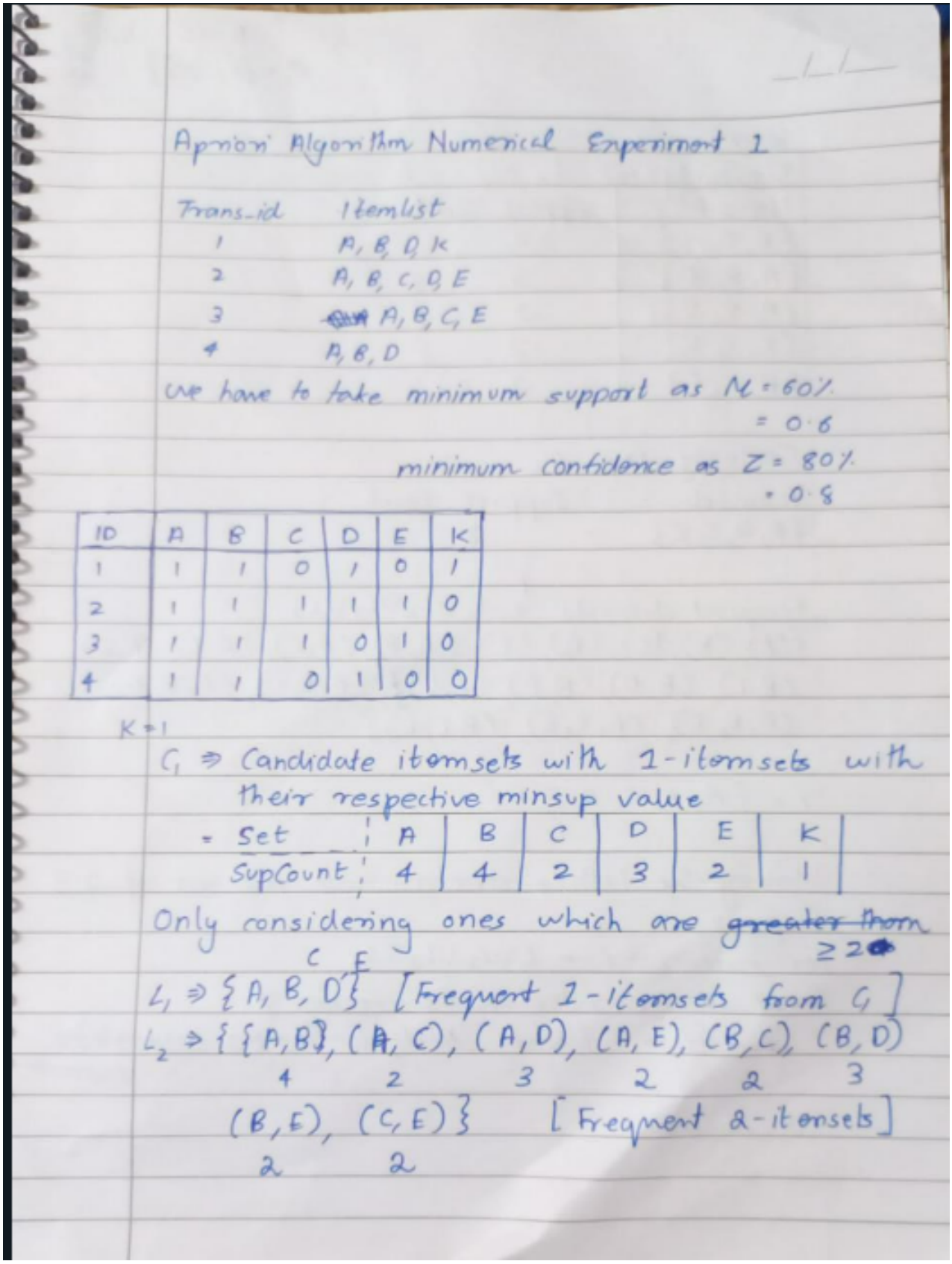
Exercise 1

Apriori for the given dataset in Canvas Numerical manual solve:



Apriori Algorithm Numerical Experiment 1

Trans_id	Itemlist
1	A, B, D, K
2	A, B, C, D, E
3	A, B, C, E
4	A, B, D

We have to take minimum support as M = 60%
= 0.6

minimum confidence as Z = 80%
= 0.8

ID	A	B	C	D	E	K
1	1	1	0	1	0	1
2	1	1	1	1	1	0
3	1	1	1	0	1	0
4	1	1	0	1	0	0

K = 1

C_1 ⇒ Candidate itemsets with 1-itemsets with their respective minsup value

Set	A	B	C	D	E	K
SupCount	4	4	2	3	2	1

Only considering ones which are ~~greater than~~ ≥ 2

L_1 ⇒ {A, B, C, D, E} [Frequent 1-itemsets from C_1]

