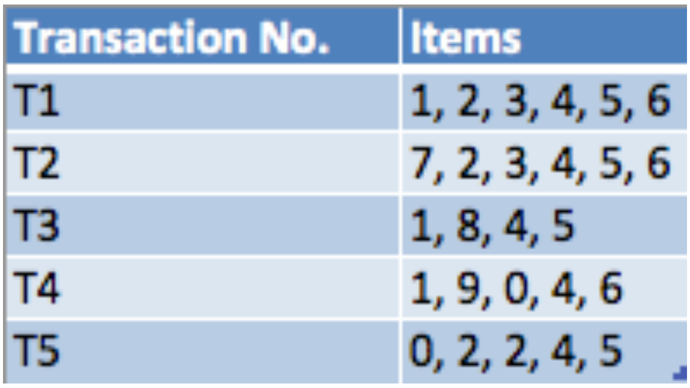
Frequent ItemSets : Apriori Algorithm and Example Part I

This is the starting for our new Tutorial Topic, "Data Mining". Apriori Algorithm is one of the classic algorithm used in Data Mining to find association rules. An initial reading to Apriori might look complex but it's not. Let me give an example and try explaining it:

Suppose we have transactions of a shopping centre as below:



Transaction No.	Items
T1	1, 2, 3, 4, 5, 6
T2	7, 2, 3, 4, 5, 6
T3	1, 8, 4, 5
T4	1, 9, 0, 4, 6
T5	0, 2, 2, 4, 5

Learning association rule means finding those items which were bought together most often i.e. single items, pair-wise items, triples etc.

So, as I mentioned earlier Apriori is a classic and the most basic algorithm when it comes to find association rules. A lot of resources are available over the internet which we can find, but here I will try to make it intuitive and easy.

Algorithm:

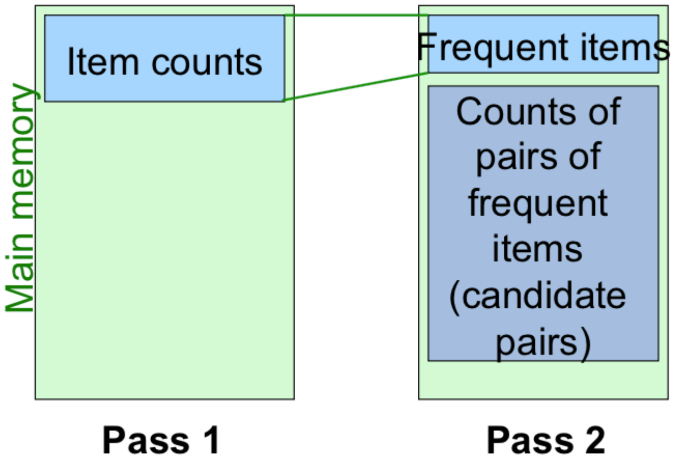
- A two-pass algorithm which limits the need for main memory.
- One of the **Key Idea** behind Apriori is **Monotonicity:** If a set of items I appear at least *s* times, so does every ***subset J*** of ***I.***

Pass 1: Read the baskets and count in main memory the occurrence/frequency of each item.

After the Pass 1, is completed, check the count for each item. And, if the count of item is more than equal to s i.e. Count(i) >= s, then the item i is frequent. Save this for next pass.

Pass 2: Read baskets again and count in main memory the occurrence/frequency of pair of items formed using the frequent items (which we got from Pass 1).

After Pass 2 end, check for the count of each pair of item and if more than equal to s, the pair if considered to be frequent, i.e. Cunt(i, j) >= s.

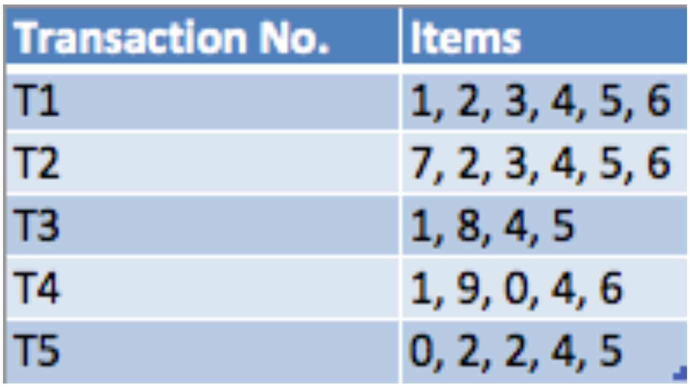


Example:

We will consider few things:

- Our Support or threshold is 3.

