

# Data Mining

## 資料探勘

FP-Growth Example

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IKM

# Explain the idea by using an example

2

TID	Items
1	Milk, Bread, Beer
2	Bread, Coffee
3	Bread, Egg
4	Milk, Bread, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Milk, Bread, Egg, Beer
9	Milk, Bread, Egg

**minsup = 2**

Find each item with its corresponding frequency

**FIRST SCAN!**

Sort the list in decreasing order!

Milk : 6	Bread : 7	Beer : 2	Coffee : 2	Egg : 6
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# Save the data into a data structure (FP-Tree)

3

Create the root of the tree, labeled with “null”

Sort the items of each transaction

TID	Items
1	Bread, Milk, Beer
2	Bread, Coffee
3	Bread, Egg
4	Bread, Milk, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Bread, Milk, Egg, Beer
9	Bread, Milk, Egg

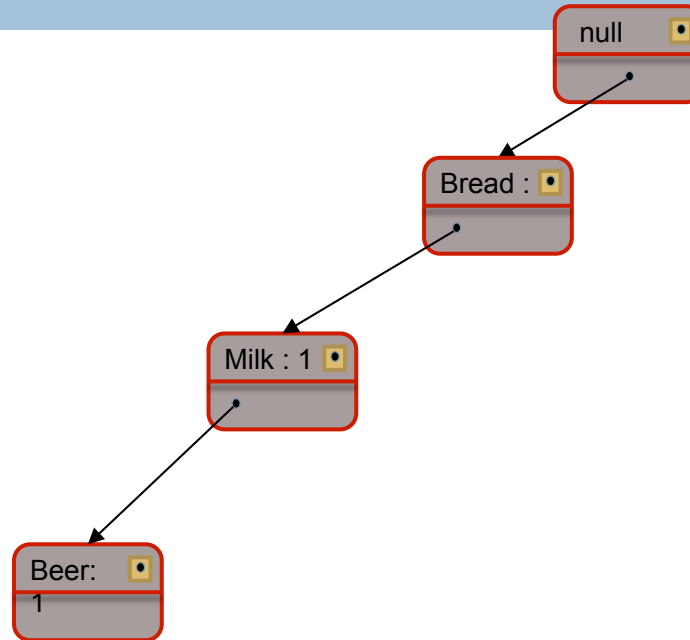


**minsup = 2**

# Save the data into a data structure (FP-Tree)

4

TID	Items
1	Bread, Milk, Beer
2	Bread, Coffee
3	Bread, Egg
4	Bread, Milk, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Bread, Milk, Egg, Beer
9	Bread, Milk, Egg

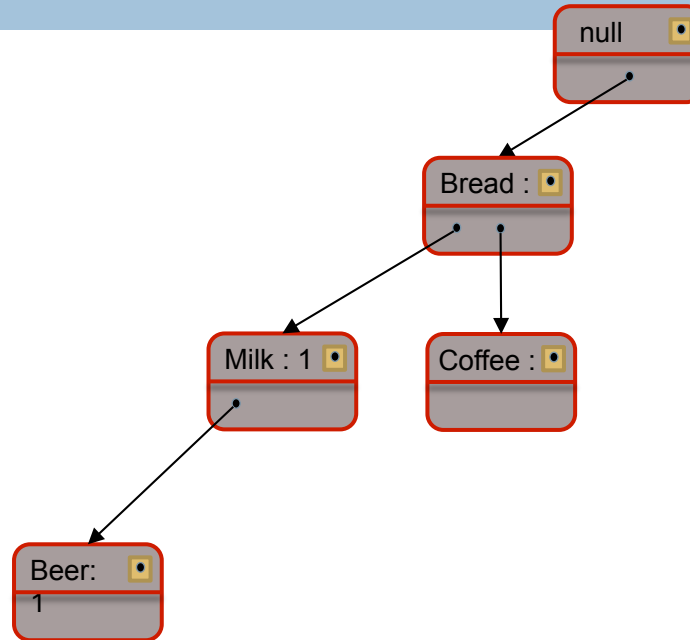


**minsup = 2**

# Save the data into a data structure (FP-Tree)

5

TID	Items
1	Bread, Milk, Beer
2	Bread, Coffee
3	Bread, Egg
4	Bread, Milk, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Bread, Milk, Egg, Beer
9	Bread, Milk, Egg

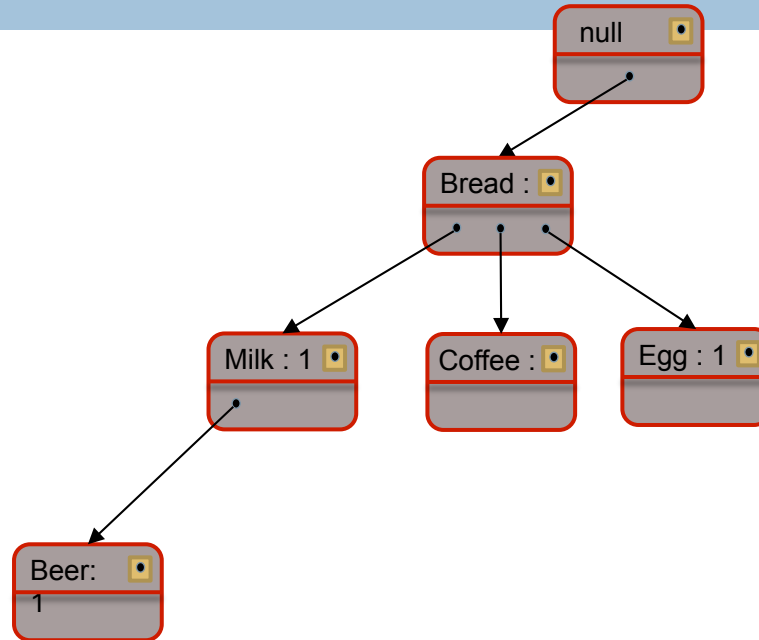


**minsup = 2**

# Save the data into a data structure (FP-Tree)

6

TID	Items
1	Bread, Milk, Beer
2	Bread, Coffee
3	Bread, Egg
4	Bread, Milk, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Bread, Milk, Egg, Beer
9	Bread, Milk, Egg