L_2 ⇒ {{A,B}, (A, C), (A,D), (A, E), (B, C), (B, D)
4 2 3 2 2 3
(B, E), (C, E)}
2 2
[Frequent 2-itemsets]

l_2 $b \to c$ (b,c)
$M_2 = \{l \mid l \in L_2\}$ $\frac{2}{4}$

~~K=2~~

Similarly for L_3

Itemset	Support Count
{A, B, C}	2
{A, B, D}	3
{A, B, E}	2
{A, C, E}	2
{B, C, E}	2

Similarly for L_4

Itemset	Support Count
{A, B, C, E}	2

Frequent itemsets $\Rightarrow L = L_1 \cup L_2 \cup L_3 \cup L_4$
{(A), (B), (C), (D), (E), (A, B), (A, C), (A, D), (A, E), (B, C), (B, D), (B, E), (C, E)} (A, B, C), (A, B, D), (A, B, E), (A, C, E), (B, C, E)}

$i = \{A, B, C, D, E, K\}$

~~Making the lattice structure with min conf of 0.8~~
~~Steps ⇒~~
~~For each $i \in L = L_1 \cup L_2 \cup L_3 \cup L_4$~~
~~Genr all the rules in the form of~~
~~$R = \{L \to R \mid R \subset i, |R| > 1, L \cdot (i - R), \sigma(L \to R) \geq$~~
~~this conf~~

For 2-itemsets

~~Rule 1 → A → B~~

Rules	Confidence	Good Rule
A → B	1/4 = 1	[≥ 0.8] ✓
B → A	1	[≥ 0.8] ✓
A → C	0.5	×
C → A	1	[≥ 0.8] ✓
A → D	0.75	×
D → A	1	[≥ 0.8] ✓
A → E	0.5	×
E → A	1	[≥ 0.8] ✓
B → C	0.5	×
C → B	1	[≥ 0.8] ✓
B → D	0.75	×
D → B	1	[≥ 0.8] ✓
B → E	0.5	×
C → E	1	[≥ 0.8] ✓
E → B	1	[≥ 0.8] ✓

As we can see a total of 9 rules with one item in the head

Some will be repeated for other rules and ~~the number~~ some of the other best rules are

b, d → a Confidence 1

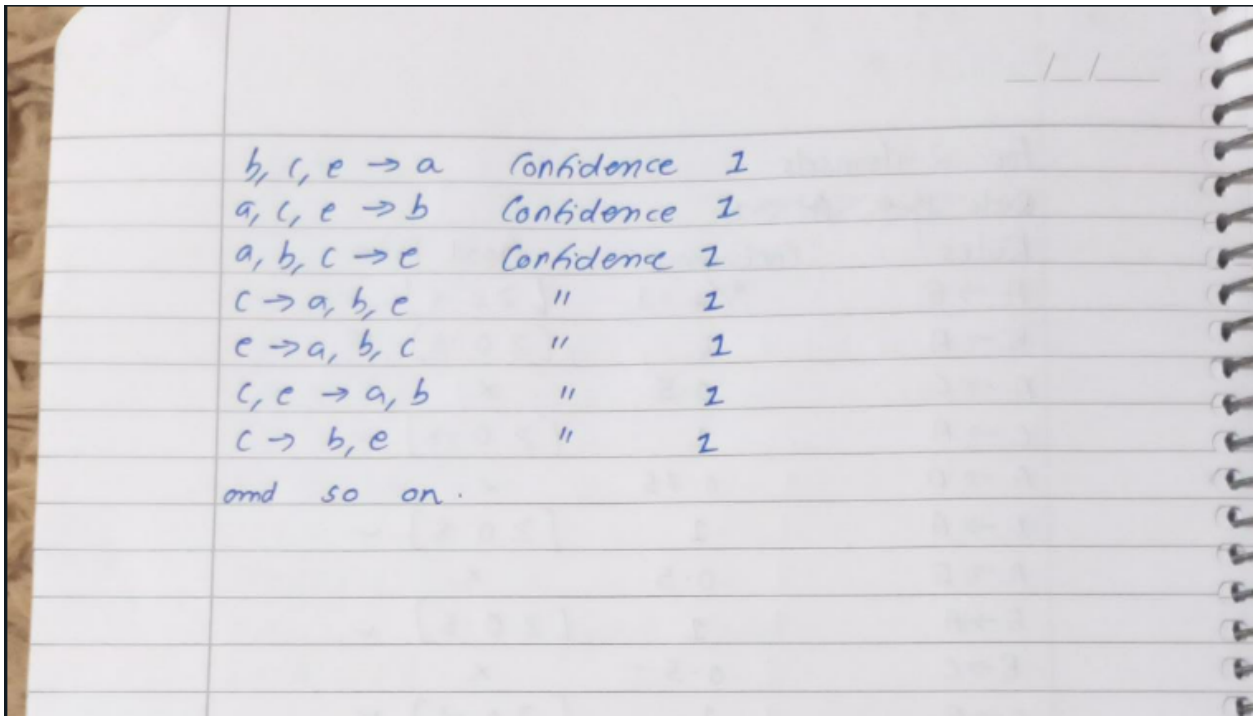
a, d → b Confidence 1

d → a, b Confidence 1

b, c → a Confidence 1

a, c → b Confidence 1

~~and so on.~~



Exercise 2

Apriori for the given dataset in Canvas

The 'database' below has four transactions. What association rules can be found in this set, if the minimum support (i.e coverage) is 60% and the minimum confidence (i.e. accuracy) is 80% ?