Our Transaction Table:



Transaction No.	Items
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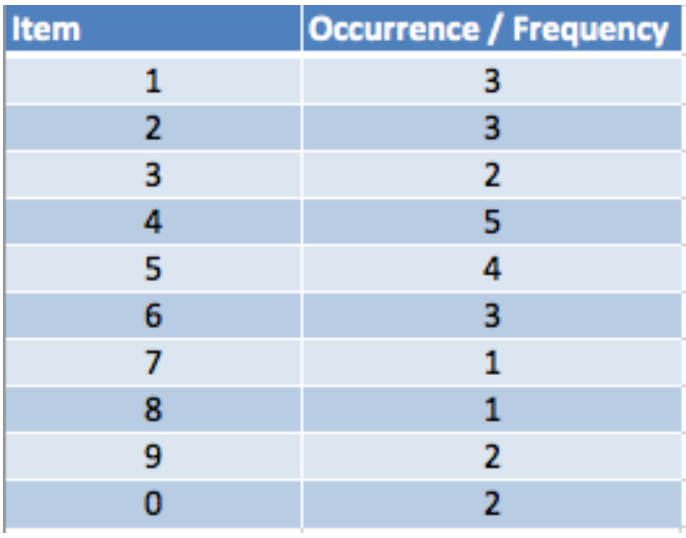
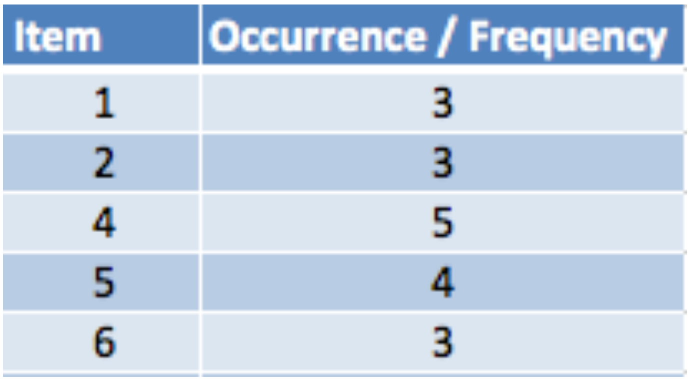
T5	0, 2, 2, 4, 5

Step 1: Count the occurrence of each item.



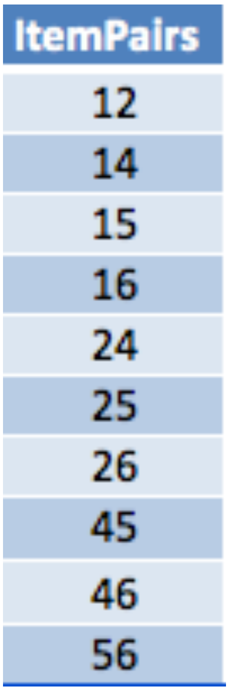
Item	Occurrence / Frequency
1	3
2	3
3	2
4	5
5	4
6	3
7	1
8	1
9	2
0	2

Step 2: Remember, the algorithm says, an item is considered to be frequent if it's bought more then the Support/Threshold i.e. 3. Therefore, below is the list of Frequent Singletons.



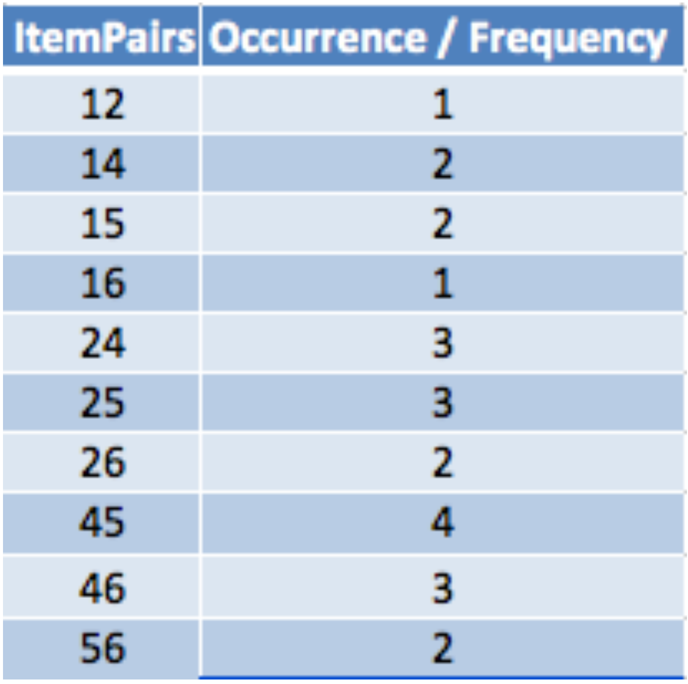
Item	Occurrence / Frequency
1	3
2	3
4	5
5	4
6	3

