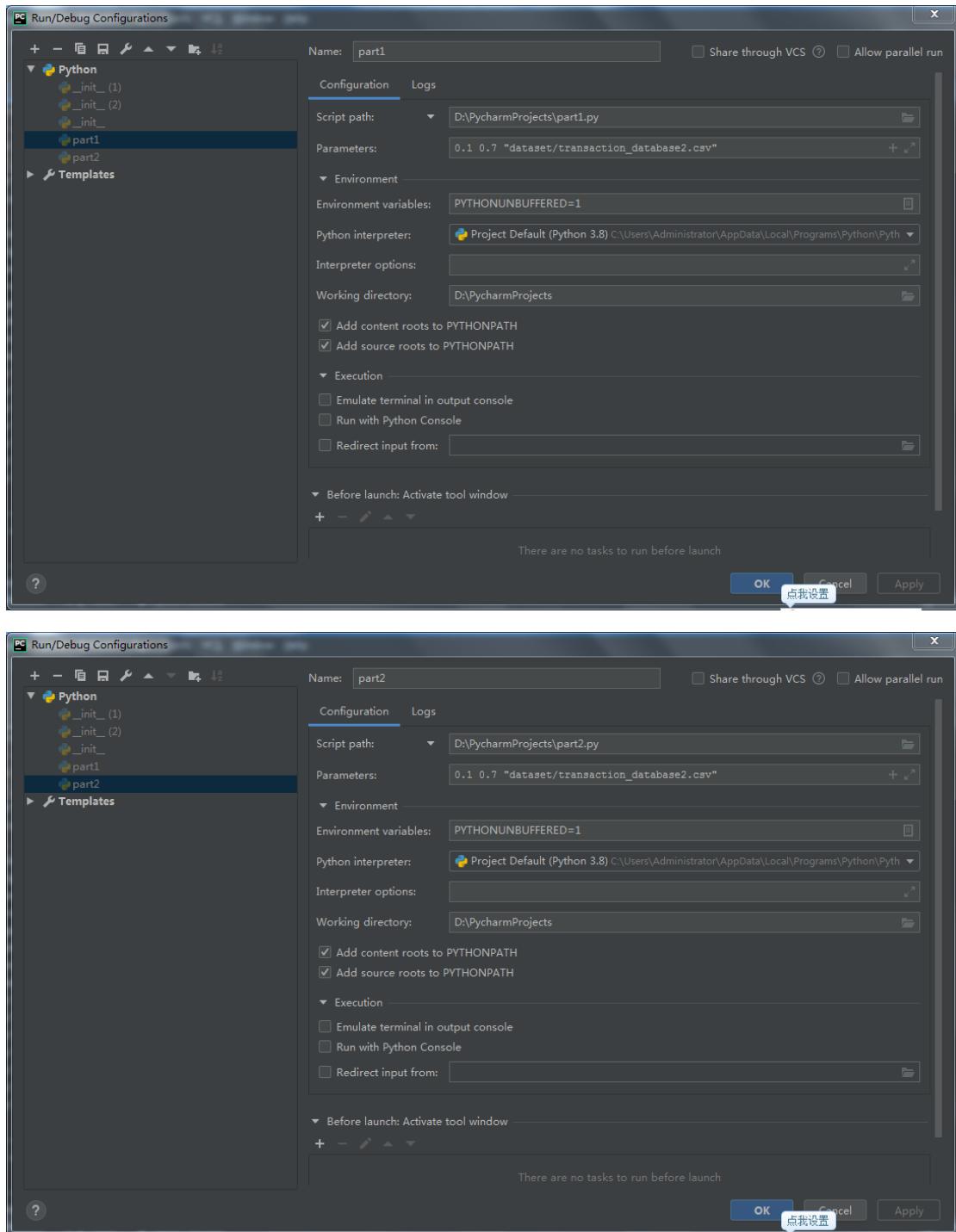
PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part1.py part2.py
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.1 0.7 dataset/transaction_database1.csv
----- INPUT TRANSACTIONS:
['apple', 'banana', 'orange']
['beef', 'grape']
['bread', 'chicken']
['broccoli', 'clothes']
['oil', 'bleach']
['candle', 'conditioner']
['detergent', 'moisture']
['shampoo', 'tissue']
['camera', 'cell phone']
['charger', 'handbag']
['headphone', 'light bulb']
['screen protector', 'shoe']
['speaker', 'television']
['apple', 'banana', 'clothes', 'thermostat']
['apple', 'oil']
['apple', 'beef']
['apple', 'bread']
['apple', 'broccoli']
['apple', 'clothes']
['apple', 'grape']

----- RULES SUPPORT CONFIDENCE:
banana => apple 0.1 1.0

----- RUNNING TIME:
0.0599994279541016s

```

12. Next, I test minimum support = 0.1, minimum confidence = 0.7, transaction_database2.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is 0.0s.

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1 x part1.py x part2.py x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.1 0.7 dataset/transaction_database2.csv
----- INPUT TRANSACTIONS:
['bleach', 'candle', 'beef', 'moisture']
['apple', 'conditioner', 'beef', 'moisture']
['banana', 'detergent', 'tissue']
['beef', 'moisture']
['bread', 'shampoo']
['broccoli', 'tissue']
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0
bread => shampoo 0.1 1.0

----- RUNNING TIME:
0.06s
Process finished with exit code 0

```

I get the running time for Brute Force is around 0.06s, slightly greater than the one for Apriori.

```

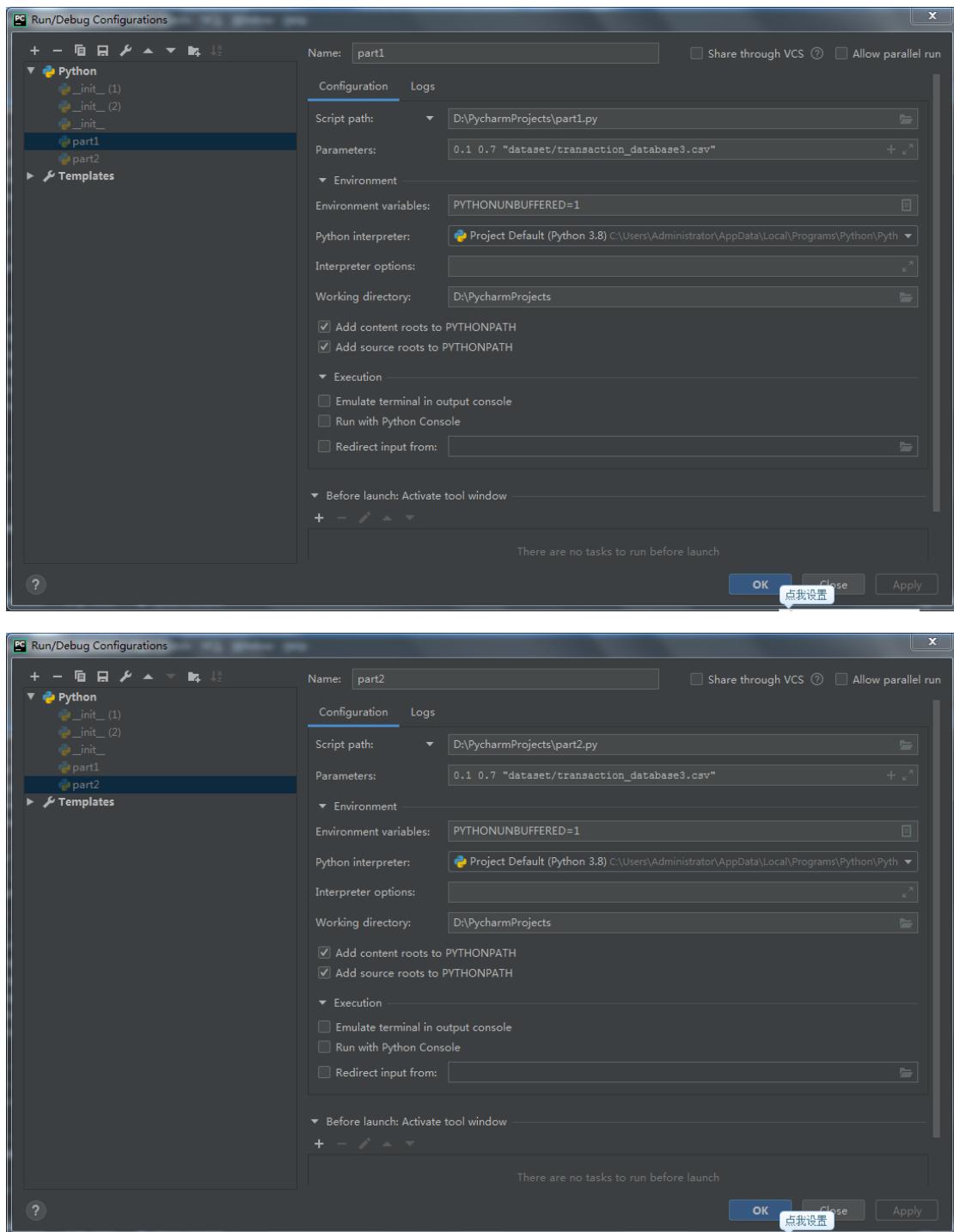
PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2 x part1.py x part2.py x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.1 0.7 dataset/transaction_database2.csv
----- INPUT TRANSACTIONS:
['bleach', 'candle', 'beef', 'moisture']
['apple', 'conditioner', 'beef', 'moisture']
['banana', 'detergent', 'tissue']
['beef', 'moisture']
['bread', 'shampoo']
['broccoli', 'tissue']
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0
bread => shampoo 0.1 1.0

----- RUNNING TIME:
0.060000018119812012s
Process finished with exit code 0

```

13. Next, I test minimum support = 0.1, minimum confidence = 0.7, transaction_database3.csv. Set up parameters for part1.py and part2.py.



Then I get the running time for Apriori is 0.0s.

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run Favorites
part1 x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.1 0.7 dataset/transaction_database3.csv
----- INPUT TRANSACTIONS:
['camera', 'cell phone', 'shampoo', 'moisture']
['apple', 'charger']
['banana', 'handbag']
['beef', 'headphone']
['bread', 'light bulb']
['broccoli', 'screen protector']
['chicken', 'shoe']
['clothes', 'speaker']
['egg', 'television']
['grape', 'thermostat']
['bleach', 'cell phone', 'moisture', 'shampoo']
['milk', 'candle']
['orange', 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

----- RULES SUPPORT CONFIDENCE:
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0

```

I get the running time for Brute Force is around 0.43s, slightly greater than the one for Apriori.