Trans_id	Itemlist
T1	{K, A, D, B}
T2	{D, A C, E, B}
T3	{C, A, B, E}
T4	{B, A, D}

Solution:

Data in Weka:

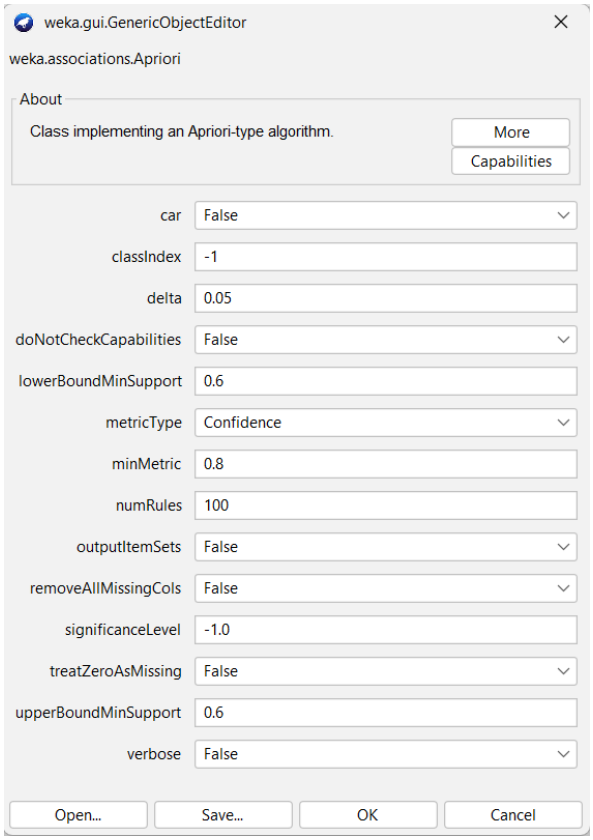
Viewer

Relation: exercise

No.	1: exista Nominal	2: existb Nominal	3: existc Nominal	4: existd Nominal	5: existe Nominal	6: **existk** Nominal
1	TRUE	TRUE		TRUE		TRUE
2	TRUE	TRUE	TRUE	TRUE	TRUE	
3	TRUE	TRUE	TRUE		TRUE	
4	TRUE	TRUE		TRUE		

Configuration:

MinSup set to 0.6
MinConf set to 0.8



Log Output after running Weka:

=== Run information ===

Scheme: weka.associations.Apriori -N 100 -T 0 -C 0.8 -D 0.05 -U 0.6 -M 0.6 -S -1.0 -c -1
Relation: exercise
Instances: 4
Attributes: 6
exista
existb
existc
existd
existe
existk
=== Associator model (full training set) ===

Apriori
=======

Minimum support: 0.6 (2 instances)
Minimum metric <confidence>: 0.8
Number of cycles performed: 8

Generated sets of large itemsets:

Size of set of large itemsets L(1): 5

Size of set of large itemsets L(2): 8

Size of set of large itemsets L(3): 5

Size of set of large itemsets L(4): 1

Best rules found:

1. existc=TRUE 2 ==> exista=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
2. existe=TRUE 2 ==> exista=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
3. existc=TRUE 2 ==> existb=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
4. existe=TRUE 2 ==> existb=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
5. existe=TRUE 2 ==> existc=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
6. existc=TRUE 2 ==> existe=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
7. existb=TRUE existc=TRUE 2 ==> exista=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
8. exista=TRUE existc=TRUE 2 ==> existb=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
9. existc=TRUE 2 ==> exista=TRUE existb=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
10. existb=TRUE existe=TRUE 2 ==> exista=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
11. exista=TRUE existe=TRUE 2 ==> existb=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
12. existe=TRUE 2 ==> exista=TRUE existb=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
13. existc=TRUE existe=TRUE 2 ==> exista=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
14. exista=TRUE existe=TRUE 2 ==> existc=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
15. exista=TRUE existc=TRUE 2 ==> existe=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
16. existe=TRUE 2 ==> exista=TRUE existc=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
17. existc=TRUE 2 ==> exista=TRUE existe=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
18. existc=TRUE existe=TRUE 2 ==> existb=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
19. existb=TRUE existe=TRUE 2 ==> existc=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
20. existb=TRUE existc=TRUE 2 ==> existe=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
21. existe=TRUE 2 ==> existb=TRUE existc=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
22. existc=TRUE 2 ==> existb=TRUE existe=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
23. existb=TRUE existc=TRUE existe=TRUE 2 ==> exista=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
24. exista=TRUE existc=TRUE existe=TRUE 2 ==> existb=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
25. exista=TRUE existb=TRUE existe=TRUE 2 ==> existc=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
26. exista=TRUE existb=TRUE existc=TRUE 2 ==> existe=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
27. existc=TRUE existe=TRUE 2 ==> exista=TRUE existb=TRUE 2 <conf:(1)> lift:(1) lev:(0) [0] conv:(0)
28. existb=TRUE existe=TRUE 2 ==> exista=TRUE existc=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
29. existb=TRUE existc=TRUE 2 ==> exista=TRUE existe=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
30. exista=TRUE existe=TRUE 2 ==> existb=TRUE existc=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
31. exista=TRUE existc=TRUE 2 ==> existb=TRUE existe=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
32. existe=TRUE 2 ==> exista=TRUE existb=TRUE existc=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)
33. existc=TRUE 2 ==> exista=TRUE existb=TRUE existe=TRUE 2 <conf:(1)> lift:(2) lev:(0.25) [1] conv:(1)