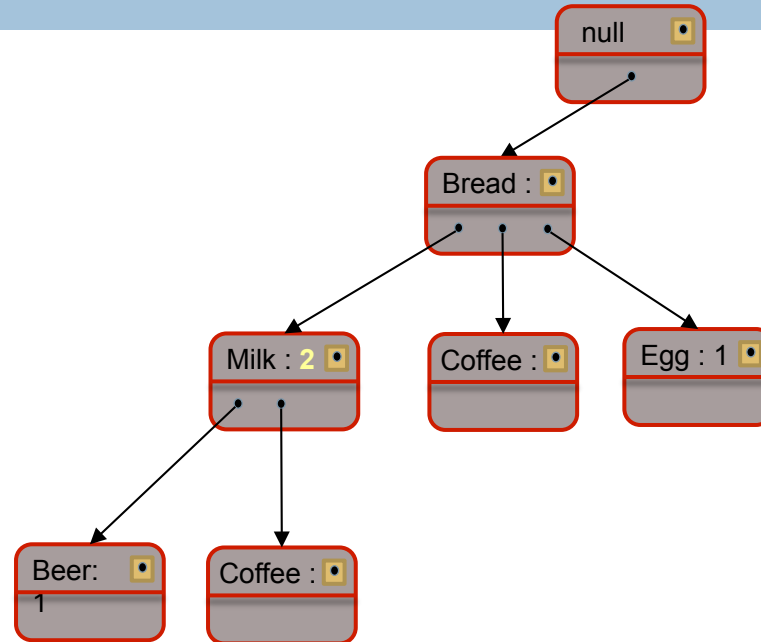


**minsup = 2**

# Save the data into a data structure (FP-Tree)

7

TID	Items
1	Bread, Milk, Beer
2	Bread, Coffee
3	Bread, Egg
4	Bread, Milk, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Bread, Milk, Egg, Beer
9	Bread, Milk, Egg

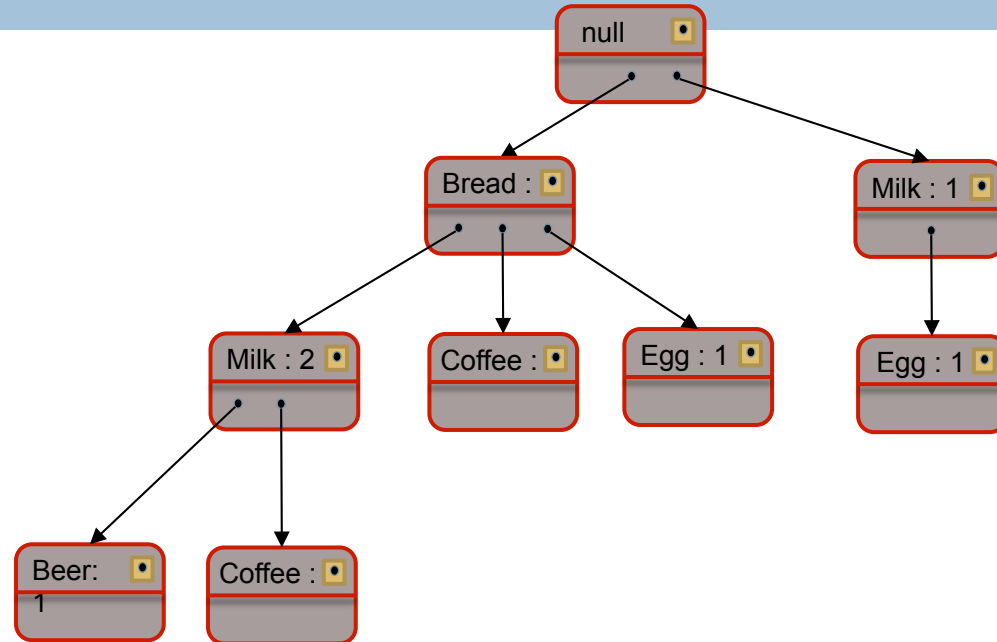


**minsup = 2**

# Save the data into a data structure (FP-Tree)

8

TID	Items
1	Bread, Milk, Beer
2	Bread, Coffee
3	Bread, Egg
4	Bread, Milk, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Bread, Milk, Egg, Beer
9	Bread, Milk, Egg



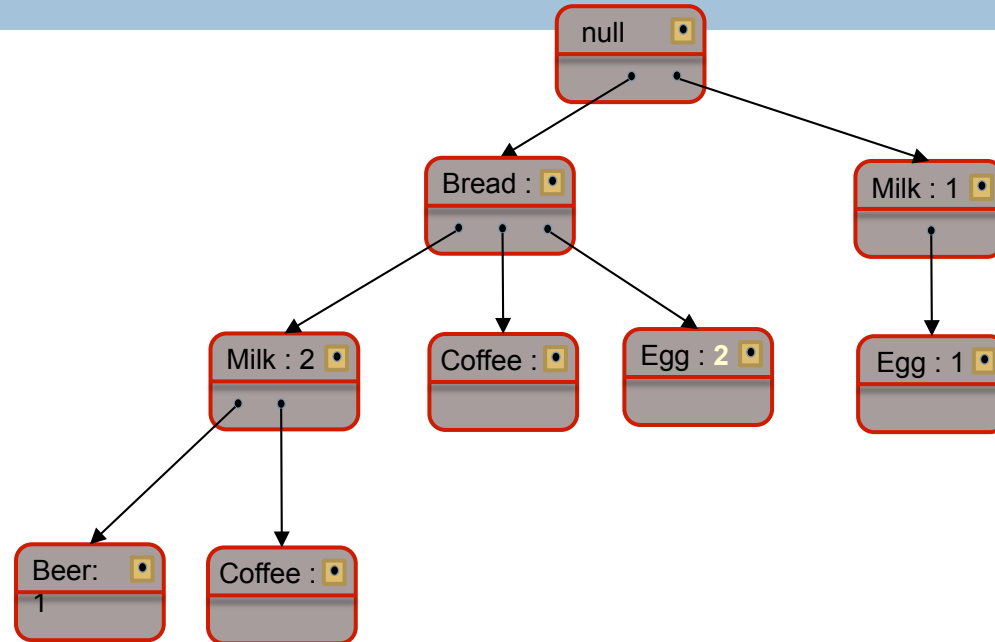
**minsup = 2**



# Save the data into a data structure (FP-Tree)

9

TID	Items
1	Bread, Milk, Beer
2	Bread, Coffee
3	Bread, Egg
4	Bread, Milk, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Bread, Milk, Egg, Beer
9	Bread, Milk, Egg