```

PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run Favorites
part2 x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.1 0.7 dataset/transaction_database3.csv
----- INPUT TRANSACTIONS:
['camera', 'cell phone', 'shampoo', 'moisture']
['apple', 'charger']
['banana', 'handbag']
['beef', 'headphone']
['bread', 'light bulb']
['broccoli', 'screen protector']
['chicken', 'shoe']
['clothes', 'speaker']
['egg', 'television']
['grape', 'thermostat']
['bleach', 'cell phone', 'moisture', 'shampoo']
['milk', 'candle']
['orange', 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

----- RULES SUPPORT CONFIDENCE:
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0

```

```

PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2.py part1.py part2.py
part2 x
[grapes, 'thermostat']
['bleach', 'cell phone', 'moisture', 'shampoo']
['milk', 'candle']
['orange', 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

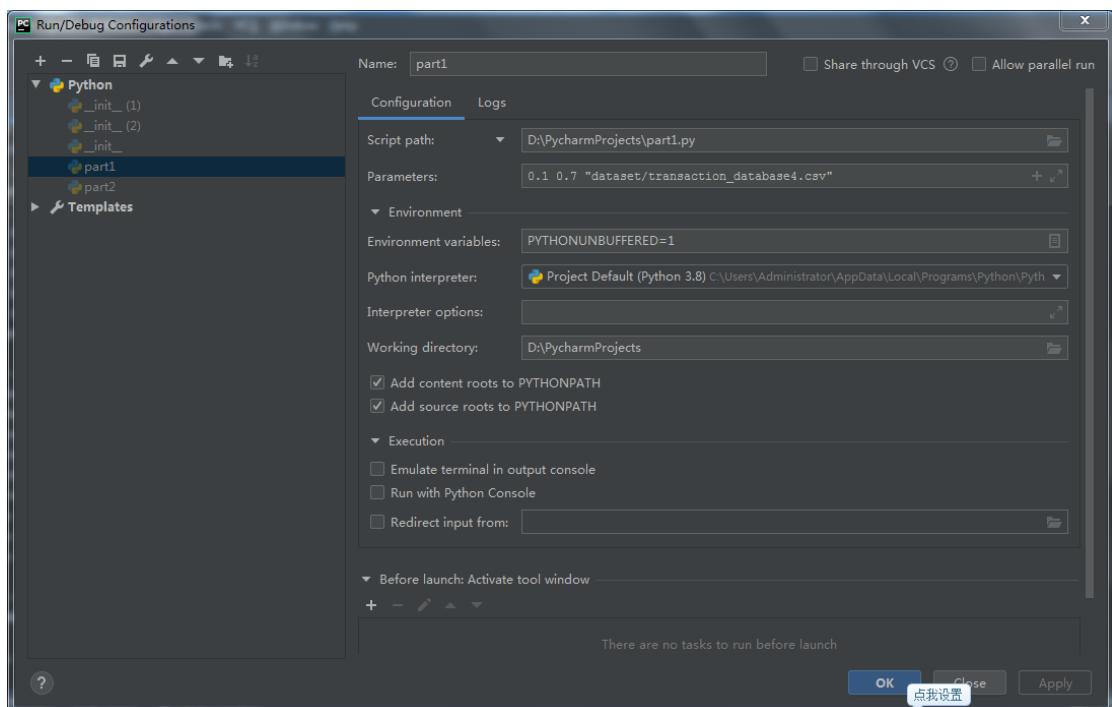
----- RULES SUPPORT CONFIDENCE:
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0
moisture => shampoo 0.2 1.0
moisture,shampoo => cell phone 0.2 1.0
shampoo => cell phone 0.2 1.0
shampoo => cell phone,moisture 0.2 1.0
shampoo => moisture 0.2 1.0

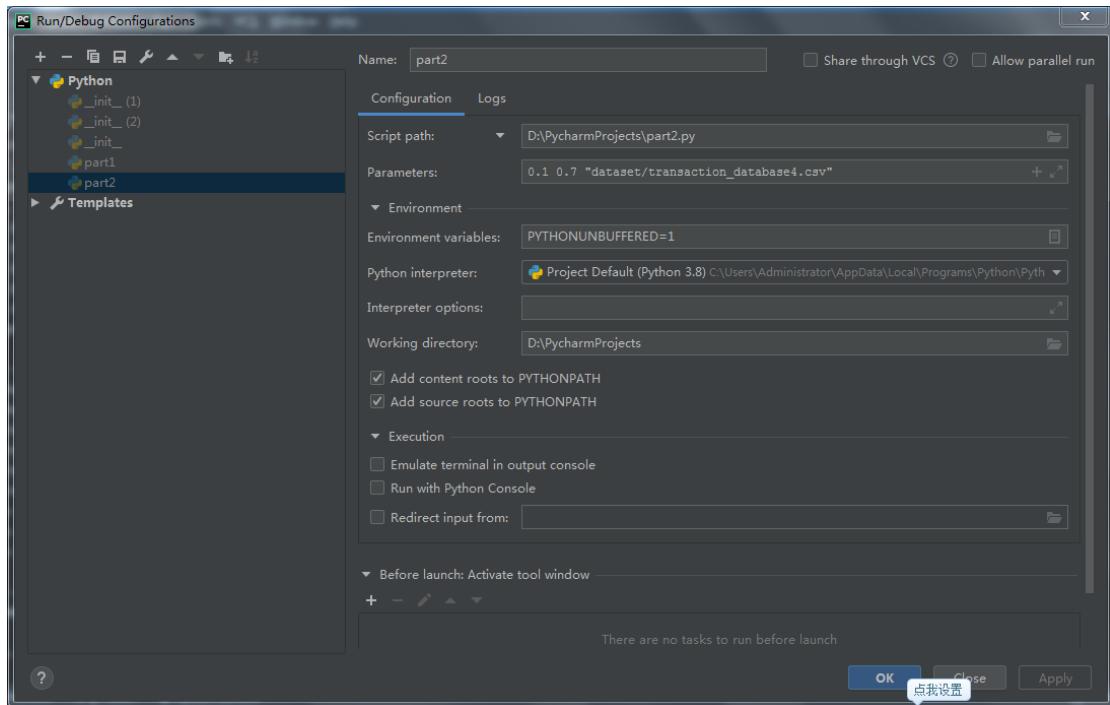
----- RUNNING TIME:
0.43000078201293945s

Process finished with exit code 0

```

14. Next, I test minimum support = 0.1, minimum confidence = 0.7, transaction_database4.csv. Set up parameters for part1.py and part2.py.





Then I get the running time for Apriori is 0.0s.

```

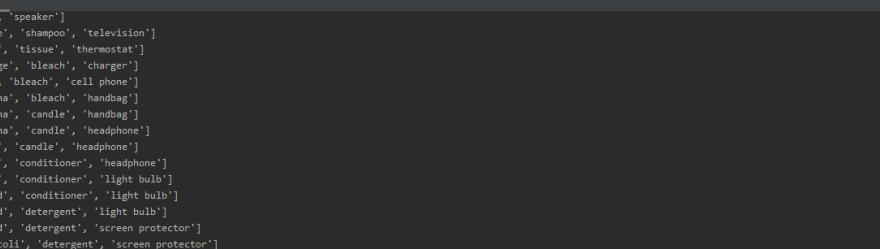
PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run part1
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.1 0.7 dataset/transaction_database4.csv
----- INPUT TRANSACTIONS:
['apple', 'bleach']
['clothes', 'camera']
['egg', 'speaker']
['grape', 'shampoo', 'television']
['milk', 'tissue', 'thermostat']
['orange', 'bleach', 'charger']
['oil', 'bleach', 'cell phone']
['banana', 'bleach', 'handbag']
['banana', 'candle', 'handbag']
['banana', 'candle', 'headphone']
['beef', 'candle', 'headphone']
['beef', 'conditioner', 'headphone']
['beef', 'conditioner', 'light bulb']
['bread', 'conditioner', 'light bulb']
['bread', 'detergent', 'light bulb']
['bread', 'detergent', 'screen protector']
['broccoli', 'detergent', 'screen protector']
['broccoli', 'moisture', 'screen protector']
['broccoli', 'moisture', 'shoe']
['chicken', 'moisture', 'shoe']

----- RULES SUPPORT CONFIDENCE:
handbag => banana 0.1 1.0
shoe => moisture 0.1 1.0

----- RUNNING TIME:

```

The screenshot shows the PyCharm IDE interface with the project 'PycharmProjects' open. The 'part1' run configuration is selected. The terminal tab shows the output of the Apriori algorithm execution. The output includes the input transactions, rules found, and the running time, which is 0.0s. The status bar at the bottom indicates the Python version is 3.8.



```
PycharmProjects [D:\PycharmProjects] - ...part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
part1.py part2.py

Run: part1 x
[+] part1 x
  ['egg', 'speaker']
  ['grape', 'shampoo', 'television']
  ['milk', 'tissue', 'thermostat']
  ['orange', 'bleach', 'charger']
  ['oil', 'bleach', 'cell phone']
  ['banana', 'bleach', 'handbag']
  ['banana', 'candle', 'handbag']
  ['banana', 'candle', 'headphone']
  ['beef', 'candle', 'headphone']
  ['beef', 'conditioner', 'headphone']
  ['beef', 'conditioner', 'light bulb']
  ['bread', 'conditioner', 'light bulb']
  ['bread', 'detergent', 'light bulb']
  ['bread', 'detergent', 'screen protector']
  ['broccoli', 'detergent', 'screen protector']
  ['broccoli', 'moisture', 'screen protector']
  ['broccoli', 'moisture', 'shoe']
  ['chicken', 'moisture', 'shoe']

----- RULES SUPPORT CONFIDENCE:
handbag => banana 0.1 1.0
shoe => moisture 0.1 1.0

----- RUNNING TIME:
0.0s

Process finished with exit code 0
```

I get the running time for Brute Force is around 0.05s, slightly greater than the one for Apriori.

```
PycharmProjects [D:\PycharmProjects\...]\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects > part2.py
Project part1.py part2.py
Run: part2 x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:\PycharmProjects\part2.py 0.1 0.7 dataset\transaction_database4.csv
----- INPUT TRANSACTIONS:
['apple', 'bleach']
['clothes', 'camera']
['egg', 'speaker']
['grape', 'shampoo', 'television']
['milk', 'tissue', 'thermostat']
['orange', 'bleach', 'charger']
['oil', 'bleach', 'cell phone']
['banana', 'bleach', 'handbag']
['banana', 'candle', 'handbag']
['banana', 'candle', 'headphone']
['beef', 'candle', 'headphone']
['beef', 'conditioner', 'headphone']
['beef', 'conditioner', 'light bulb']
['bread', 'conditioner', 'light bulb']
['bread', 'detergent', 'light bulb']
['bread', 'detergent', 'screen protector']
['broccoli', 'detergent', 'screen protector']
['broccoli', 'moisture', 'screen protector']
['broccoli', 'moisture', 'shoe']
['chicken', 'moisture', 'shoe']

----- RULES SUPPORT CONFIDENCE:
handbag => banana 0.1 1.0
shoe => moisture 0.1 1.0

----- RUNNING TIME:
```

```

PycharmProjects [D:\PycharmProjects] - ...\\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project part2 part1.py part2.py
Run part2
[...]
['egg', 'speaker']
['grape', 'shampoo', 'television']
['milk', 'tissue', 'thermostat']
['orange', 'bleach', 'charger']
['oil', 'bleach', 'cell phone']
['banana', 'bleach', 'handbag']
['banana', 'candle', 'handbag']
['banana', 'candle', 'headphone']
['beef', 'candle', 'headphone']
['beef', 'conditioner', 'headphone']
['beef', 'conditioner', 'light bulb']
['bread', 'conditioner', 'light bulb']
['bread', 'detergent', 'light bulb']
['bread', 'detergent', 'screen protector']
['broccoli', 'detergent', 'screen protector']
['broccoli', 'moisture', 'screen protector']
['broccoli', 'moisture', 'shoe']
['chicken', 'moisture', 'shoe']