Conclusion:
We can see that from the numerical we solved. Some of the rules we wrote matched the console log output and a total of 33 rules were generated. The confidence value of itemsets shown above match our calculations.

Exercise 3

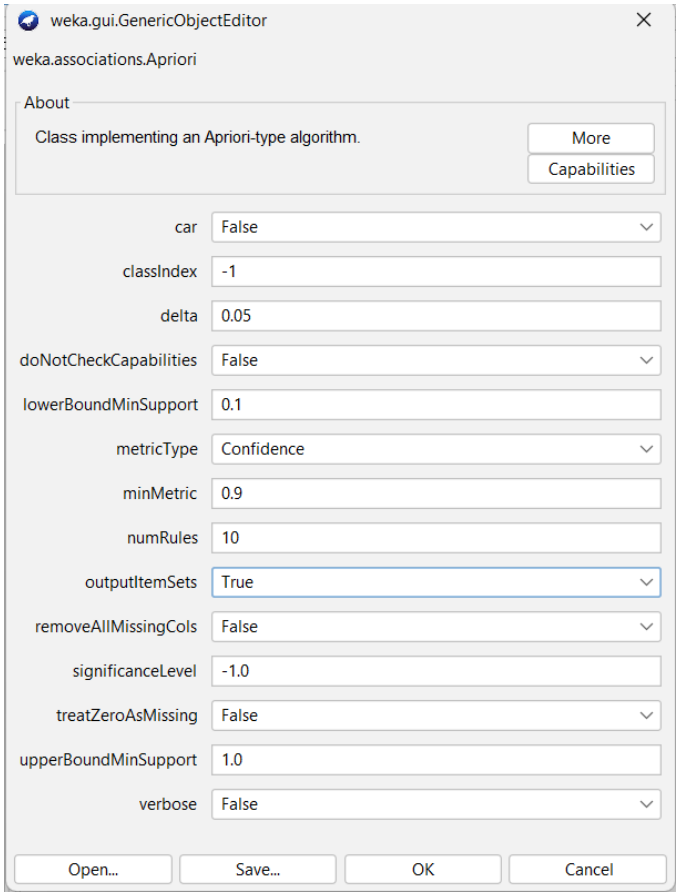
Apriori for the nominal weather dataset

Data in Weka:

Relation: weather.symbolic

No.	1: outlook Nominal	2: temperature Nominal	3: humidity Nominal	4: windy Nominal	5: **play** Nominal
1	sunny	hot	high	FALSE	no
2	sunny	hot	high	TRUE	no
3	overcast	hot	high	FALSE	yes
4	rainy	mild	high	FALSE	yes
5	rainy	cool	normal	FALSE	yes
6	rainy	cool	normal	TRUE	no
7	overcast	cool	normal	TRUE	yes
8	sunny	mild	high	FALSE	no
9	sunny	cool	normal	FALSE	yes
10	rainy	mild	normal	FALSE	yes
11	sunny	mild	normal	TRUE	yes
12	overcast	mild	high	TRUE	yes
13	overcast	hot	normal	FALSE	yes
14	rainy	mild	high	TRUE	no

Configuration 1:



=== Run information ===

Scheme: weka.associations.Apriori -I -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0 -c -1
Relation: weather.symbolic
Instances: 14
Attributes: 5
outlook
temperature
humidity
windy
play
=== Associator model (full training set) ===

Apriori
=======

Minimum support: 0.15 (2 instances)
Minimum metric <confidence>: 0.9
Number of cycles performed: 17

Generated sets of large itemsets:

Size of set of large itemsets L(1): 12

Large Itemsets L(1):
outlook=sunny 5
outlook=overcast 4
outlook=rainy 5
temperature=hot 4
temperature=mild 6
temperature=cool 4
humidity=high 7
humidity=normal 7
windy=TRUE 6
windy=FALSE 8
play=yes 9
play=no 5

