

The background features a complex, abstract design. It includes a network of red lines connecting green dots, resembling a graph or a molecular structure. There are also faint, repeating patterns of small symbols (like arrows and plus signs) and a grid of small crosses. A large, light-colored, angular shape is positioned behind the title text.

# **Mining Multiple-Level Associations**

# Mining Multiple-Level Frequent Patterns

- Items often form hierarchies

- Ex.: Dairyland 2% milk;  
Wonder wheat bread

- How to set min-support thresholds?

- Uniform min-support across multiple levels (reasonable?)

- Level-reduced min-support: Items at the lower level are expected to have lower support

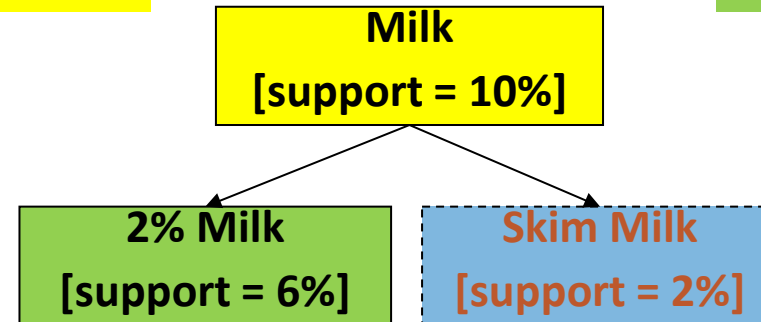
- Efficient mining: *Shared* multi-level mining

- Use the lowest min-support to pass down the set of candidates

## Uniform support

Level 1  
min\_sup = 5%

Level 2  
min\_sup = 5%



## Reduced support

Level 1  
min\_sup = 5%

Level 2  
min\_sup = 1%

# Redundancy Filtering at Mining Multi-Level Associations

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- ❑ Multi-level association mining may generate many redundant rules

- ❑ Redundancy filtering: Some rules may be redundant due to “ancestor” relationships between items

(Suppose the 2% milk sold is about  $\frac{1}{4}$  of milk sold in gallons)

- ❑ milk  $\Rightarrow$  wheat bread [support = 8%, confidence = 70%] (1)
- ❑ 2% milk  $\Rightarrow$  wheat bread [support = 2%, confidence = 72%] (2)
- ❑ A rule is *redundant* if its support is close to the “expected” value, according to its “ancestor” rule, and it has a similar confidence as its “ancestor”
  - ❑ Rule (1) is an ancestor of rule (2), which one to prune?

# Customized Min-Supports for Different Kinds of Items

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- ❑ We have used the same min-support threshold for all the items or item sets to be mined in each association mining
- ❑ In reality, some items (e.g., diamond, watch, ...) are valuable but less frequent
- ❑ It is necessary to have customized min-support settings for different kinds of items
- ❑ One Method: Use **group-based “individualized” min-support**
  - ❑ E.g., {diamond, watch}: 0.05%; {bread, milk}: 5%; ...
  - ❑ How to mine such rules efficiently?
    - ❑ Existing scalable mining algorithms can be easily extended to cover such cases