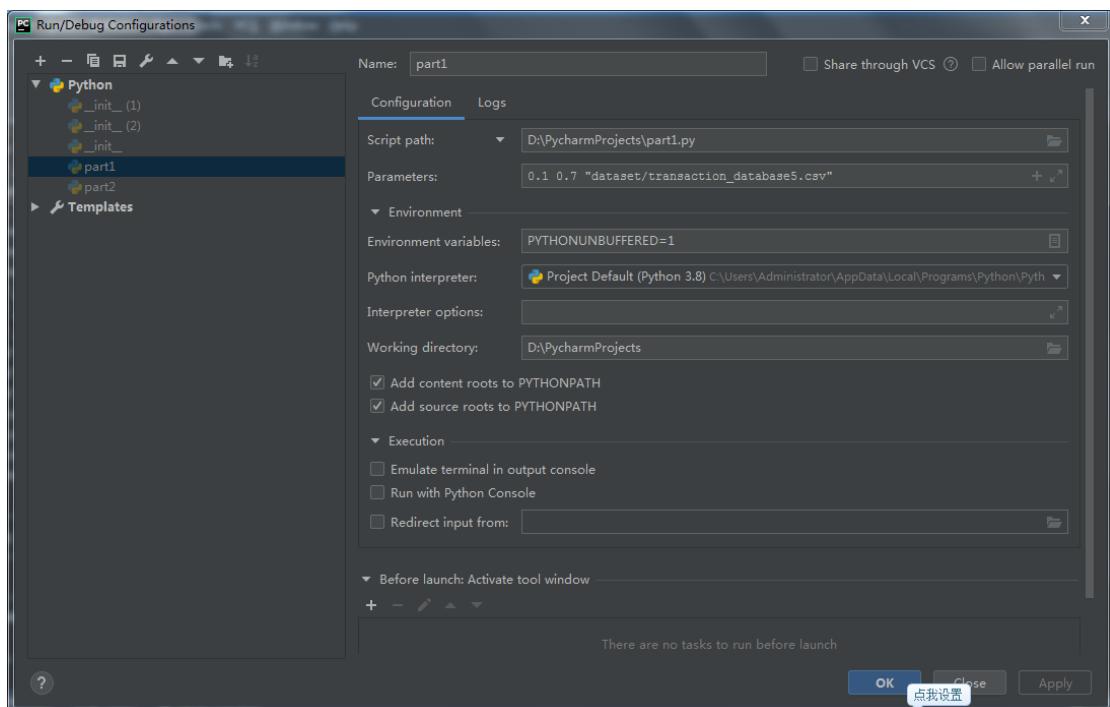
----- RULES SUPPORT CONFIDENCE:
handbag => banana 0.1 1.0
shoe => moisture 0.1 1.0

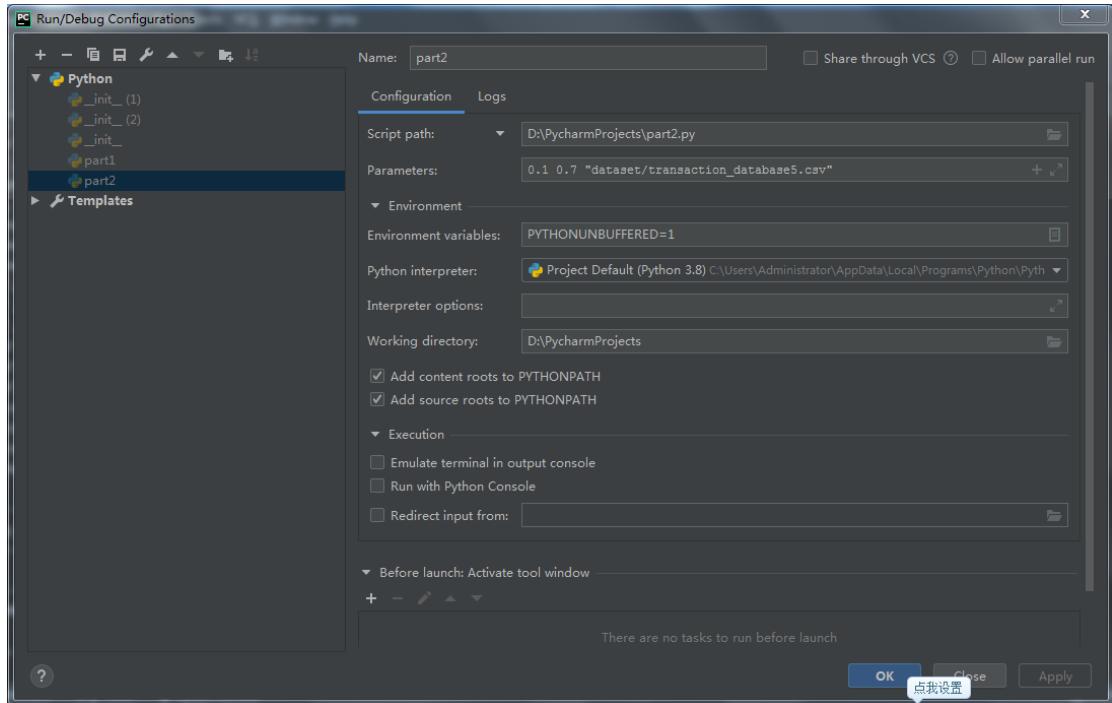
----- RUNNING TIME:
0.05000013073486528s

Process finished with exit code 0

```

15. Next, I test minimum support = 0.1, minimum confidence = 0.7, transaction_database5.csv. Set up parameters for part1.py and part2.py.





Then I get the running time for Apriori is around 0.01s.

```

C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.1 0.7 dataset/transaction_database5.csv
----- INPUT TRANSACTIONS:
['banana', 'chicken', 'shampoo', 'shoe']
['beef', 'chicken', 'shampoo', 'speaker']
['bread', 'clothes', 'shampoo', 'speaker']
['apple', 'clothes', 'tissue', 'speaker']
['broccoli', 'clothes', 'tissue', 'television']
['egg', 'tissue', 'television']
['egg', 'bleach', 'candle', 'thermostat']
['egg', 'bleach', 'candle', 'television']
['grape', 'bleach', 'candle', 'thermostat']
['grape', 'bleach', 'conditioner', 'television']
['grape', 'conditioner', 'detergent', 'camera', 'cell phone']
['grape', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'candle', 'conditioner', 'screen protector', 'shoe']

----- RULES SUPPORT CONFIDENCE:
bleach,egg => candle 0.1 1.0
bleach,grape => television 0.1 1.0
bleach,oil => screen protector 0.1 1.0
bleach,oil => screen protector,shoe 0.1 1.0

```

PyCharmProjects [D:\PyCharmProjects] - part1.py - PyCharm (Administrator)

```

bleach,oil => shoe 0.1 1.0
bleach,oil,screen protector => shoe 0.1 1.0
bleach,oil,shoe => screen protector 0.1 1.0
bleach,orange => tissue 0.1 1.0
bleach,screen protector => shoe 0.15 1.0
bleach,screen protector,tissue => shoe 0.1 1.0
bleach,shoe => screen protector 0.15 1.0
bleach,shoe,tissue => screen protector 0.1 1.0
candle => bleach 0.2 1.0
candle,egg => bleach 0.1 1.0
candle,television => bleach 0.1 1.0
charger => handbag 0.15 1.0
charger,conditioner => detergent 0.1 1.0
charger,conditioner => detergent,handbag 0.1 1.0
charger,conditioner => handbag 0.1 1.0
charger,conditioner,detergent => handbag 0.1 1.0
charger,conditioner,handbag => detergent 0.1 1.0
charger,detergent => conditioner 0.1 1.0
charger,detergent => conditioner,handbag 0.1 1.0
charger,detergent => handbag 0.1 1.0
charger,detergent,handbag => conditioner 0.1 1.0
charger,milk => handbag 0.1 1.0
chicken => shampoo 0.1 1.0
conditioner,detergent,handbag => charger 0.1 1.0
conditioner,handbag => charger,conditioner 0.1 1.0
conditioner,handbag => charger,detergent 0.1 1.0
conditioner,handbag => detergent 0.1 1.0
detergent => conditioner 0.15 1.0

```

PyCharmProjects [D:\PyCharmProjects] - part1.py - PyCharm (Administrator)

```

detergent,grape => conditioner 0.1 1.0
detergent,handbag => charger 0.1 1.0
detergent,handbag => charger,conditioner 0.1 1.0
detergent,handbag => conditioner 0.1 1.0
grape => conditioner 0.15 0.7499999999999999
grape,television => bleach 0.1 1.0
handbag => charger 0.15 1.0
handbag,milk => charger 0.1 1.0
headphone => light bulb 0.15 1.0
headphone,light bulb,moisture => shampoo 0.1 1.0
headphone,light bulb,shampoo => moisture 0.1 1.0
headphone,moisture => light bulb,shampoo 0.1 1.0
headphone,moisture => shampoo 0.1 1.0
headphone,moisture,shampoo => light bulb 0.1 1.0
headphone,orange => light bulb 0.1 1.0
headphone,shampoo => light bulb 0.1 1.0
headphone,shampoo => light bulb,moisture 0.1 1.0
headphone,shampoo => moisture 0.1 1.0
light bulb => headphone 0.15 1.0
light bulb,moisture => headphone 0.1 1.0
light bulb,moisture => headphone,shampoo 0.1 1.0
light bulb,moisture => shampoo 0.1 1.0
light bulb,moisture,shampoo => headphone 0.1 1.0
light bulb,orange => headphone 0.1 1.0
light bulb,shampoo => headphone 0.1 1.0
light bulb,shampoo => moisture 0.1 1.0

```

PyCharmProjects [D:\PyCharmProjects] - part1.py - PyCharm (Administrator)

```

milk,moisture => shampoo 0.1 1.0
milk,shampoo => moisture 0.1 1.0
moisture => shampoo 0.15 1.0
oil => bleach 0.1 1.0
oil => bleach,screen protector 0.1 1.0
oil => bleach,screen protector,shoe 0.1 1.0
oil => bleach,shoe 0.1 1.0
oil => screen protector 0.1 1.0
oil => screen protector,shoe 0.1 1.0
oil => shoe 0.1 1.0
oil,screen protector => bleach 0.1 1.0
oil,screen protector => bleach,shoe 0.1 1.0
oil,screen protector => shoe 0.1 1.0
oil,screen protector,shoe => bleach 0.1 1.0
oil,shoe => bleach 0.1 1.0
oil,shoe => bleach,screen protector 0.1 1.0
oil,shoe => screen protector 0.1 1.0
orange,tissue => bleach 0.1 1.0
screen protector => bleach 0.15 1.0
screen protector => bleach,shoe 0.15 1.0
screen protector => shoe 0.15 1.0
screen protector,shoe => bleach 0.15 1.0
screen protector,shoe,tissue => bleach 0.1 1.0
screen protector,tissue => bleach,shoe 0.1 1.0
screen protector,tissue => shoe 0.1 1.0
shoe => bleach 0.15 0.7499999999999999
shoe => bleach,screen protector 0.15 0.7499999999999999

```

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run Favorites
part1.x
oil,screen protector => bleach 0.1 1.0
oil,screen protector => bleach,shoe 0.1 1.0
oil,screen protector => shoe 0.1 1.0
oil,screen protector,shoe => bleach 0.1 1.0
oil,shoe => bleach 0.1 1.0
oil,shoe => bleach,screen protector 0.1 1.0
oil,shoe => screen protector 0.1 1.0
orange,tissue => bleach 0.1 1.0
screen protector => bleach 0.15 1.0
screen protector => bleach,shoe 0.15 1.0
screen protector => shoe 0.15 1.0
screen protector,shoe => bleach 0.15 1.0
screen protector,shoe,tissue => bleach 0.1 1.0
screen protector,tissue => bleach,shoe 0.1 1.0
screen protector,tissue => shoe 0.1 1.0
shoe => bleach 0.15 0.7499999999999999
shoe => bleach,screen protector 0.15 0.7499999999999999
shoe => screen protector 0.15 0.7499999999999999
shoe,tissue => bleach 0.1 1.0
shoe,tissue => bleach,screen protector 0.1 1.0
shoe,tissue => screen protector 0.1 1.0

----- RUNNING TIME:
0.00999990463256836s

Process finished with exit code 0