Size of set of large itemsets L(2): 47

Large Itemsets L(2):
outlook=sunny temperature=hot 2
outlook=sunny temperature=mild 2
outlook=sunny humidity=high 3
outlook=sunny humidity=normal 2
outlook=sunny windy=TRUE 2
outlook=sunny windy=FALSE 3
outlook=sunny play=yes 2
outlook=sunny play=no 3
outlook=overcast temperature=hot 2
outlook=overcast humidity=high 2
outlook=overcast humidity=normal 2
outlook=overcast windy=TRUE 2
outlook=overcast windy=FALSE 2
outlook=overcast play=yes 4
outlook=rainy temperature=mild 3
outlook=rainy temperature=cool 2
outlook=rainy humidity=high 2
outlook=rainy humidity=normal 3
outlook=rainy windy=TRUE 2
outlook=rainy windy=FALSE 3
outlook=rainy play=yes 3
outlook=rainy play=no 2
temperature=hot humidity=high 3
temperature=hot windy=FALSE 3
temperature=hot play=yes 2
temperature=hot play=no 2
temperature=mild humidity=high 4
temperature=mild humidity=normal 2
temperature=mild windy=TRUE 3
temperature=mild windy=FALSE 3

temperature=mild play=yes 4
temperature=mild play=no 2
temperature=cool humidity=normal 4
temperature=cool windy=TRUE 2
temperature=cool windy=FALSE 2
temperature=cool play=yes 3
humidity=high windy=TRUE 3
humidity=high windy=FALSE 4
humidity=high play=yes 3
humidity=high play=no 4
humidity=normal windy=TRUE 3
humidity=normal windy=FALSE 4
humidity=normal play=yes 6
windy=TRUE play=yes 3
windy=TRUE play=no 3
windy=FALSE play=yes 6
windy=FALSE play=no 2

Size of set of large itemsets L(3): 39

Large Itemsets L(3):
outlook=sunny temperature=hot humidity=high 2
outlook=sunny temperature=hot play=no 2
outlook=sunny humidity=high windy=FALSE 2
outlook=sunny humidity=high play=no 3
outlook=sunny humidity=normal play=yes 2
outlook=sunny windy=FALSE play=no 2
outlook=overcast temperature=hot windy=FALSE 2
outlook=overcast temperature=hot play=yes 2
outlook=overcast humidity=high play=yes 2
outlook=overcast humidity=normal play=yes 2
outlook=overcast windy=TRUE play=yes 2
outlook=overcast windy=FALSE play=yes 2
outlook=rainy temperature=mild humidity=high 2
outlook=rainy temperature=mild windy=FALSE 2
outlook=rainy temperature=mild play=yes 2
outlook=rainy temperature=cool humidity=normal 2
outlook=rainy humidity=normal windy=FALSE 2
outlook=rainy humidity=normal play=yes 2
outlook=rainy windy=TRUE play=no 2
outlook=rainy windy=FALSE play=yes 3
temperature=hot humidity=high windy=FALSE 2
temperature=hot humidity=high play=no 2
temperature=hot windy=FALSE play=yes 2
temperature=mild humidity=high windy=TRUE 2
temperature=mild humidity=high windy=FALSE 2
temperature=mild humidity=high play=yes 2
temperature=mild humidity=high play=no 2

temperature=mild humidity=normal play=yes 2
temperature=mild windy=TRUE play=yes 2
temperature=mild windy=FALSE play=yes 2
temperature=cool humidity=normal windy=TRUE 2
temperature=cool humidity=normal windy=FALSE 2
temperature=cool humidity=normal play=yes 3
temperature=cool windy=FALSE play=yes 2
humidity=high windy=TRUE play=no 2
humidity=high windy=FALSE play=yes 2
humidity=high windy=FALSE play=no 2
humidity=normal windy=TRUE play=yes 2
humidity=normal windy=FALSE play=yes 4