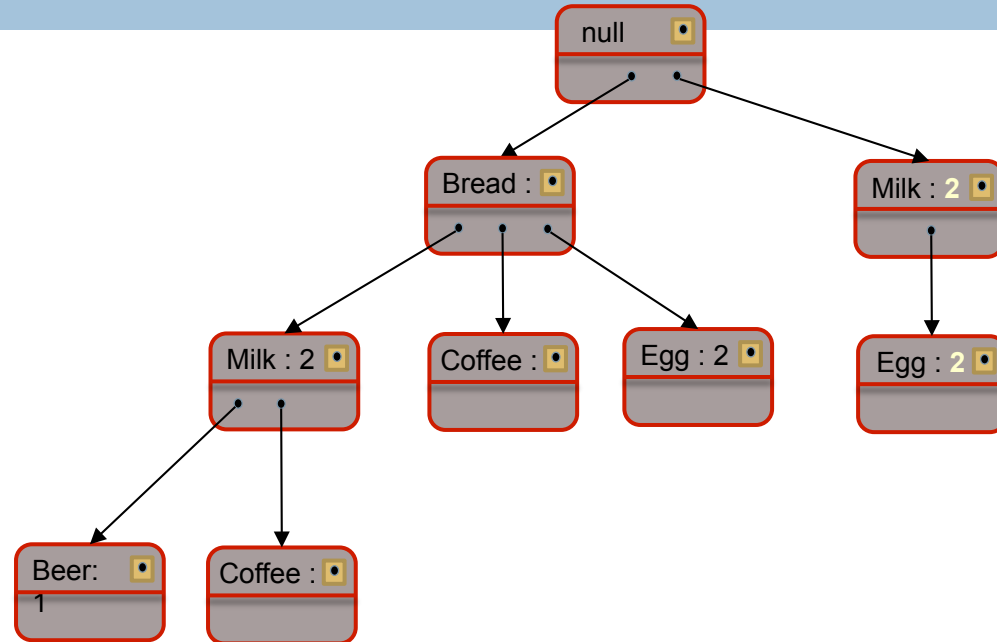


**minsup = 2**

# Save the data into a data structure (FP-Tree)

10

TID	Items
1	Bread, Milk, Beer
2	Bread, Coffee
3	Bread, Egg
4	Bread, Milk, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Bread, Milk, Egg, Beer
9	Bread, Milk, Egg

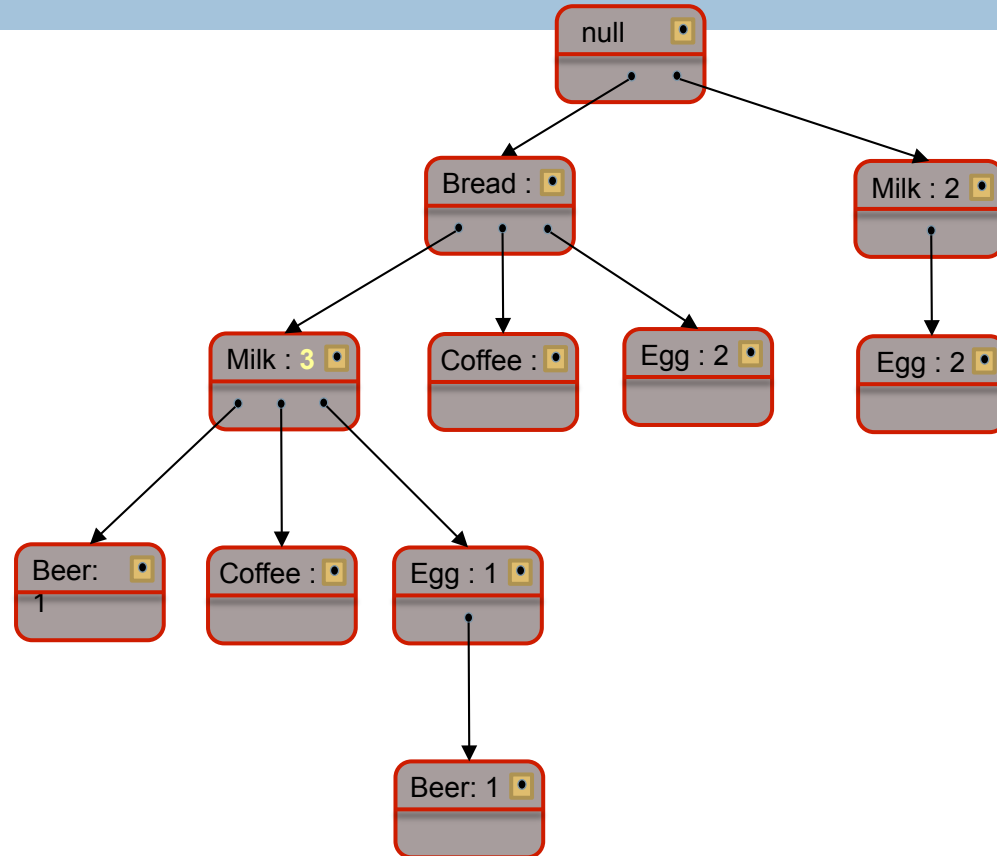


**minsup = 2**

# Save the data into a data structure (FP-Tree)

11

TID	Items
1	Bread, Milk, Beer
2	Bread, Coffee
3	Bread, Egg
4	Bread, Milk, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Bread, Milk, Egg, Beer
9	Bread, Milk, Egg