```

I get the running time for Brute Force is around 2.88s, greater than the one for Apriori.

```

PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run Favorites
part2.x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.1 0.7 dataset/transaction_database5.csv
----- INPUT TRANSACTIONS:
['banana', 'chicken', 'shampoo', 'shoe']
['beef', 'chicken', 'shampoo', 'speaker']
['bread', 'clothes', 'shampoo', 'speaker']
['apple', 'clothes', 'tissue', 'speaker']
['broccoli', 'clothes', 'tissue', 'television']
['egg', 'tissue', 'television']
['egg', 'bleach', 'candle', 'television']
['egg', 'bleach', 'candle', 'thermostat']
['grape', 'bleach', 'candle', 'television']
['grape', 'bleach', 'conditioner', 'television']
['grape', 'conditioner', 'detergent', 'camera', 'cell phone']
['grape', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'candle', 'conditioner', 'screen protector', 'shoe']

----- RULES SUPPORT CONFIDENCE:
bleach,egg => candle 0.1 1.0
bleach,grape => television 0.1 1.0
bleach,oil => screen protector 0.3 1.0
bleach,oil => screen protector,shoe 0.1 1.0

Process finished with exit code 0

```

PyCharmProjects [D:\PycharmProjects] - part2.py - PyCharm (Administrator)

```

File Edit View Navigate Code Refactor Run Tools VCS Window Help
PyCharmProjects part2.py
Project Run PyCharmProjects part1.py part2.py
part2
bleach,oil => shoe 0.1 1.0
bleach,oil,screen protector => shoe 0.1 1.0
bleach,oil,shoe => screen protector 0.1 1.0
bleach,orange => tissue 0.1 1.0
bleach,screen protector => shoe 0.15 1.0
bleach,shoe => screen protector 0.15 1.0
bleach,shoe,tissue => screen protector 0.1 1.0
candle => bleach 0.2 1.0
candle,egg => bleach 0.1 1.0
candle,television => bleach 0.1 1.0
charger => handbag 0.15 1.0
charger,conditioner => detergent 0.1 1.0
charger,conditioner => detergent,handbag 0.1 1.0
charger,conditioner => handbag 0.1 1.0
charger,conditioner,detergent => handbag 0.1 1.0
charger,conditioner,handbag => detergent 0.1 1.0
charger,detergent => conditioner,handbag 0.1 1.0
charger,detergent => handbag 0.1 1.0
charger,detergent,handbag => conditioner 0.1 1.0
charger,milk => handbag 0.1 1.0
chicken => shampoo 0.1 1.0
conditioner,detergent,handbag => charger 0.1 1.0
conditioner,handbag => charger 0.1 1.0
conditioner,handbag => charger,detergent 0.1 1.0
conditioner,handbag => detergent 0.1 1.0
detergent => conditioner 0.15 1.0

```

Run Structure TODO Python Console

PyCharmProjects [D:\PycharmProjects] - part2.py - PyCharm (Administrator)

```

File Edit View Navigate Code Refactor Run Tools VCS Window Help
PyCharmProjects part1.py part2.py
Project Run PyCharmProjects part1.py part2.py
part2
detergent,grape => conditioner 0.1 1.0
detergent,handbag => charger 0.1 1.0
detergent,handbag => charger,conditioner 0.1 1.0
detergent,handbag => conditioner 0.1 1.0
grape => conditioner 0.15 0.7499999999999999
grape,television => bleach 0.1 1.0
handbag => charger 0.15 1.0
handbag,milk => charger 0.1 1.0
headphone => light bulb 0.15 1.0
headphone,light bulb,moisture => shampoo 0.1 1.0
headphone,light bulb,shampoo => moisture 0.1 1.0
headphone,moisture => light bulb,shampoo 0.1 1.0
headphone,moisture => shampoo 0.1 1.0
headphone,moisture,shampoo => light bulb 0.1 1.0
headphone,orange => light bulb 0.1 1.0
headphone,shampoo => light bulb 0.1 1.0
headphone,shampoo => light bulb,moisture 0.1 1.0
headphone,shampoo => moisture 0.1 1.0
light bulb => headphone 0.15 1.0
light bulb,moisture => headphone 0.1 1.0
light bulb,moisture => headphone,shampoo 0.1 1.0
light bulb,moisture => shampoo 0.1 1.0
light bulb,moisture,shampoo => headphone 0.1 1.0
light bulb,orange => headphone 0.1 1.0
light bulb,shampoo => headphone 0.1 1.0
light bulb,shampoo => headphone,moisture 0.1 1.0
light bulb,shampoo => moisture 0.1 1.0

```

Run Structure TODO Python Console

PyCharmProjects [D:\PycharmProjects] - part2.py - PyCharm (Administrator)

```

File Edit View Navigate Code Refactor Run Tools VCS Window Help
PyCharmProjects part1.py part2.py
Project Run PyCharmProjects part1.py part2.py
part2
milk,moisture => shampoo 0.1 1.0
milk,shampoo => moisture 0.1 1.0
moisture => shampoo 0.15 1.0
oil => bleach 0.1 1.0
oil => bleach,screen protector 0.1 1.0
oil => bleach,screen protector,shoe 0.1 1.0
oil => bleach,shoe 0.1 1.0
oil => screen protector 0.1 1.0
oil => screen protector,shoe 0.1 1.0
oil => shoe 0.1 1.0
oil,screen protector => bleach 0.1 1.0
oil,screen protector => bleach,shoe 0.1 1.0
oil,screen protector => shoe 0.1 1.0
oil,screen protector,shoe => bleach 0.1 1.0
oil,shoe => bleach 0.1 1.0
oil,shoe => bleach,screen protector 0.1 1.0
oil,shoe => screen protector 0.1 1.0
orange,tissue => bleach 0.1 1.0
screen protector => bleach 0.15 1.0
screen protector => bleach,shoe 0.15 1.0
screen protector => shoe 0.15 1.0
screen protector,shoe => bleach 0.15 1.0
screen protector,shoe,tissue => bleach 0.1 1.0
screen protector,tissue => bleach 0.1 1.0
screen protector,tissue => bleach,shoe 0.1 1.0
shoe => bleach 0.15 0.7499999999999999
shoe => bleach,screen protector 0.15 0.7499999999999999

```

Run Structure TODO Python Console

```

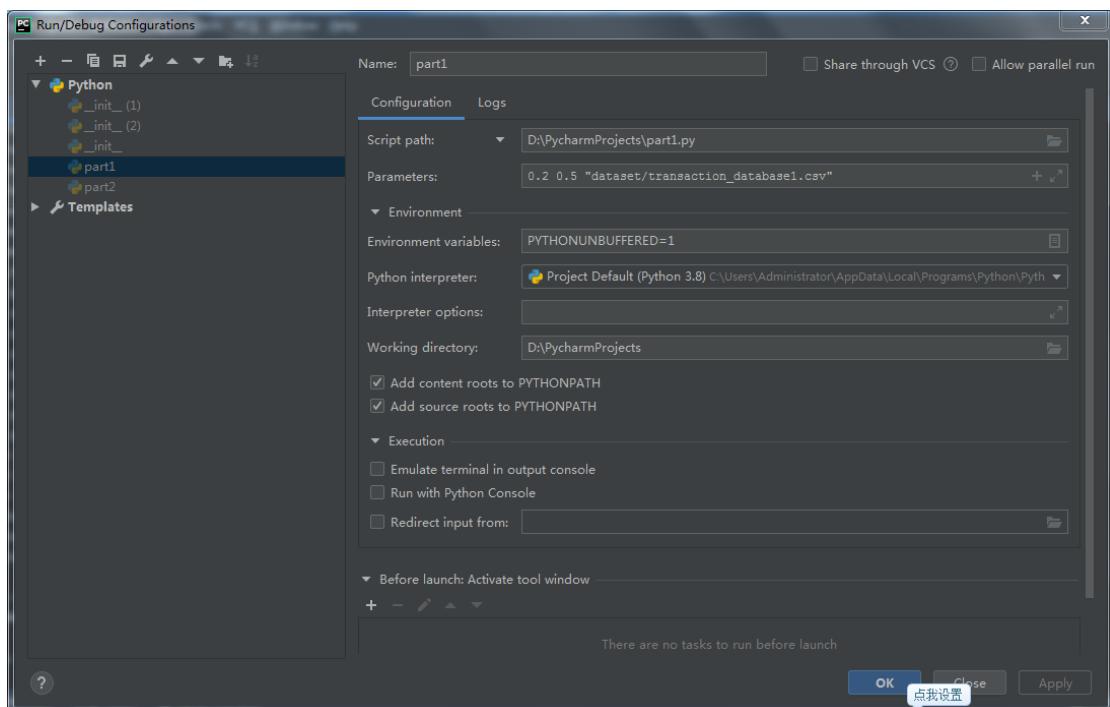
PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2.py part1.py part2.py
part2
oil,screen protector => bleach 0.1 1.0
oil,screen protector => bleach,shoe 0.1 1.0
oil,screen protector => shoe 0.1 1.0
oil,screen protector,shoe => bleach 0.1 1.0
oil,shoe => bleach 0.1 1.0
oil,shoe => bleach,screen protector 0.1 1.0
oil,shoe => screen protector 0.1 1.0
orange,tissue => bleach 0.1 1.0
screen protector => bleach 0.15 1.0
screen protector => bleach,shoe 0.15 1.0
screen protector => shoe 0.15 1.0
screen protector,shoe => bleach 0.1 1.0
screen protector,tissue => bleach 0.1 1.0
screen protector,tissue => bleach,shoe 0.1 1.0
screen protector,tissue => shoe 0.1 1.0
shoe => bleach 0.15 0.7499999999999999
shoe => bleach,screen protector 0.15 0.7499999999999999
shoe => screen protector 0.15 0.7499999999999999
shoe,tissue => bleach 0.1 1.0
shoe,tissue => bleach,screen protector 0.1 1.0
shoe,tissue => screen protector 0.1 1.0

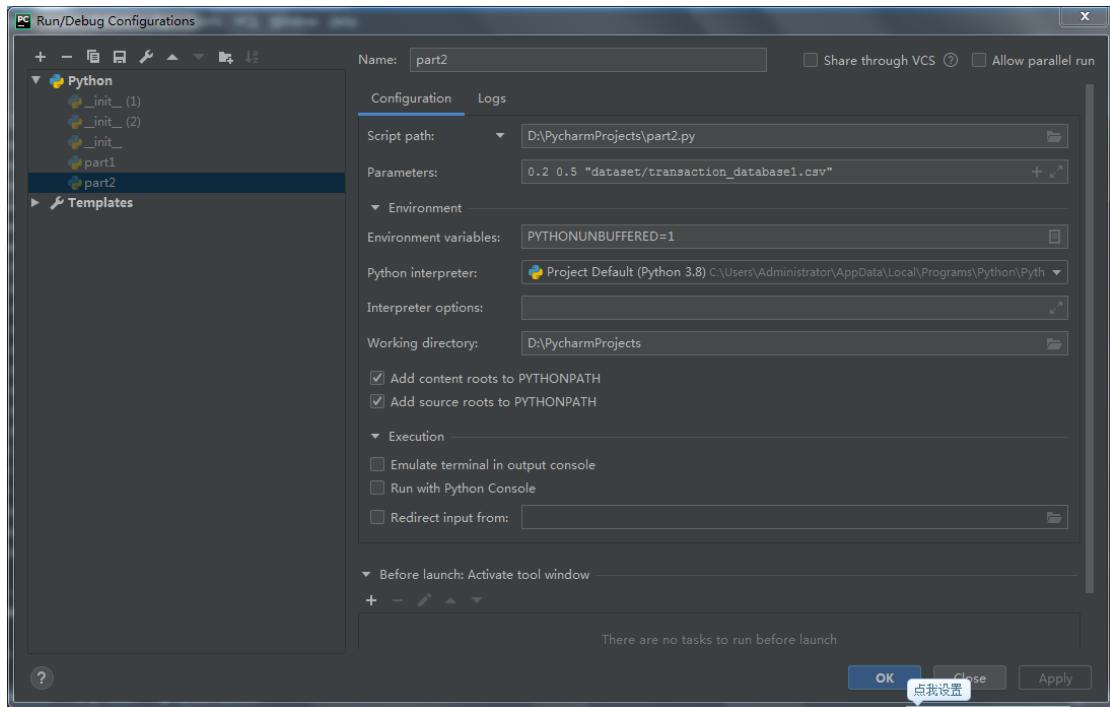
-----
RUNNING TIME:
2.88000416755676275

Process finished with exit code 0

```

16. Next, I test minimum support = 0.2, minimum confidence = 0.5, transaction_database1.csv. Set up parameters for part1.py and part2.py.