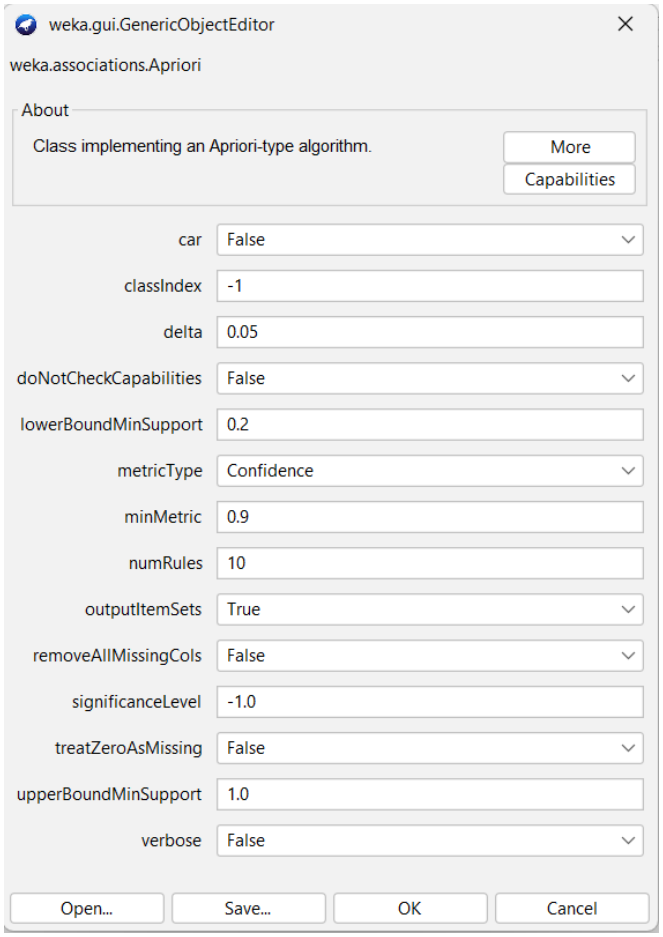
Size of set of large itemsets L(4): 6

Large Itemsets L(4):
outlook=sunny temperature=hot humidity=high play=no 2
outlook=sunny humidity=high windy=FALSE play=no 2
outlook=overcast temperature=hot windy=FALSE play=yes 2
outlook=rainy temperature=mild windy=FALSE play=yes 2
outlook=rainy humidity=normal windy=FALSE play=yes 2
temperature=cool humidity=normal windy=FALSE play=yes 2

Best rules found:

1. outlook=overcast 4 ==> play=yes 4 <conf:(1)> lift:(1.56) lev:(0.1) [1] conv:(1.43)
2. temperature=cool 4 ==> humidity=normal 4 <conf:(1)> lift:(2) lev:(0.14) [2] conv:(2)
3. humidity=normal windy=FALSE 4 ==> play=yes 4 <conf:(1)> lift:(1.56) lev:(0.1) [1] conv:(1.43)
4. outlook=sunny play=no 3 ==> humidity=high 3 <conf:(1)> lift:(2) lev:(0.11) [1] conv:(1.5)
5. outlook=sunny humidity=high 3 ==> play=no 3 <conf:(1)> lift:(2.8) lev:(0.14) [1] conv:(1.93)
6. outlook=rainy play=yes 3 ==> windy=FALSE 3 <conf:(1)> lift:(1.75) lev:(0.09) [1] conv:(1.29)
7. outlook=rainy windy=FALSE 3 ==> play=yes 3 <conf:(1)> lift:(1.56) lev:(0.08) [1] conv:(1.07)
8. temperature=cool play=yes 3 ==> humidity=normal 3 <conf:(1)> lift:(2) lev:(0.11) [1] conv:(1.5)
9. outlook=sunny temperature=hot 2 ==> humidity=high 2 <conf:(1)> lift:(2) lev:(0.07) [1] conv:(1)
10. temperature=hot play=no 2 ==> outlook=sunny 2 <conf:(1)> lift:(2.8) lev:(0.09) [1] conv:(1.29)

Configuration 2:



Log output:

=== Run information ===

Scheme: weka.associations.Apriori -I -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.2 -S -1.0 -c -1
Relation: weather.symbolic
Instances: 14
Attributes: 5
outlook
temperature
humidity
windy
play
=== Associator model (full training set) ===

Apriori
=======

Minimum support: 0.2 (3 instances)
Minimum metric <confidence>: 0.9
Number of cycles performed: 16

Generated sets of large itemsets:

Size of set of large itemsets L(1): 12

Large Itemsets L(1):
outlook=sunny 5
outlook=overcast 4
outlook=rainy 5
temperature=hot 4
temperature=mild 6
temperature=cool 4
humidity=high 7
humidity=normal 7
windy=TRUE 6
windy=FALSE 8
play=yes 9
play=no 5

Size of set of large itemsets L(2): 26

Large Itemsets L(2):
outlook=sunny humidity=high 3
outlook=sunny windy=FALSE 3
outlook=sunny play=no 3
outlook=overcast play=yes 4
outlook=rainy temperature=mild 3
outlook=rainy humidity=normal 3
outlook=rainy windy=FALSE 3
outlook=rainy play=yes 3
temperature=hot humidity=high 3
temperature=hot windy=FALSE 3
temperature=mild humidity=high 4
temperature=mild windy=TRUE 3
temperature=mild windy=FALSE 3
temperature=mild play=yes 4
temperature=cool humidity=normal 4
temperature=cool play=yes 3
humidity=high windy=TRUE 3
humidity=high windy=FALSE 4
humidity=high play=yes 3
humidity=high play=no 4
humidity=normal windy=TRUE 3
humidity=normal windy=FALSE 4
humidity=normal play=yes 6
windy=TRUE play=yes 3
windy=TRUE play=no 3
windy=FALSE play=yes 6