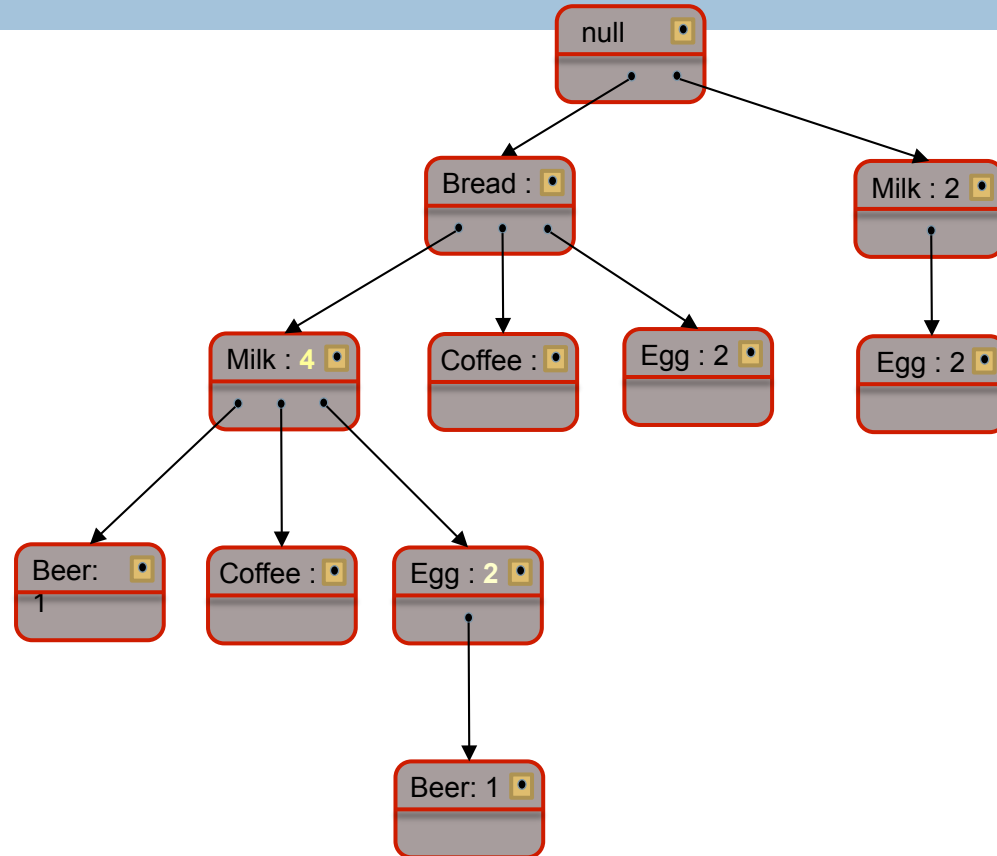


**minsup = 2**

# Save the data into a data structure (FP-Tree)

12

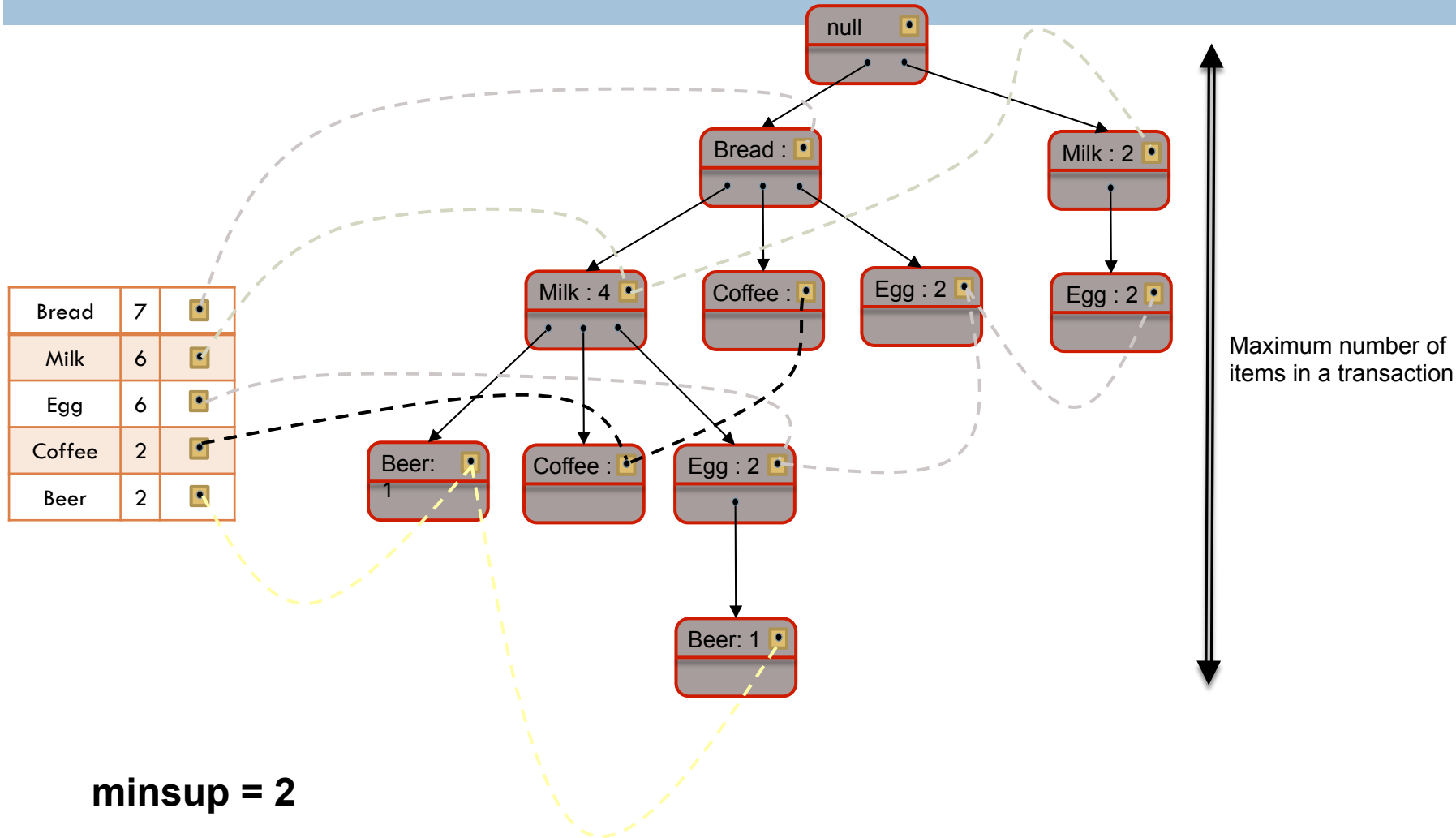
TID	Items
1	Bread, Milk, Beer
2	Bread, Coffee
3	Bread, Egg
4	Bread, Milk, Coffee
5	Milk, Egg
6	Bread, Egg
7	Milk, Egg
8	Bread, Milk, Egg, Beer
9	Bread, Milk, Egg



**minsup = 2**

# Save the data into a data structure (FP-Tree)

13



# FP-Tree Mining

14

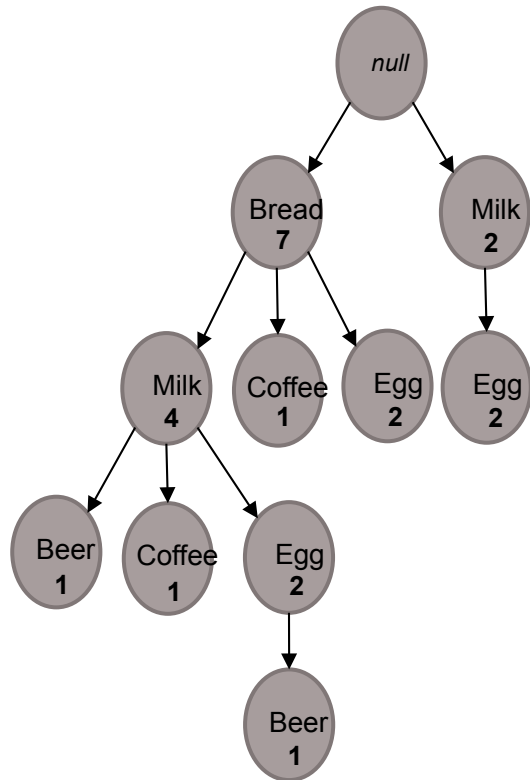
Bread :  
7

Milk : 6

Egg : 6

Coffee :  
2

Beer : 2



**minsup = 2**

**Start from frequent pattern with the lowest frequency in the list**

**For each item  $i$  in the list:**

**Extract suffix patterns of paths to the item  $i$**

**Construct its Conditional Pattern Base**

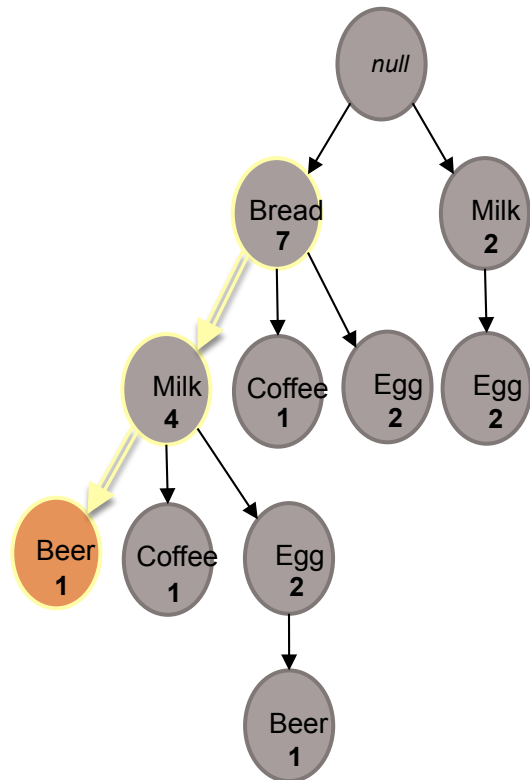
**The pattern growth is achieved by the concatenation of the suffix pattern with the frequent patterns generated from a Conditional Pattern Base**