Then I get the running time for Apriori is 0.0s. No association rules meet the requirements of minimum support and minimum confidence.

```
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:\PycharmProjects\part1.py 0.2 0.5 dataset/transaction_database1.csv
-----
INPUT TRANSACTIONS:
['apple', 'banana', 'orange']
['beef', 'grape']
['bread', 'chicken']
['broccoli', 'clothes']
['oil', 'bleach']
['candle', 'conditioner']
['detergent', 'moisture']
['shampoo', 'tissue']
['camera', 'cell phone']
['charger', 'handbag']
['headphone', 'light bulb']
['screen protector', 'shoe']
['speaker', 'television']
['apple', 'banana', 'clothes', 'thermostat']
['apple', 'oil']
['apple', 'beef']
['apple', 'bread']
['apple', 'broccoli']
['apple', 'clothes']
['apple', 'grape']

-----
RULES SUPPORT CONFIDENCE:
-----
RUNNING TIME:
0.0s
```

I get the running time for Brute Force is around 0.01s, which is slightly greater than the one for Apriori, although the size of association rules is 0.

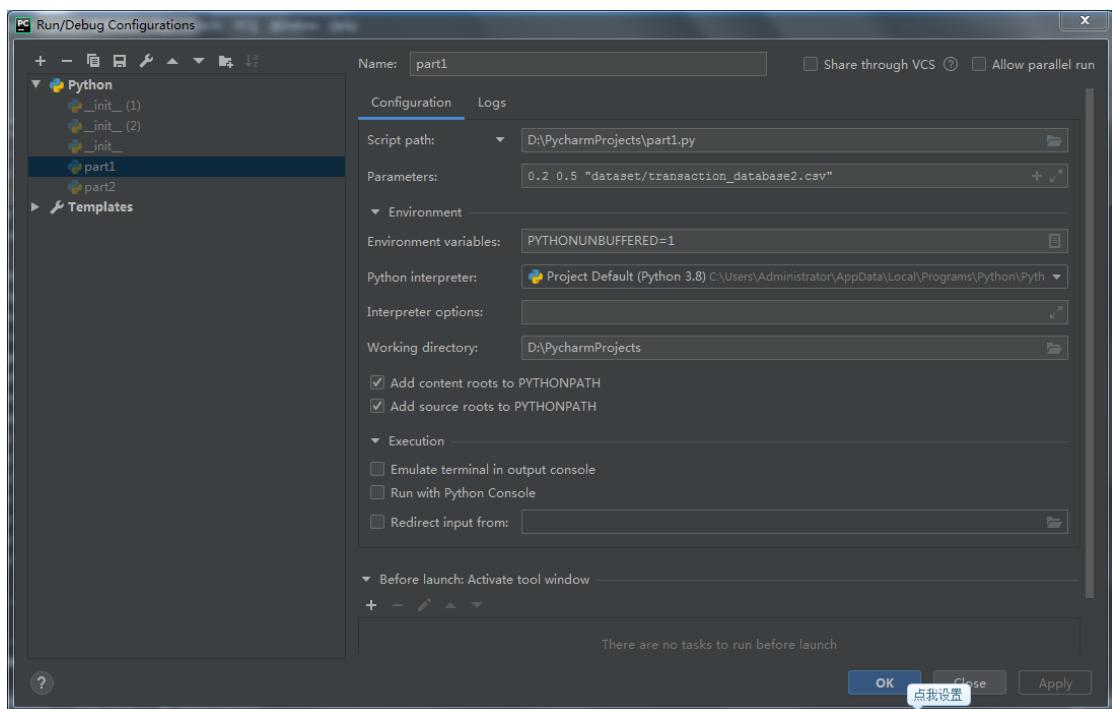
```

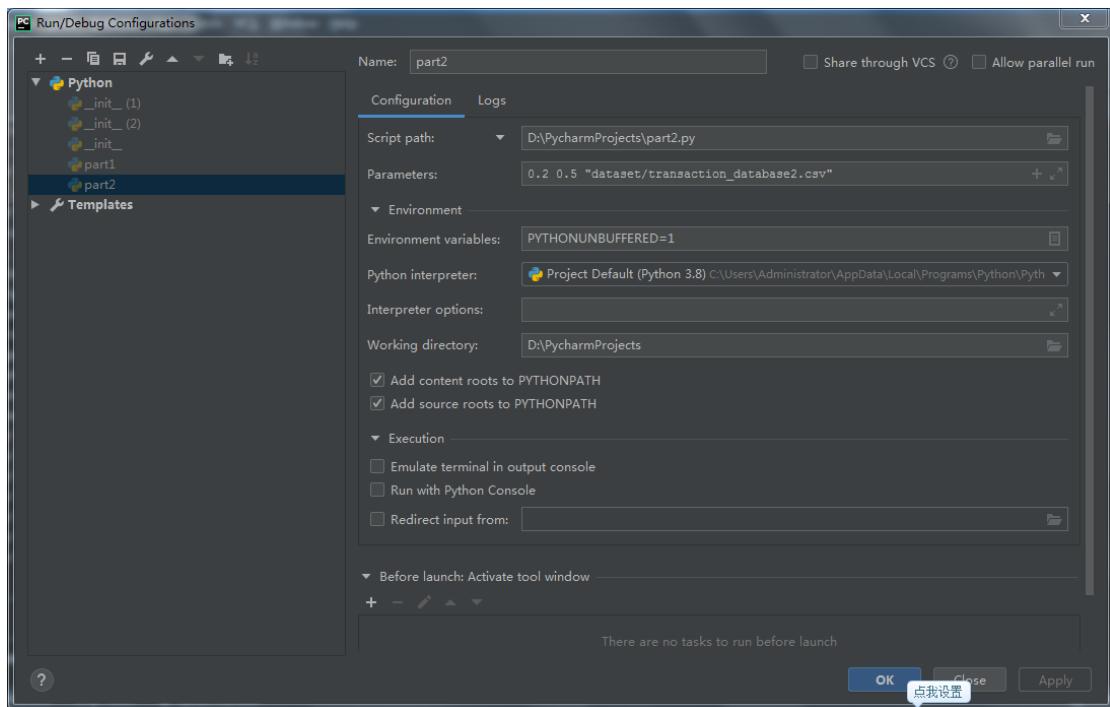
PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2.py part1.py part2.py
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.2 0.5 dataset/transaction_database1.csv
----- INPUT TRANSACTIONS:
['apple', 'banana', 'orange']
['beef', 'grape']
['bread', 'chicken']
['broccoli', 'clothes']
['oil', 'bleach']
['candle', 'conditioner']
['detergent', 'moisture']
['shampoo', 'tissue']
['camera', 'cell phone']
['charger', 'handbag']
['headphone', 'light bulb']
['screen protector', 'shoe']
['speaker', 'television']
['apple', 'banana', 'clothes', 'thermostat']
['apple', 'oil']
['apple', 'beef']
['apple', 'bread']
['apple', 'broccoli']
['apple', 'clothes']
['apple', 'grape']

----- RULES SUPPORT CONFIDENCE:
----- RUNNING TIME:
0.010000228881835938s

```

17. Next, I test minimum support = 0.2, minimum confidence = 0.5, transaction_database2.csv. Set up parameters for part1.py and part2.py.





Then I get the running time for Apriori is 0.0s.

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project part1
Run
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.2 0.5 dataset/transaction_database2.csv
----- INPUT TRANSACTIONS:
['bleach', 'candle', 'beef', 'moisture']
['apple', 'conditioner', 'beef', 'moisture']
['banana', 'detergent', 'tissue']
['beef', 'moisture']
['bread', 'shampoo']
['broccoli', 'tissue']
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0
moisture => beef 0.2 0.6666666666666667

----- RUNNING TIME:

```

The terminal window shows the command run: 'C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.2 0.5 dataset/transaction_database2.csv'. It displays the input transactions, rules generated by the Apriori algorithm, and the running time.

PycharmProjects [D:\PycharmProjects] - part1.py - PyCharm (Administrator)

File Edit View Navigate Code Refactor Run Tools VCS Window Help

PycharmProjects part1.py part1.py

Project part1 part1.py part2.py

Run: part1

Up ↑ Down ↓ Left ← Right → Run Run

['banana', 'detergent', 'tissue']
['beef', 'moisture']
['bread', 'shampoo']
['broccoli', 'tissue']
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

----- RULES SUPPORT CONFIDENCE:

beef => moisture 0.2 1.0
moisture => beef 0.2 0.6666666666666667

----- RUNNING TIME:

0.0s

Process finished with exit code 0

I get the running time for Brute Force is around 0.07s, which is slightly greater than the one for Apriori.