Size of set of large itemsets L(3): 4

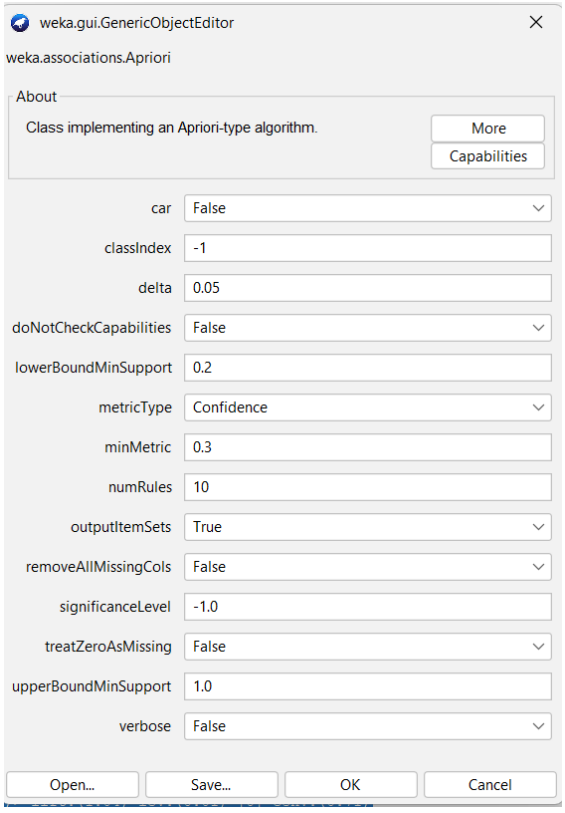
Large Itemsets L(3):
outlook=sunny humidity=high play=no 3
outlook=rainy windy=FALSE play=yes 3
temperature=cool humidity=normal play=yes 3
humidity=normal windy=FALSE play=yes 4

Best rules found:

1. outlook=overcast 4 ==> play=yes 4 <conf:(1)> lift:(1.56) lev:(0.1) [1] conv:(1.43)
2. temperature=cool 4 ==> humidity=normal 4 <conf:(1)> lift:(2) lev:(0.14) [2] conv:(2)
3. humidity=normal windy=FALSE 4 ==> play=yes 4 <conf:(1)> lift:(1.56) lev:(0.1) [1] conv:(1.43)
4. outlook=sunny play=no 3 ==> humidity=high 3 <conf:(1)> lift:(2) lev:(0.11) [1] conv:(1.5)
5. outlook=sunny humidity=high 3 ==> play=no 3 <conf:(1)> lift:(2.8) lev:(0.14) [1] conv:(1.93)
6. outlook=rainy play=yes 3 ==> windy=FALSE 3 <conf:(1)> lift:(1.75) lev:(0.09) [1] conv:(1.29)
7. outlook=rainy windy=FALSE 3 ==> play=yes 3 <conf:(1)> lift:(1.56) lev:(0.08) [1] conv:(1.07)
8. temperature=cool play=yes 3 ==> humidity=normal 3 <conf:(1)> lift:(2) lev:(0.11) [1] conv:(1.5)

We can see that the number of best rules decreased in the second configuration

Configuration 3:



Log output:
=== Run information ===

Scheme: weka.associations.Apriori -I -N 10 -T 0 -C 0.3 -D 0.05 -U 1.0 -M 0.2 -S -1.0 -c -1
Relation: weather.symbolic

Instances: 14
Attributes: 5
outlook
temperature
humidity
windy
play
=== Associator model (full training set) ===

Apriori
=======

Minimum support: 0.3 (4 instances)
Minimum metric <confidence>: 0.3
Number of cycles performed: 14

Generated sets of large itemsets:

Size of set of large itemsets L(1): 12

Large Itemsets L(1):
outlook=sunny 5
outlook=overcast 4
outlook=rainy 5
temperature=hot 4
temperature=mild 6
temperature=cool 4
humidity=high 7
humidity=normal 7
windy=TRUE 6
windy=FALSE 8
play=yes 9
play=no 5

Size of set of large itemsets L(2): 9

Large Itemsets L(2):
outlook=overcast play=yes 4
temperature=mild humidity=high 4
temperature=mild play=yes 4
temperature=cool humidity=normal 4
humidity=high windy=FALSE 4
humidity=high play=no 4
humidity=normal windy=FALSE 4
humidity=normal play=yes 6
windy=FALSE play=yes 6

Size of set of large itemsets L(3): 1

Large Itemsets L(3):
humidity=normal windy=FALSE play=yes 4

Best rules found:

1. outlook=overcast 4 ==> play=yes 4 <conf:(1)> lift:(1.56) lev:(0.1) [1] conv:(1.43)
2. temperature=cool 4 ==> humidity=normal 4 <conf:(1)> lift:(2) lev:(0.14) [2] conv:(2)
3. humidity=normal windy=FALSE 4 ==> play=yes 4 <conf:(1)> lift:(1.56) lev:(0.1) [1] conv:(1.43)
4. humidity=normal 7 ==> play=yes 6 <conf:(0.86)> lift:(1.33) lev:(0.11) [1] conv:(1.25)
5. play=no 5 ==> humidity=high 4 <conf:(0.8)> lift:(1.6) lev:(0.11) [1] conv:(1.25)
6. windy=FALSE 8 ==> play=yes 6 <conf:(0.75)> lift:(1.17) lev:(0.06) [0] conv:(0.95)
7. play=yes 9 ==> humidity=normal 6 <conf:(0.67)> lift:(1.33) lev:(0.11) [1] conv:(1.13)
8. play=yes 9 ==> windy=FALSE 6 <conf:(0.67)> lift:(1.17) lev:(0.06) [0] conv:(0.96)
9. temperature=mild 6 ==> humidity=high 4 <conf:(0.67)> lift:(1.33) lev:(0.07) [1] conv:(1)
10. temperature=mild 6 ==> play=yes 4 <conf:(0.67)> lift:(1.04) lev:(0.01) [0] conv:(0.71)