# FP-Tree Mining

15

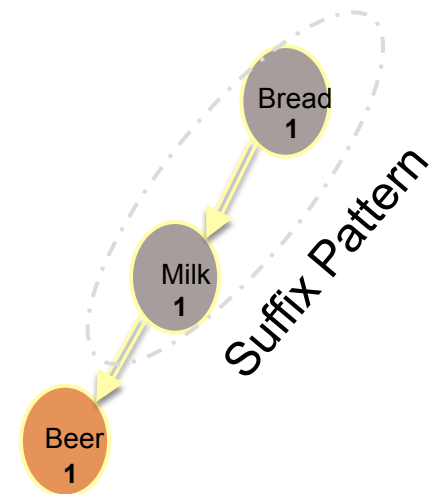
Bread : 7	Milk : 6	Egg : 6	Coffee : 2	Beer : 2
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minsup = 2

Find all paths to **Beer**

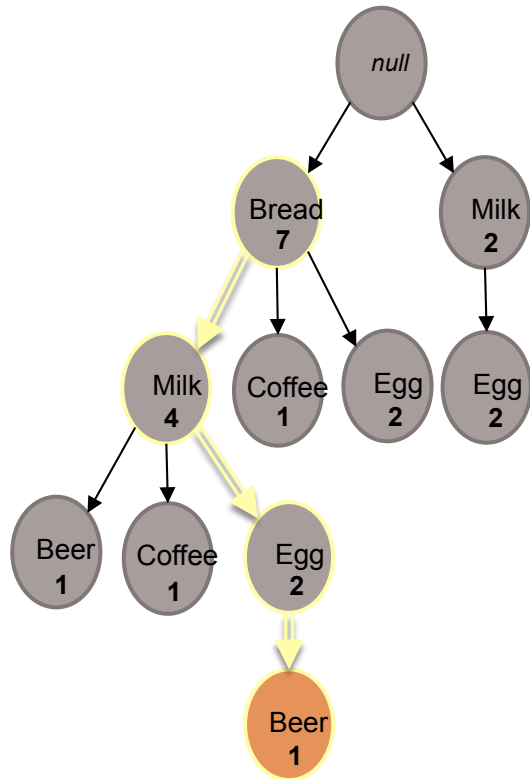
Path No.1 (Bread, Milk, Beer): 1



# FP-Tree Mining

16

Bread : 7	Milk : 6	Egg : 6	Coffee : 2	Beer : 2
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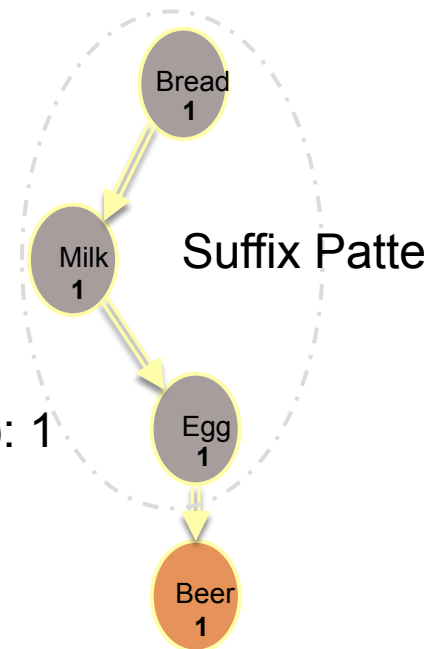