```
PycharmProjects [D:\PycharmProjects] - ... .part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects > part2.py
part2.py
part1.py part2.py
Run: part2 x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.2 0.5 dataset/transaction_database2.csv
----- INPUT TRANSACTIONS:
['bleach', 'candle', 'beef', 'moisture']
['apple', 'conditioner', 'beef', 'moisture']
['banana', 'detergent', 'tissue']
['beef', 'moisture']
['bread', 'shampoo']
['broccoli', 'tissue']
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0
moisture => beef 0.2 0.6666666666666666

----- RUNNING TIME:
```

```

PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2.py part1.py part2.py
part2.py
[banana, 'detergent', 'tissue']
['beef', 'moisture']
['bread', 'shampoo']
['broccoli', 'tissue']
['chicken', 'camera']
['clothes', 'cell phone']
['egg', 'charger']
['grape', 'handbag']
['milk', 'headphone']
['orange', 'light bulb']
['oil', 'screen protector']
['shoe', 'speaker']
['television', 'thermostat']
['detergent', 'moisture', 'beef']
['detergent', 'shampoo', 'bread']
['detergent', 'tissue']
['moisture', 'shampoo']
['moisture', 'tissue']

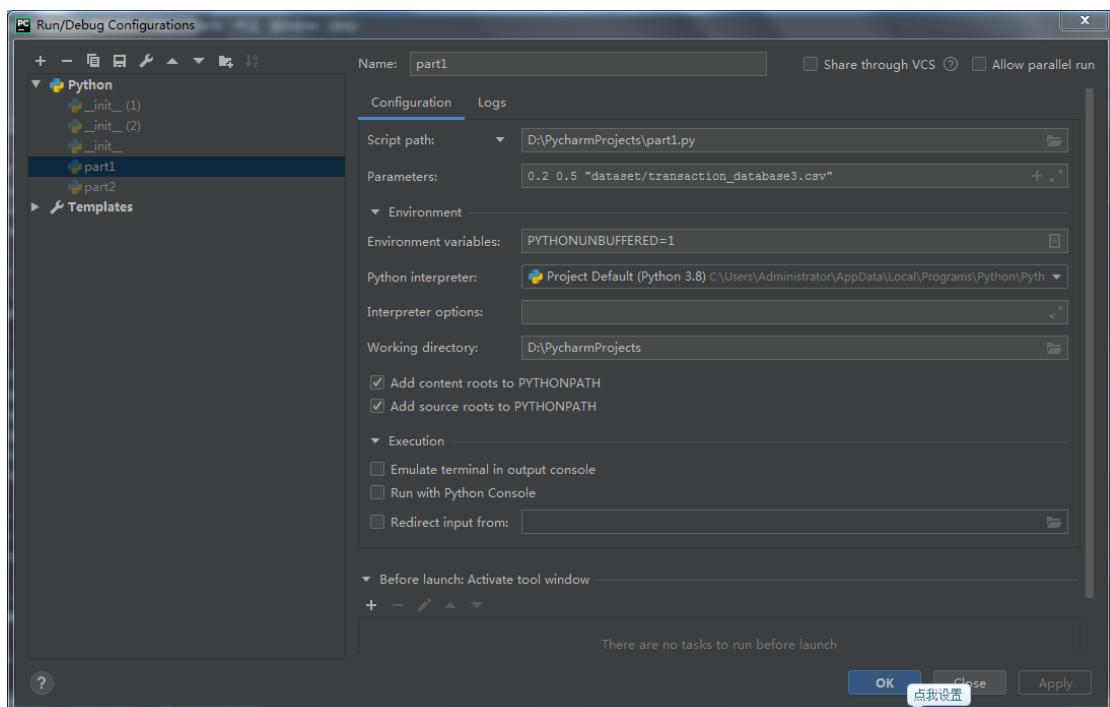
----- RULES SUPPORT CONFIDENCE:
beef => moisture 0.2 1.0
moisture => beef 0.2 0.6666666666666667

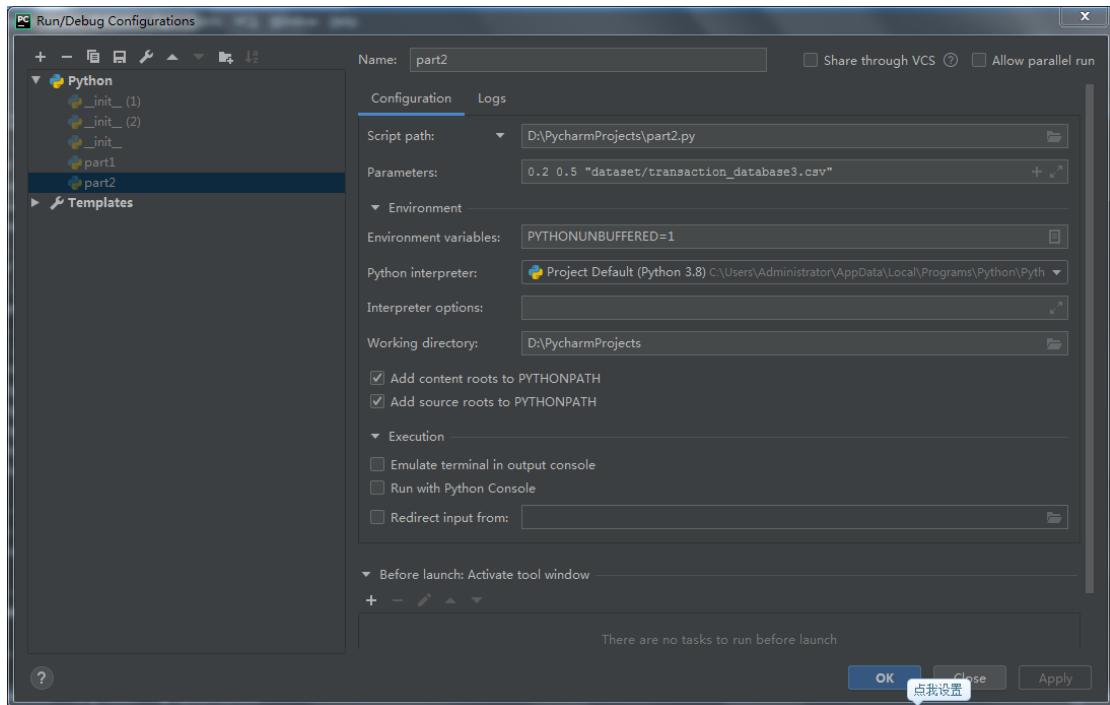
----- RUNNING TIME:
0.070000017166137695s

Process finished with exit code 0

```

18. Next, I test minimum support = 0.2, minimum confidence = 0.5, transaction_database3.csv. Set up parameters for part1.py and part2.py.





Then I get the running time for Apriori is 0.0s.

```

C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.2 0.5 dataset/transaction_database3.csv
----- INPUT TRANSACTIONS:
['camera', 'cell phone', 'shampoo', 'moisture']
['apple', 'charger']
['banana', 'handbag']
['beef', 'headphone']
['bread', 'light bulb']
['broccoli', 'screen protector']
['chicken', 'shoe']
['clothes', 'speaker']
['egg', 'television']
['grape', 'thermostat']
['bleach', 'cell phone', 'moisture', 'shampoo']
['milk', 'candle']
['orange', 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

----- RULES SUPPORT CONFIDENCE:
cell phone => moisture 0.2 0.5714285714285715
cell phone => moisture,shampoo 0.2 0.5714285714285715
cell phone => shampoo 0.2 0.5714285714285715
cell phone,moisture => shampoo 0.2 1.0

```

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run Favorites
part1.x
[orange, 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

----- RULES SUPPORT CONFIDENCE:
cell phone => moisture 0.2 0.5714285714285715
cell phone => moisture,shampoo 0.2 0.5714285714285715
cell phone => shampoo 0.2 0.5714285714285715
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0
moisture => shampoo 0.2 1.0
moisture,shampoo => cell phone 0.2 1.0
shampoo => cell phone 0.2 1.0
shampoo => cell phone,moisture 0.2 1.0
shampoo => moisture 0.2 1.0

----- RUNNING TIME:
0.0s

Process finished with exit code 0

```

I get the running time for Brute Force is around 0.45s, which is slightly greater than the one for Apriori.

```

PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run Favorites
part2.x
C:/Users/Administrator/AppData/Local/Programs/Python/Python38/python.exe D:/PycharmProjects/part2.py 0.2 0.5 dataset/transaction_database3.csv
----- INPUT TRANSACTIONS:
['camera', 'cell phone', 'shampoo', 'moisture']
['apple', 'charger']
['banana', 'handbag']
['beef', 'headphone']
['bread', 'light bulb']
['broccoli', 'screen protector']
['chicken', 'shoe']
['clothes', 'speaker']
['egg', 'television']
['grape', 'thermostat']
['bleach', 'cell phone', 'moisture', 'shampoo']
['milk', 'candle']
['orange', 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

----- RULES SUPPORT CONFIDENCE:
cell phone => moisture 0.2 0.5714285714285715
cell phone => moisture,shampoo 0.2 0.5714285714285715
cell phone => shampoo 0.2 0.5714285714285715
cell phone,moisture => shampoo 0.2 1.0

```

```

PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py part1.py part2.py
Project Run Favorites
part2 x
[orange, 'conditioner']
['oil', 'detergent']
['cell phone', 'moisture']
['cell phone', 'shampoo', 'screen protector', 'shampoo']
['cell phone', 'shampoo', 'shoe', 'moisture']
['cell phone', 'tissue', 'speaker']
['cell phone', 'television']
['cell phone', 'thermostat']
['charger', 'handbag']

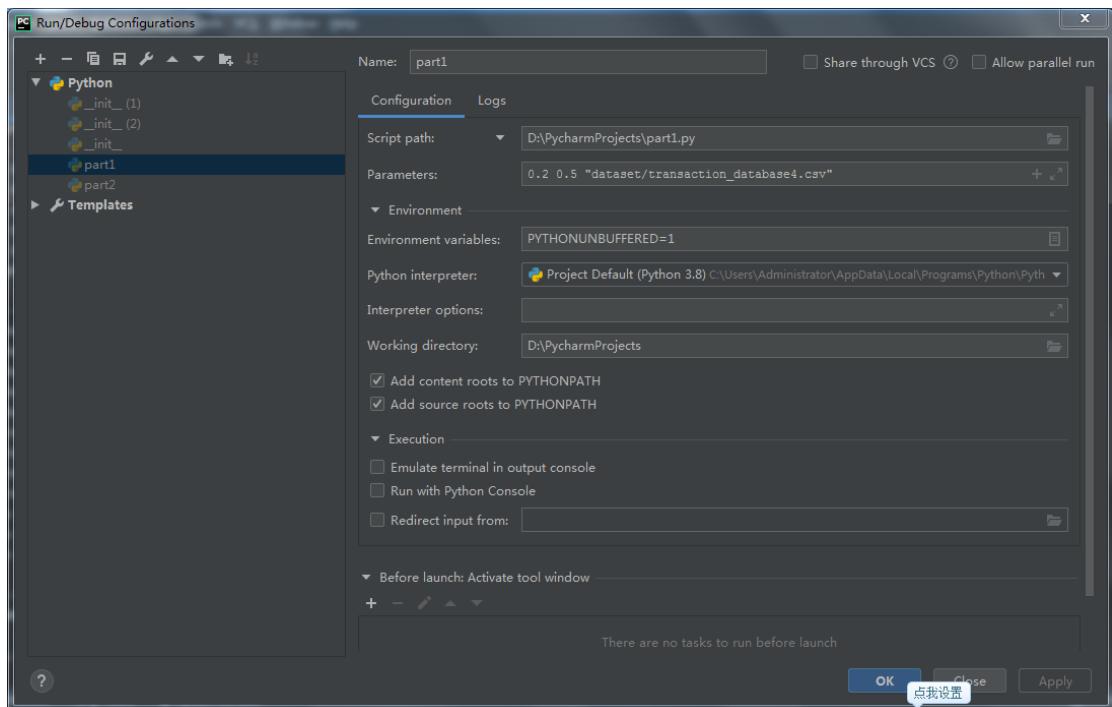
----- RULES SUPPORT CONFIDENCE:
cell phone => moisture 0.2 0.5714285714285715
cell phone => moisture,shampoo 0.2 0.5714285714285715
cell phone => shampoo 0.2 0.5714285714285715
cell phone,moisture => shampoo 0.2 1.0
cell phone,shampoo => moisture 0.2 1.0
moisture => cell phone 0.2 1.0
moisture => cell phone,shampoo 0.2 1.0
moisture => shampoo 0.2 1.0
moisture,shampoo => cell phone 0.2 1.0
shampoo => cell phone 0.2 1.0
shampoo => cell phone,moisture 0.2 1.0
shampoo => moisture 0.2 1.0

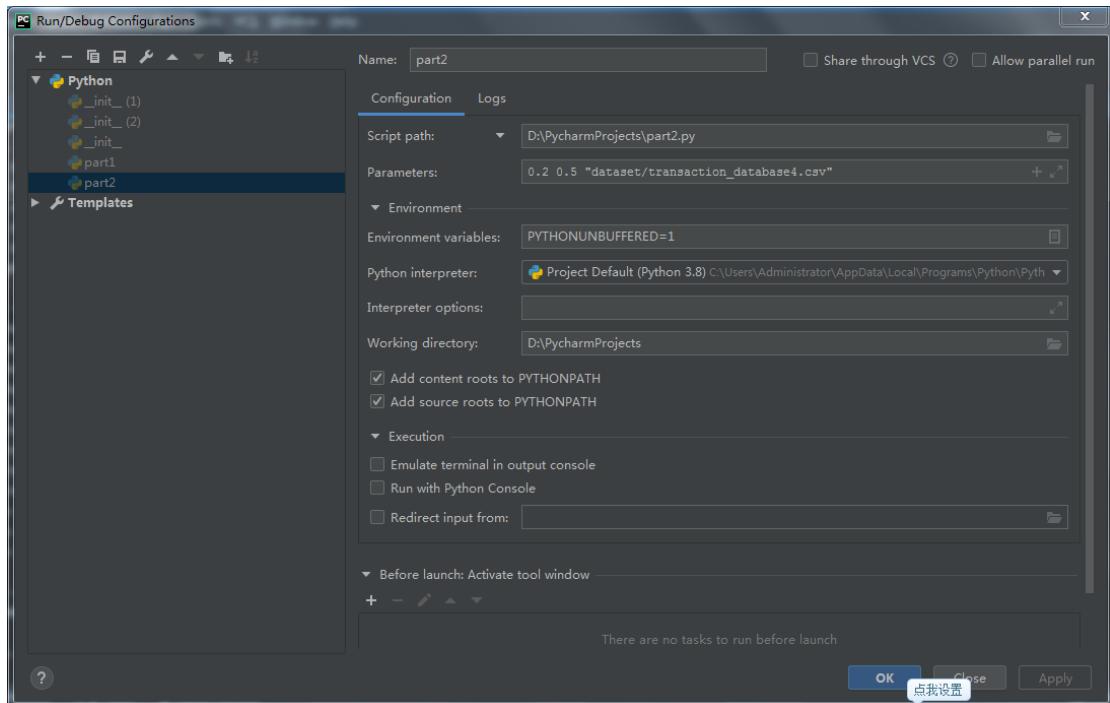
----- RUNNING TIME:
0.4500007629394531s

Process finished with exit code 0

