Tutorial 3B

Association Rules Mining
Answers to Q 6 & 7

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1

- Apply the Apriori algorithm to find all itemsets with support >= 0.2 from the following data:

Transaction	Items in Transaction
101	Milk, Bread, Eggs
102	Milk, Juice
103	Juice, Butter
104	Milk, Bread, Eggs
105	Coffee, Eggs
106	Coffee
107	Coffee, Juice
108	Milk, Bread, Cookies, Eggs
109	Cookies, Butter
110	Milk, Bread

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2

- Apriori Principle Step 1: Count up the occurrences of 1 item:

Itemset	Count
Milk	5
Bread	4
Eggs	4
Juice	3
Butter	2
Coffee	3
Cookies	2

*Note: since it is out of 10, 0.2 support means if it appears twice in the list.

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- Apriori Principle Step 2: Look for frequent occurrences of 2 items (in bold, not strikethrough):

Itemset	Count
Milk, Bread	4
Milk, Eggs	3
~~Milk, Juice~~	~~1~~
~~Milk, Cookies~~	~~1~~
Bread, Eggs	3
~~Bread, Cookies~~	~~1~~
~~Eggs, Coffee~~	~~1~~
~~Eggs, Cookies~~	~~1~~
~~Juice, Butter~~	~~1~~
~~Juice, Coffee~~	~~1~~
~~Butter, Cookies~~	~~1~~

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- Apriori Principle Step 3: Look for frequent occurrences of 3 items (in bold, not strikethrough):

Itemset	Count
Milk, Bread, Eggs	3

Therefore, the most frequent and highest itemset {**Milk, Bread, Eggs**}.

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5

- Using the data set in question 2 (**{Milk, Bread, Eggs}**), find all the association rules with support >= 0.2 and confidence >= 0.8.

- "{Milk, Bread} -> Eggs" where {Milk, Bread} is X and Eggs is Y.
- Support = {itemset (X and Y)}/transactions
- Confidence = {itemset (X and Y)}/{itemset (X)}
- To do this, we check each permutation of the association rules.

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Association Rules for {Milk, Bread, Eggs}:

{Milk, Bread} -> {Eggs}
Support =
Confidence =

{Milk Eggs} -> {Bread}
Support =
Confidence =

{Eggs, Bread} -> {Milk}
Support =
Confidence =

Transaction	Items in Transaction
1	**Milk, Bread, Eggs**
2	Milk, Juice
3	Juice, Butter
4	**Milk, Bread, Eggs**
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	**Milk, Bread, Cookies, Eggs**
9	Cookies, Butter
10	**Milk, Bread**

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Association Rules for {Milk, Bread, Eggs}:

~~{Milk, Bread} -> {Eggs}~~
~~Support = 3/10 = 0.3~~
~~Confidence = 3/4 = 0.75~~

{Milk Eggs} -> {Bread}
Support =
Confidence =

{Eggs, Bread} -> {Milk}
Support =
Confidence =

Transaction	Items in Transaction
1	**Milk, Bread, Eggs**
2	Milk, Juice
3	Juice, Butter
4	**Milk, Bread, Eggs**
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	**Milk, Bread, Cookies, Eggs**
9	Cookies, Butter
10	**Milk, Bread**

8

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Association Rules for {Milk, Bread, Eggs}:

~~{Milk, Bread} -> {Eggs}~~
~~Support = 3/10 = 0.3~~
~~Confidence = 3/4 = 0.75~~

{Milk Eggs} -> {Bread}
Support = 3/10 = 0.3
Confidence = 3/3 = 1

{Eggs, Bread} -> {Milk}
Support =
Confidence =

Transaction	Items in Transaction
1	**Milk, Bread, Eggs**
2	Milk, Juice
3	Juice, Butter
4	**Milk, Bread, Eggs**
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	**Milk, Bread, Cookies, Eggs**
9	Cookies, Butter
10	**Milk, Bread**

9

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Association Rules for {Milk, Bread, Eggs}:

~~{Milk, Bread} -> {Eggs}~~
~~Support = 3/10 = 0.3~~
~~Confidence = 3/4 = 0.75~~

{Milk Eggs} -> {Bread}
Support = 3/10 = 0.3
Confidence = 3/3 = 1

{Eggs, Bread} -> {Milk}
Support = 3/10 = 0.3
Confidence = 3/3 = 1

Transaction	Items in Transaction
1	**Milk, Bread, Eggs**
2	Milk, Juice
3	Juice, Butter
4	**Milk, Bread, Eggs**
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	**Milk, Bread, Cookies, Eggs**
9	Cookies, Butter
10	**Milk, Bread**

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Association Rules for {Milk, Bread}:

{Milk} -> {Bread}
Support =
Confidence =

{Bread} -> {Milk}
Support =
Confidence =

Transaction	Items in Transaction
1	**Milk, Bread, Eggs**
2	**Milk, Juice**
3	Juice, Butter
4	**Milk, Bread, Eggs**
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	**Milk, Bread, Cookies, Eggs**
9	Cookies, Butter
10	**Milk, Bread**

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Association Rules for {Milk, Bread}:

{Milk} -> {Bread}
Support = 4/10 = 0.4
Confidence = 4/5 = 0.8

{Bread} -> {Milk}
Support =
Confidence =

Transaction	Items in Transaction
1	**Milk, Bread, Eggs**
2	**Milk, Juice**
3	Juice, Butter
4	**Milk, Bread, Eggs**
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	**Milk, Bread, Cookies, Eggs**
9	Cookies, Butter
10	**Milk, Bread**

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Association Rules for {Milk, Bread}:

{Milk} -> {Bread}
Support = 4/10 = 0.4
Confidence = 4/5 = 0.8

{Bread} -> {Milk}
Support = 4/10 = 0.4
Confidence = 4/4 = 1

Transaction	Items in Transaction
1	Milk, Bread, Eggs
2	Milk, Juice
3	Juice, Butter
4	Milk, Bread, Eggs
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	Milk, Bread, Cookies, Eggs
9	Cookies, Butter
10	Milk, Bread

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Association Rules for {Milk, Eggs}:

{Milk} -> {Eggs}
Support =
Confidence =

{Eggs} -> {Milk}
Support =
Confidence =

Transaction	Items in Transaction
1	Milk, Bread, Eggs
2	Milk, Juice
3	Juice, Butter
4	Milk, Bread, Eggs
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	Milk, Bread, Cookies, Eggs
9	Cookies, Butter
10	Milk, Bread

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Question 3: Applying the Apiori Algorithm

Association Rules for {Milk, Eggs}:

~~{Milk} -> {Eggs}~~
~~Support = 3/10 = 0.3~~
~~Confidence = 3/5 = 0.6~~

{Eggs} -> {Milk}
Support =
Confidence =

Transaction	Items in Transaction
1	Milk, Bread, Eggs
2	Milk, Juice
3	Juice, Butter
4	Milk, Bread, Eggs
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	Milk, Bread, Cookies, Eggs
9	Cookies, Butter
10	Milk, Bread

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Association Rules for {Milk, Eggs}:

~~{Milk} -> {Eggs}~~
~~Support = 3/10 = 0.25~~
~~Confidence = 3/5 = 0.6~~

~~{Eggs} -> {Milk}~~
~~Support = 3/10 = 0.3~~
~~Confidence = 3/4 = 0.75~~

Transaction	Items in Transaction
1	Milk, Bread, Eggs
2	Milk, Juice
3	Juice, Butter
4	Milk, Bread, Eggs
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	Milk, Bread, Cookies, Eggs
9	Cookies, Butter
10	Milk, Bread

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Association Rules for {Bread Eggs}:

{Bread} -> {Eggs}
Support =
Confidence =

{Eggs} -> {Bread}
Support =
Confidence =

Transaction	Items in Transaction
1	Milk, Bread, Eggs
2	Milk, Juice
3	Juice, Butter
4	Milk, Bread, Eggs
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	Milk, Bread, Cookies, Eggs
9	Cookies, Butter
10	Milk, Bread

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Association Rules for {Bread Eggs}:

~~{Bread} -> {Eggs}~~
~~Support = 3/10 = 0.3~~
~~Confidence = 3/4 = 0.75~~

{Eggs} -> {Bread}
Support =
Confidence =

Transaction	Items in Transaction
1	Milk, Bread, Eggs
2	Milk, Juice
3	Juice, Butter
4	Milk, Bread, Eggs
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	Milk, Bread, Cookies, Eggs
9	Cookies, Butter
10	Milk, Bread

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Association Rules for {Bread Eggs}:

~~{Bread} -> {Eggs}~~
~~Support = 3/10 = 0.25~~
~~Confidence = 3/4 = 0.75~~

~~{Eggs} -> {Bread}~~
~~Support = 3/10 = 0.3~~
~~Confidence = 3/4 = 0.75~~

Transaction	Items in Transaction
1	**Milk, Bread, Eggs**
2	Milk, Juice
3	Juice, Butter
4	**Milk, Bread, Eggs**
5	Coffee, Eggs
6	Coffee
7	Coffee, Juice
8	**Milk, Bread, Cookies, Eggs**
9	Cookies, Butter
10	**Milk, Bread**

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Therefore, the only Association Rules that satisfy the restriction of having support >= 2 and confidence >= 0.8 is:

- {Milk, Eggs} -> {Bread} (s=0.3, c=1)
- {Eggs, Bread} -> {Milk} (s=0.3, c=1)
- {Milk} -> {Bread} (s=0.4, c=0.8)
- {Bread} -> {Milk} (s=0.4, c=1)

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