minsup = 2

Find all paths to **Beer**

Path No.1 (Bread, Milk, Beer): 1

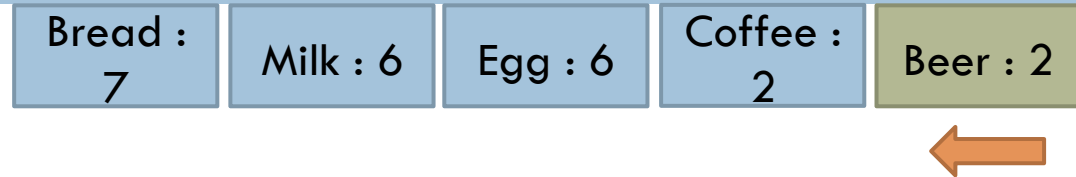
Path No.2 (Bread, Milk, Egg, Beer): 1



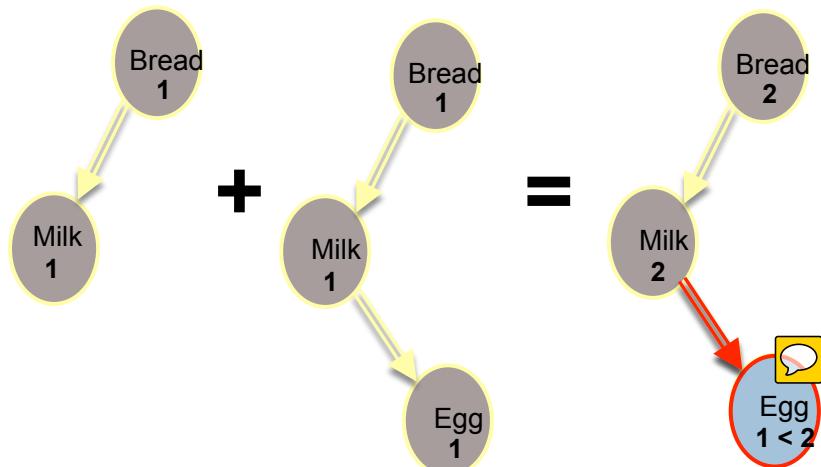


# FP-Tree Mining

17



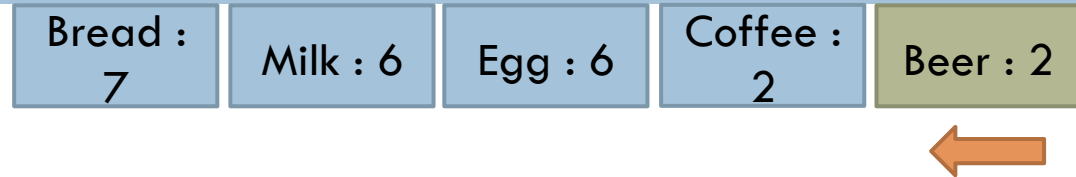
Combination of suffix patterns



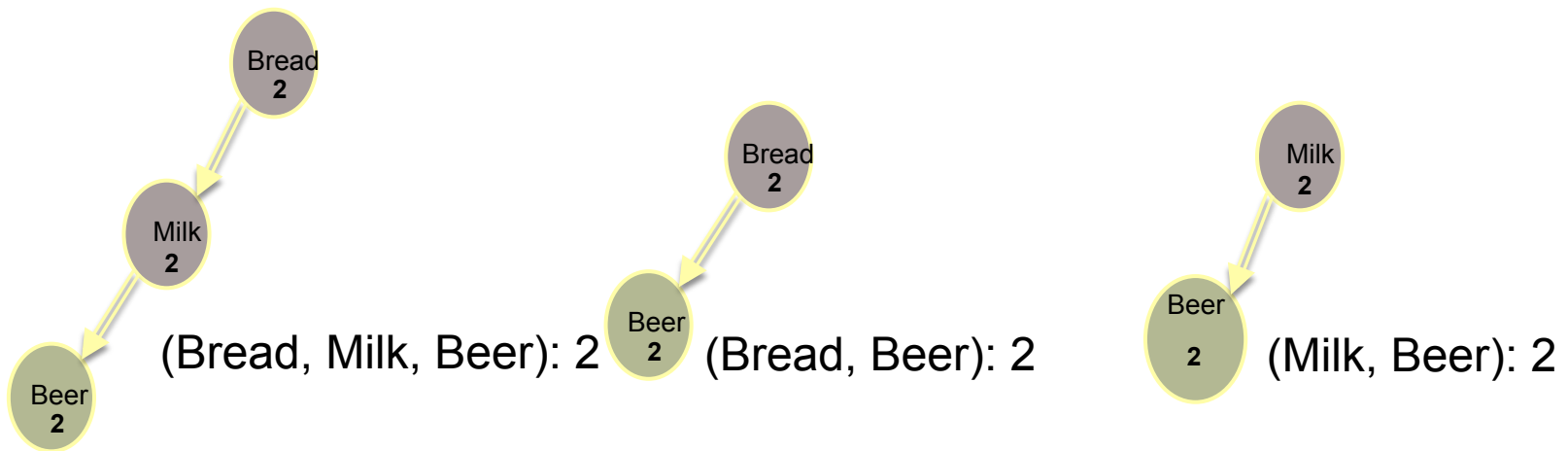
Conditional Pattern Base

# FP-Tree Mining

18



All possible combination of Conditional Pattern Base with the frequent item

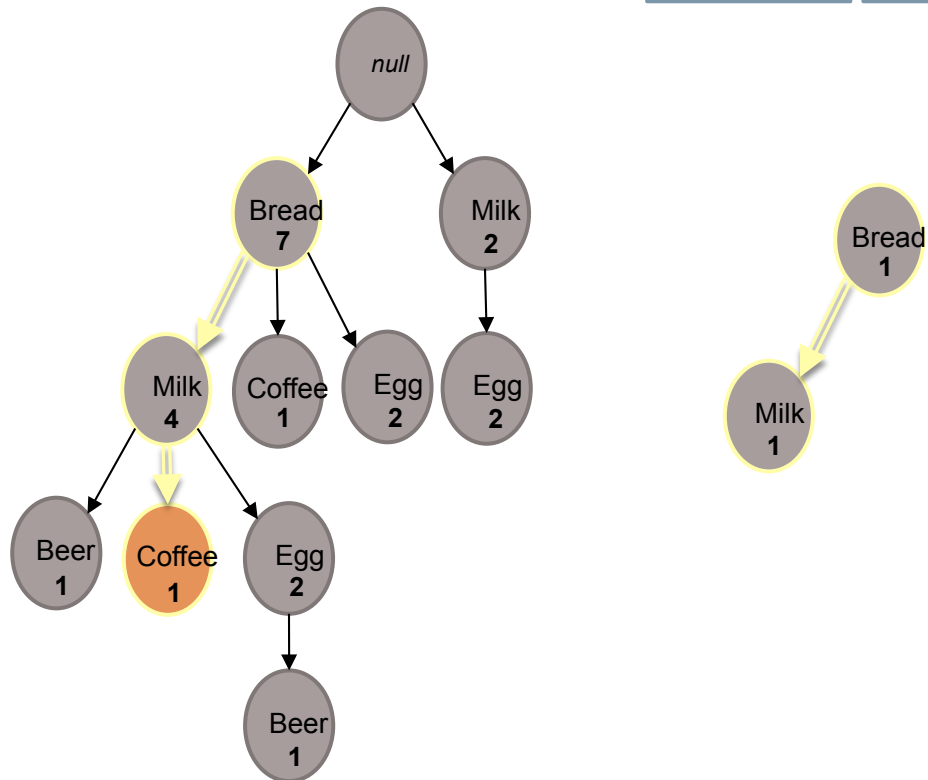


**minsup = 2**

# FP-Tree Mining

19

Bread : 7	Milk : 6	Egg : 6	Coffee : 2	Beer : 2
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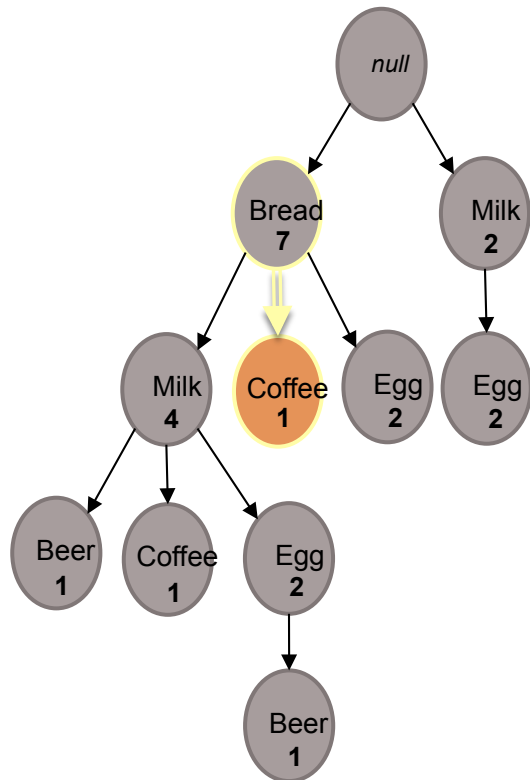