```

19. Next, I test minimum support = 0.2, minimum confidence = 0.5, transaction_database4.csv. Set up parameters for part1.py and part2.py.





Then I get the running time for Apriori is 0.0s. No association rules meet the requirements of minimum support and minimum confidence.

```
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:\PycharmProjects\part1.py 0.2 0.5 dataset/transaction_database4.csv
-----
INPUT TRANSACTIONS:
['apple', 'bleach']
['clothes', 'camera']
['egg', 'speaker']
['grape', 'shampoo', 'television']
['milk', 'tissue', 'thermostat']
['orange', 'bleach', 'charger']
['oil', 'bleach', 'cell phone']
['banana', 'bleach', 'handbag']
['banana', 'candle', 'handbag']
['banana', 'candle', 'headphone']
['beef', 'candle', 'headphone']
['beef', 'conditioner', 'headphone']
['beef', 'conditioner', 'light bulb']
['bread', 'conditioner', 'light bulb']
['bread', 'detergent', 'light bulb']
['bread', 'detergent', 'screen protector']
['broccoli', 'detergent', 'screen protector']
['broccoli', 'moisture', 'screen protector']
['broccoli', 'moisture', 'shoe']
['chicken', 'moisture', 'shoe']

-----
RULES SUPPORT CONFIDENCE:
-----
RUNNING TIME:
0.0s
```

I get the running time for Brute Force is around 0.01s, which is slightly greater than the one for Apriori, although the size of association rules is 0.

```

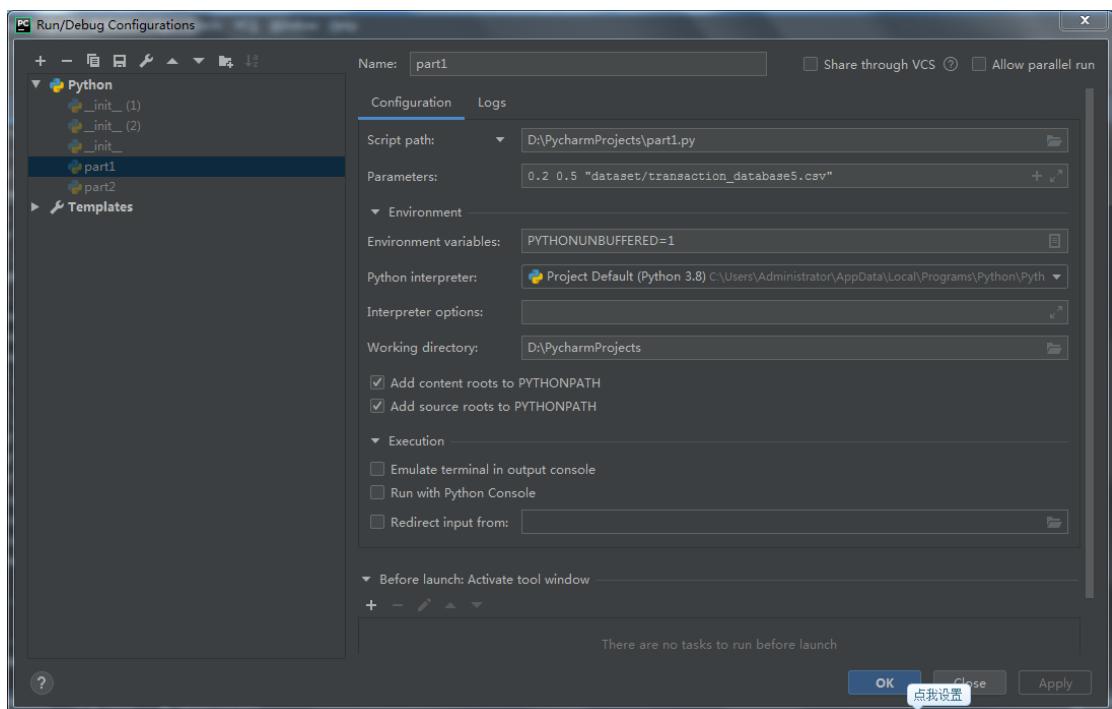
PycharmProjects [D:\PycharmProjects] - ...\\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project Run part2.py part1.py part2.py
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.2 0.5 dataset/transaction_database4.csv
----- INPUT TRANSACTIONS:
['apple', 'bleach']
['clothes', 'camera']
['egg', 'speaker']
['grape', 'shampoo', 'television']
['milk', 'tissue', 'thermostat']
['orange', 'bleach', 'charger']
['oil', 'bleach', 'cell phone']
['banana', 'bleach', 'handbag']
['banana', 'candle', 'handbag']
['banana', 'candle', 'headphone']
['beef', 'candle', 'headphone']
['beef', 'conditioner', 'headphone']
['beef', 'conditioner', 'light bulb']
['bread', 'conditioner', 'light bulb']
['bread', 'detergent', 'light bulb']
['bread', 'detergent', 'screen protector']
['broccoli', 'detergent', 'screen protector']
['broccoli', 'moisture', 'screen protector']
['broccoli', 'moisture', 'shoe']
['chicken', 'moisture', 'shoe']

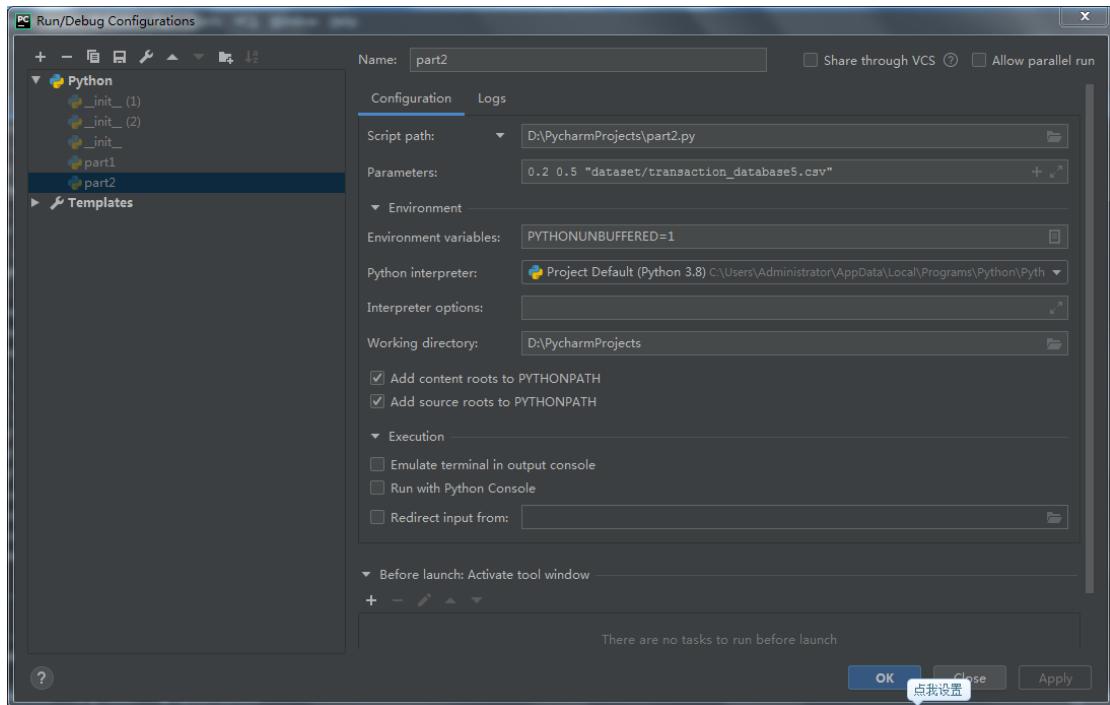
----- RULES SUPPORT CONFIDENCE:

----- RUNNING TIME:
0.009999990463256836s

```

20. Next, I test minimum support = 0.2, minimum confidence = 0.5, transaction_database5.csv. Set up parameters for part1.py and part2.py.