Step 3: We start making pairs out of the frequent itemsets we got in the above step.



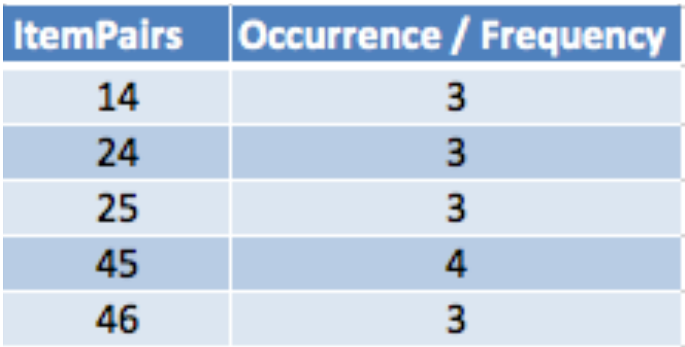
ItemPairs
12
14
15
16
24
25
26
45
46
56

Step 4: After getting the frequent Item Pairs, we start counting the occurrence of these pairs in the Transaction Set.



ItemPairs	Occurrence / Frequency
12	1
14	2
15	2
16	1
24	3
25	3
26	2
45	4
46	3
56	2

Step 5: Now again, follow the Golden Rule, and discard non-frequent paris.



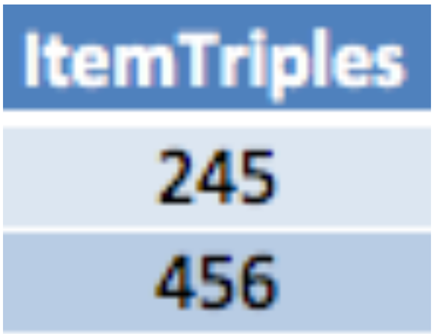
ItemPairs	Occurrence / Frequency
14	3
24	3
25	3
45	4
46	3

Now we have a table with pair of frequent items. Suppose we want to find frequent triplets. We the above table and make all the possible combinations.

Step 6: Make combinations of triples using the frequent Item pairs.

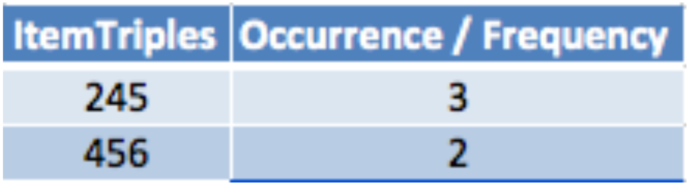
To make triples, the rule is: IF 12 and 13 are frequent, then the triple would be **123**. Similarly, if 24 and 26 then triple would be **246**.

So, using the above logic and our Frequent ItemPairs table, we get the below triples:



ItemTriples
245
456

Step 7: Get the count of the above triples (Candidates).



ItemTriples	Occurrence / Frequency
245	3
456	2

After, this, if we can find quartets, then we find those and count their occurrence/frequency.

If we had 123, 124, 134, 135, 234 and we wanted to generate a quartet then it would be 1234 and 1345. And after finding quartet we would have again got their count of occurrence /frequency and repeated the same also, until the Frequent ItemSet is null.

Thus, the frequent ItemSets are:

- Frequent Itemsets of Size 1: 1, 2, 4, 5, 6

- Frequent Itemsets of Size 2: 14, 24, 25, 45, 46

- Frequent Itemsets of Size 3: 245

To know more about how good the association rule formed is, i.e. calculating the confidence and explanation of support, please click here for the Part II of this.