**minsup = 2**

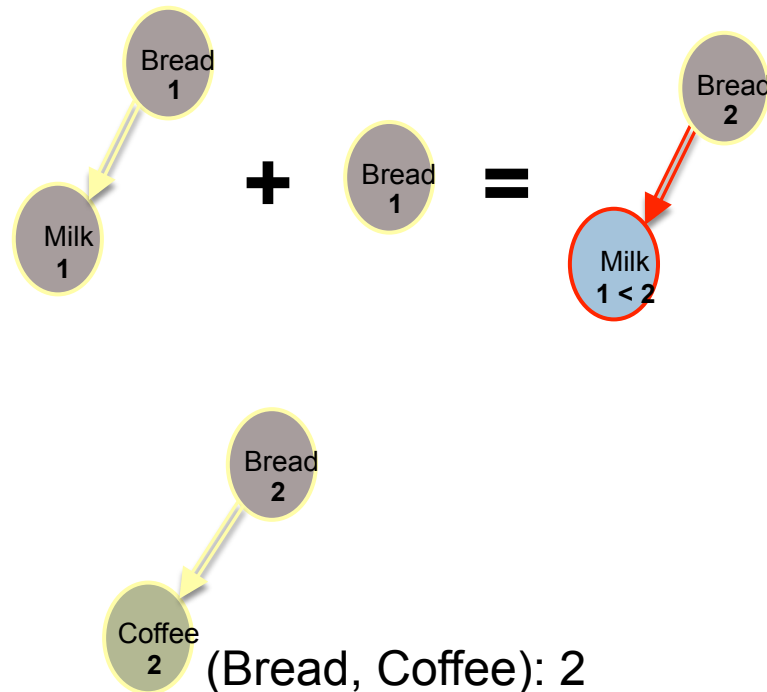
# FP-Tree Mining

20

Bread : 7	Milk : 6	Egg : 6	Coffee : 2	Beer : 2
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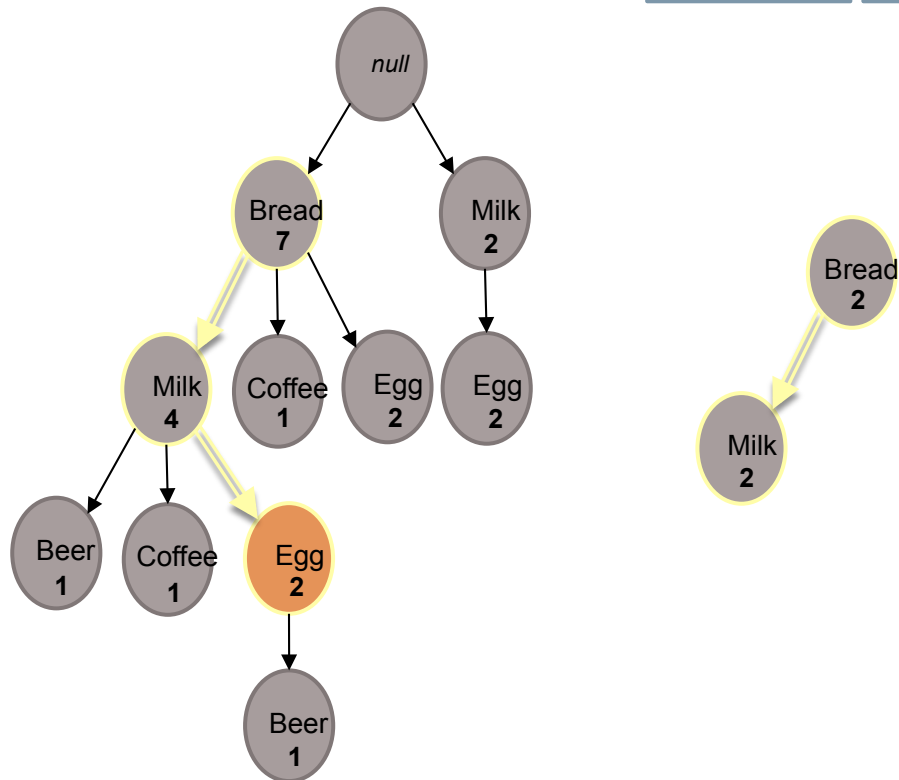
**minsup = 2**



# FP-Tree Mining

21

Bread : 7	Milk : 6	Egg : 6	Coffee : 2	Beer : 2
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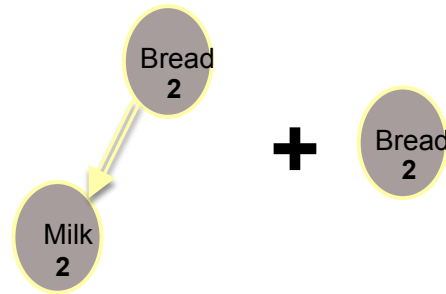
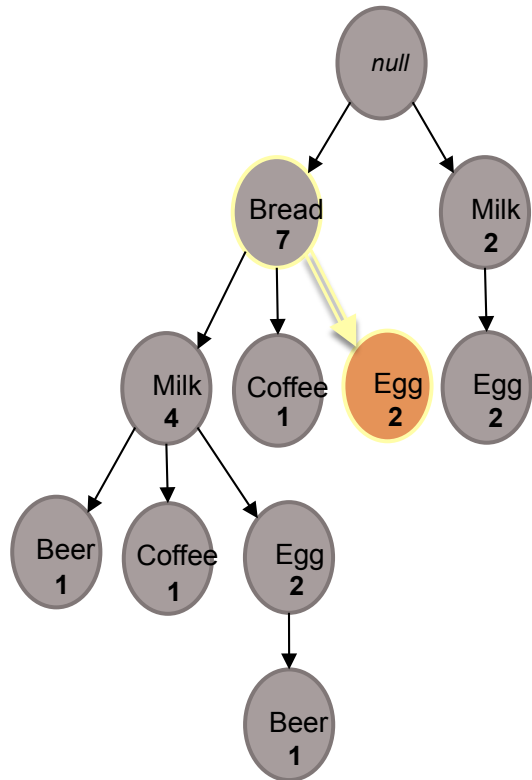


**minsup = 2**

# FP-Tree Mining

22

Bread : 7	Milk : 6	Egg : 6	Coffee : 2	Beer : 2
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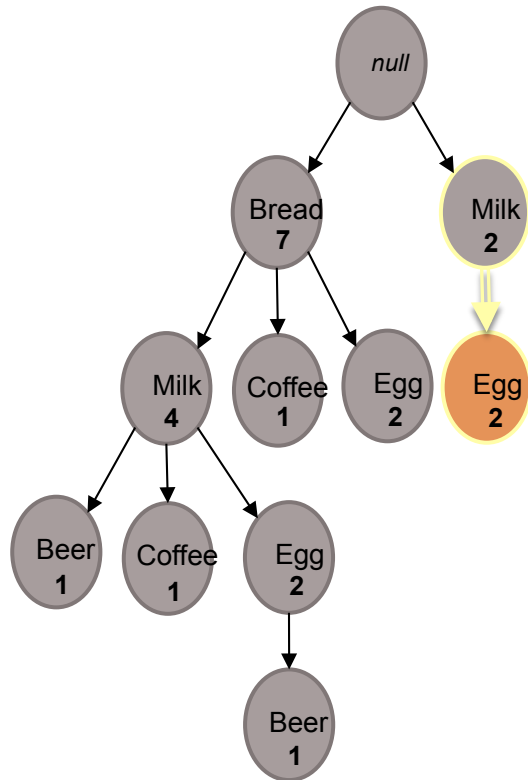