Then I get the running time for Apriori is 0.0s.

```

PycharmProjects [D:\PycharmProjects] - part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project part1
Run part1
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part1.py 0.2 0.5 dataset/transaction_database5.csv
----- INPUT TRANSACTIONS:
['banana', 'chicken', 'shampoo', 'shoe']
['beef', 'chicken', 'shampoo', 'speaker']
['bread', 'clothes', 'shampoo', 'speaker']
['apple', 'clothes', 'tissue', 'speaker']
['broccoli', 'clothes', 'tissue', 'television']
['egg', 'tissue', 'television']
['egg', 'bleach', 'candle', 'thermostat']
['egg', 'bleach', 'candle', 'television']
['grape', 'bleach', 'candle', 'thermostat']
['grape', 'bleach', 'conditioner', 'television']
['grape', 'conditioner', 'detergent', 'camera', 'cell phone']
['grape', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'candle', 'conditioner', 'screen protector', 'shoe']

----- RULES SUPPORT CONFIDENCE:
bleach => candle 0.2 0.5
candle => bleach 0.2 1.0

----- RUNNING TIME:

```

```

PycharmProjects [D:\PycharmProjects] - ..\part1.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py
Project Run Favorites
part1 x
part1.py x part2.py x
[bread, 'clothes', 'shampoo', 'speaker']
[apple, 'clothes', 'tissue', 'speaker']
[broccoli, 'clothes', 'tissue', 'television']
[egg, 'tissue', 'television']
[egg, 'bleach', 'candle', 'television']
[egg, 'bleach', 'candle', 'thermostat']
[grape, 'bleach', 'candle', 'television']
[grape, 'bleach', 'conditioner', 'television']
[grape, 'conditioner', 'detergent', 'camera', 'cell phone']
[grape, 'conditioner', 'detergent', 'charger', 'handbag']
[milk, 'conditioner', 'detergent', 'charger', 'handbag']
[milk, 'moisture', 'shampoo', 'charger', 'handbag']
[milk, 'moisture', 'shampoo', 'headphone', 'light bulb']
[orange, 'moisture', 'shampoo', 'headphone', 'light bulb']
[orange, 'bleach', 'tissue', 'headphone', 'light bulb']
[orange, 'bleach', 'tissue', 'screen protector', 'shoe']
[oil, 'bleach', 'tissue', 'screen protector', 'shoe']
[oil, 'bleach', 'candle', 'conditioner', 'screen protector', 'shoe']

----- RULES SUPPORT CONFIDENCE:
bleach => candle 0.2 0.5
candle => bleach 0.2 1.0

----- RUNNING TIME:
0.0s

Process finished with exit code 0

```

I get the running time for Brute Force is around 0.07s, which is slightly greater than the one for Apriori.

```

PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part1.py x part2.py x
Project Run Favorites
part2 x
C:\Users\Administrator\AppData\Local\Programs\Python\Python38\python.exe D:/PycharmProjects/part2.py 0.2 0.5 dataset/transaction_database5.csv
----- INPUT TRANSACTIONS:
['banana', 'chicken', 'shampoo', 'shoe']
['beef', 'chicken', 'shampoo', 'speaker']
['bread', 'clothes', 'shampoo', 'speaker']
['apple', 'clothes', 'tissue', 'speaker']
[broccoli, 'clothes', 'tissue', 'television']
[egg, 'tissue', 'television']
[egg, 'bleach', 'candle', 'television']
[egg, 'bleach', 'candle', 'thermostat']
[grape, 'bleach', 'candle', 'television']
[grape, 'bleach', 'conditioner', 'television']
[grape, 'conditioner', 'detergent', 'camera', 'cell phone']
[grape, 'conditioner', 'detergent', 'charger', 'handbag']
[milk, 'conditioner', 'detergent', 'charger', 'handbag']
[milk, 'moisture', 'shampoo', 'charger', 'handbag']
[milk, 'moisture', 'shampoo', 'headphone', 'light bulb']
[orange, 'moisture', 'shampoo', 'headphone', 'light bulb']
[orange, 'bleach', 'tissue', 'headphone', 'light bulb']
[orange, 'bleach', 'tissue', 'screen protector', 'shoe']
[oil, 'bleach', 'tissue', 'screen protector', 'shoe']
[oil, 'bleach', 'candle', 'conditioner', 'screen protector', 'shoe']

----- RULES SUPPORT CONFIDENCE:
bleach => candle 0.2 0.5
candle => bleach 0.2 1.0

----- RUNNING TIME:
0.0s

Process finished with exit code 0

```

```

PycharmProjects [D:\PycharmProjects] - ..\part2.py - PyCharm (Administrator)
File Edit View Navigate Code Refactor Run Tools VCS Window Help
PycharmProjects part2.py
Project part2.x
Run part2.x
part2.py
['bread', 'clothes', 'shampoo', 'speaker']
['apple', 'clothes', 'tissue', 'speaker']
['broccoli', 'clothes', 'tissue', 'television']
['egg', 'tissue', 'television']
['egg', 'bleach', 'candle', 'television']
['egg', 'bleach', 'candle', 'thermostat']
['grape', 'bleach', 'candle', 'television']
['grape', 'bleach', 'candle', 'conditioner', 'television']
['grape', 'conditioner', 'detergent', 'camera', 'cell phone']
['grape', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'conditioner', 'detergent', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'charger', 'handbag']
['milk', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'moisture', 'shampoo', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'headphone', 'light bulb']
['orange', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'tissue', 'screen protector', 'shoe']
['oil', 'bleach', 'candle', 'conditioner', 'screen protector', 'shoe']

----- RULES SUPPORT CONFIDENCE:
bleach => candle 0.2 0.5
candle => bleach 0.2 1.0

----- RUNNING TIME:
0.07000017166137695s

Process finished with exit code 0

```

Conclusion:

From the above combinations of minimum support, minimum confidence, and data files, I can conclude that the running time for Brute Force algorithm is greater than that for Apriori algorithm. In other words, Apriori algorithm is faster than the Brute Force method on each of the 5 transaction databases. Compared to Brute Force method, the larger size the association rule has, the faster Apriori algorithm performs.

Source code:

part1.py: Performs Apriori algorithm

```

import sys
import time

min_support = float(sys.argv[1])
min_conf = float(sys.argv[2])
t_file = sys.argv[3]

with open(t_file) as f:
    db = [l.replace("\n", "").split(",") for l in f]
    print("-----")
    -- INPUT TRANSACTIONS:")
    for transaction in db:
        print(transaction)

class Rule:

    def __init__(self, left, right, all):
        self.left = list(left)
        self.left.sort()
        self.right = list(right)
        self.right.sort()
        self.all = all

    def __str__(self):
        return ",".join(self.left)+" => "+",".join(self.right)

    def __hash__(self):
        """
        Store support value to dict
        :return: hash value in the object
        """
        return hash(str(self))

def scan(db, Ck):
    count = {s: 0 for s in Ck}
    for t in db:
        for freqset in Ck:
            if freqset.issubset(t):
                count[freqset] += 1
    n = len(db)
    return {freqset: support/n for freqset, support in count.items()}
if support/n>=min_support}

def generate_candidate(Lk):
    result = []
    for i in range(len(Lk)):
        for j in range(i+1, len(Lk)):
            a, b = Lk[i], Lk[j]
            aa, bb = list(a), list(b)
            aa.sort()
            bb.sort()
            if aa[:len(a)-1] == bb[:len(a)-1]:
                result.append(a | b)
    return result

```

```

def generate_frequent_and_support():
    support = {}
    candidate = [[]]
    Lk = [[]]
    C1 = set()
    for t in db:
        for item in t:
            C1.add(frozenset([item]))

    candidate.append(C1)
    count = scan(db, C1)
    Lk.append(list(count.keys()))
    support.update(count)

    k = 1
    while len(Lk[k]) > 0:
        candidate.append(generate_candidate(Lk[k]))
        count = scan(db, candidate[k+1])
        support.update(count)
        Lk.append(list(count.keys()))
        k += 1
    return Lk, support

def generate_sub_rule(fs, rights, all_result, support):
    right_size = len(rights[0])
    total_size = len(fs)
    if total_size-right_size > 0:
        rights = generate_candidate(rights)
        new_right = []
        for right in rights:
            left = fs - right
            if len(left) == 0:
                continue
            confidence = support[fs] / support[left]
            if confidence >= min_conf:
                all_result.append([Rule(left, right, fs),
support[fs], confidence])
                new_right.append(right)

        if len(new_right) > 1:
            generate_sub_rule(fs, new_right, all_result, support)

def generate_rules(frequent, support):
    all_result = []
    for i in range(2, len(frequent)):
        if len(frequent[i]) == 0:
            break
        freq_sets = frequent[i]

        for fs in freq_sets:
            for right in [frozenset([x]) for x in fs]:
                left = fs-right
                confidence = support[fs] / support[left]
                if confidence >= min_conf:
                    all_result.append([Rule(left, right, fs),
support[fs], confidence])

```

```
if len(freq_sets[0]) != 2:

    for fs in freq_sets:
        right = [frozenset([x]) for x in fs]
        generate_sub_rule(fs, right, all_result, support)

all_result.sort(key=lambda x: str(x[0]))
return all_result

if __name__ == '__main__':
    start_time = time.time()
    f, s = generate_frequent_and_support()
    all_result = generate_rules(f, s)
    end_time = time.time()
    print("\n-----")
    RULES SUPPORT CONFIDENCE:")
    for r in all_result:
        print(r[0], r[1], r[2])
    print("\n-----")
    ----- RUNNING TIME:")
    print(str(end_time - start_time) + "s")
```

part2.py: Performs Brute Force method. Uses item.csv to generate and enumerate all k-item sets.

```

import sys
import time

min_support = float(sys.argv[1])
min_conf = float(sys.argv[2])
t_file = sys.argv[3]

with open("dataset/item.csv") as f:
    items = f.read().replace("\n", "").split(",")
    items.sort()

with open(t_file) as f:
    db = [l.replace("\n", "").split(",") for l in f]
    print("-----")
-- INPUT TRANSACTIONS:
    for transaction in db:
        print(transaction)

def generate_k(items, k):

    if k == 1:
        return [[x] for x in items]

    all_res = []
    for i in range(len(items)-(k-1)):
        for sub in generate_k(items[i+1:], k-1):
            tmp = [items[i]]
            tmp.extend(sub)
            all_res.append(tmp)
    return all_res

def scan(db, s):
    count = 0
    for t in db:
        if set(s).issubset(t):
            count += 1
    return count

def generate_frequent_and_support():
    frequent = []
    support = {}
    for k in range(1, len(items)+1):
        current = []
        for comb in generate_k(items, k):
            count = scan(db, comb)
            if count/len(db) >= min_support:
                support[frozenset(comb)] = count/len(db)
                current.append(comb)
        if len(current) == 0:
            break
        frequent.append(current)
    return frequent, support

class Rule:

```

```

def __init__(self, left, right, all):
    self.left = list(left)
    self.left.sort()
    self.right = list(right)
    self.right.sort()
    self.all = all

def __str__(self):
    return ",".join(self.left)+" => "+",".join(self.right)

def __hash__(self):
    """
    Store support value to dict
    :return: hash value in the object
    """
    return hash(str(self))

def generate_rules(frequent, support):
    all_rule = set()
    all_result = []
    for k_freq in frequent:
        if len(k_freq) == 0:
            continue
        if len(k_freq[0]) < 2:
            continue
        for freq in k_freq:
            for i in range(1, len(freq)):
                for left in generate_k(freq, i):
                    tmp = freq.copy()
                    right = [x for x in tmp if x not in left]
                    all_rule.add(Rule(left, right, freq))
    for rule in all_rule:
        confidence = support[frozenset(rule.all)] /
support[frozenset(rule.left)]
        if confidence >= min_conf:
            all_result.append([rule, support[frozenset(rule.all)], confidence])

    all_result.sort(key=lambda x: str(x[0]))

    return all_result

if __name__ == '__main__':
    start_time = time.time()
    f, s = generate_frequent_and_support()
    all_result = generate_rules(f, s)
    end_time = time.time()
    print("\n-----")
    RULES SUPPORT CONFIDENCE:")
    for r in all_result:
        print(r[0], r[1], r[2])
    print("\n-----")
    ----- RUNNING TIME:")
    print(str(end_time - start_time) + "s")

```