**minsup = 2**

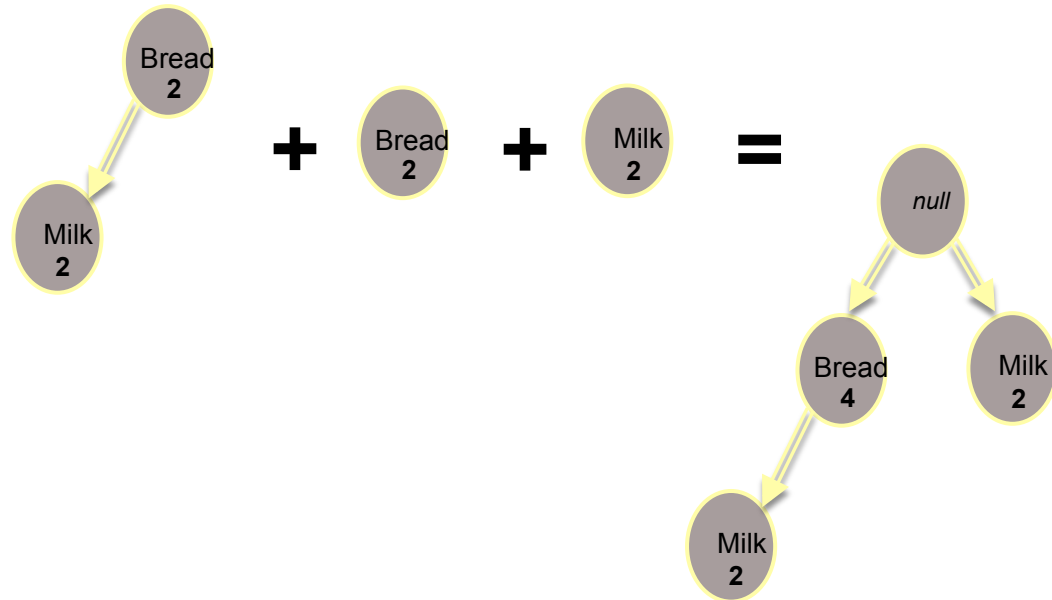
# FP-Tree Mining

23

Bread : 7	Milk : 6	Egg : 6	Coffee : 2	Beer : 2
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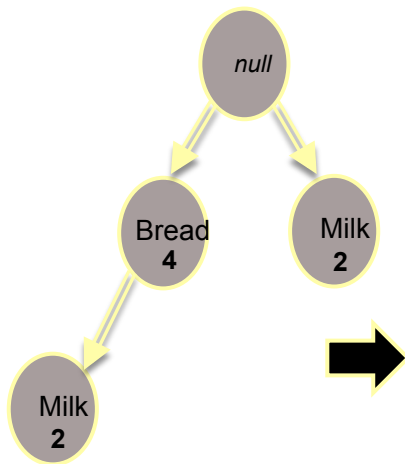
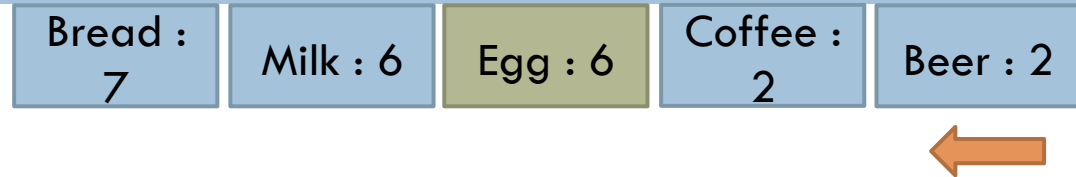


minsup = 2

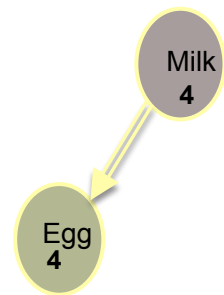


# FP-Tree Mining

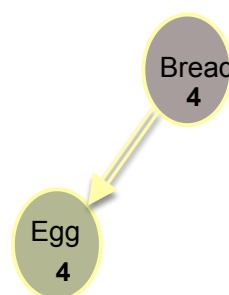
24



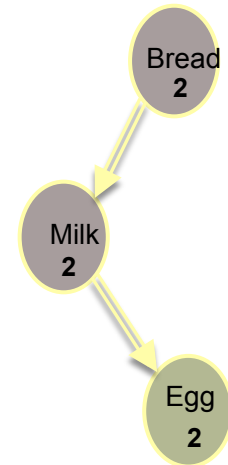
(Milk, Egg): 4



(Bread, Egg): 4



(Bread, Milk, Egg): 2

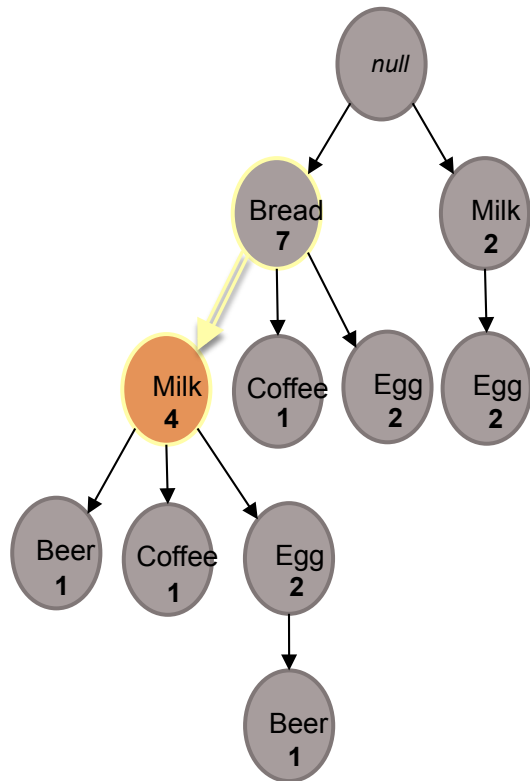




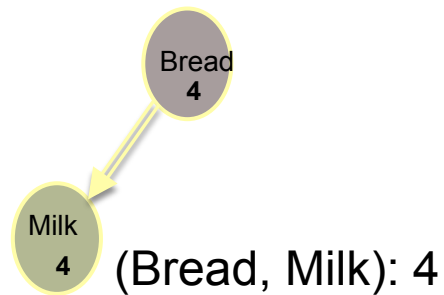
# FP-Tree Mining

25

Bread : 7	Milk : 6	Egg : 6	Coffee : 2	Beer : 2
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**minsup = 2**



# Frequent Patterns

26

(Bread, Milk, Beer): **2**

(Bread, Beer): **2**

(Milk, Beer): **2**

(Bread, Coffee): **2**

(Milk, Egg): **4**

(Bread, Egg): **4**

(Bread, Milk, Egg): **2**

(Bread, Milk): **4**

(Beer): **2**

(Coffee): **2**

(Egg): **6**

(Milk): **6**

(Bread): **6**