Exercise 4

Vote dataset

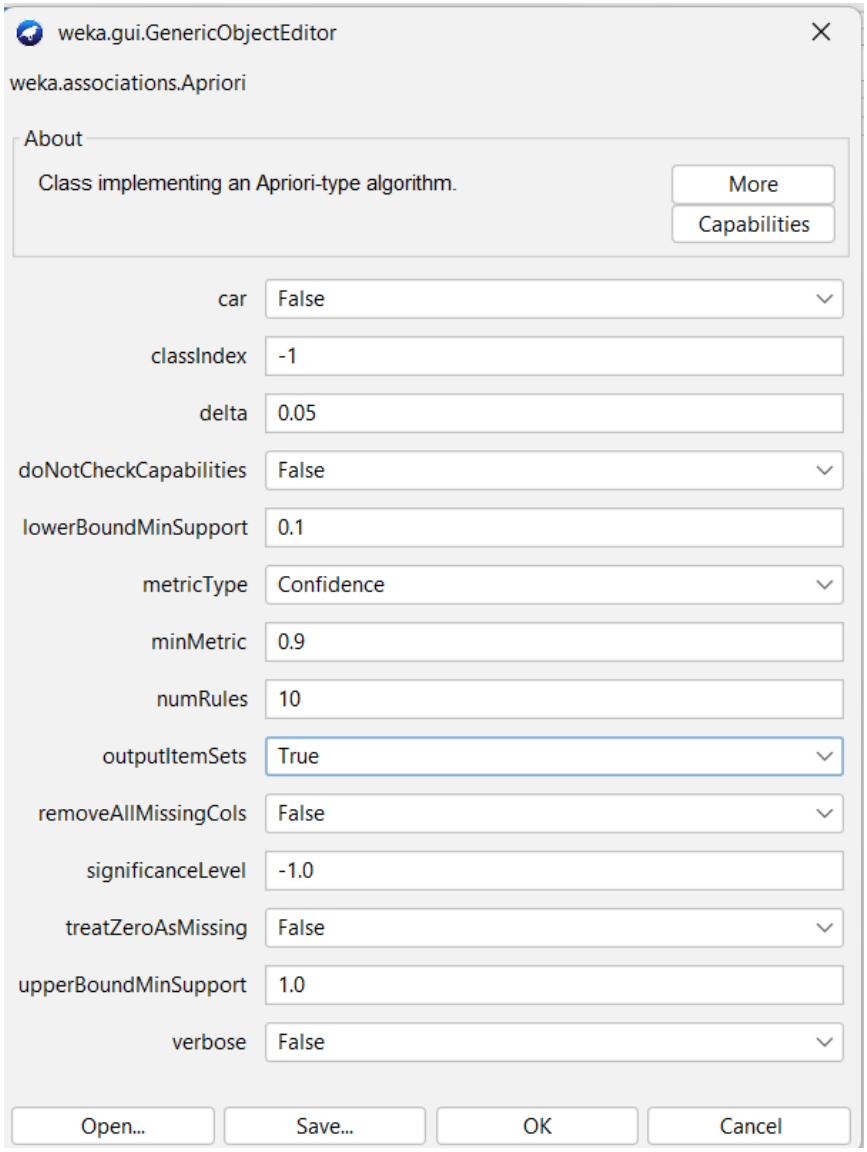
Dataset in WEKA:

Viewer

Relation: vote

No.	1: handicapped-infants Nominal	2: water-project-cost-sharing Nominal	3: adoption-of-the-budget-resolution Nominal	4: physician-fee-freeze Nominal	5: el-salvador-aid Nominal	6: religious-groups-in-schools Nominal	7: ant
1	n	y	n	y	y	y	n
2	n	y	n	y	y	y	n
3		y	y		y	y	n
4	n	y	y	n		y	n
5	y	y	y	n	y	y	n
6	n	y	y	n	y	y	n
7	n	y	n	y	y	y	n
8	n	y	n	y	y	y	n
9	n	y	n	y	y	y	n
10	y	y	y	n	n	n	y
11	n	y	n	y	y	n	n
12	n	y	n	y	y	y	n
13	n	y	y	n	n	n	y
14	y	y	y	n	n	y	y
15	n	y	n	y	y	y	n
16	n	y	n	y	y	y	n
17	y	n	y	n	n	y	n
18	y		y	n	n	n	y
19	n	y	n	y	y	y	n
20	y	y	y	n	n	n	y
21	y	y	y	n	n		y
22	y	y	y	n	n	n	y
23	y		y	n	n	n	y

Configuration:



Log output:

=== Run information ===

Scheme: weka.associations.Apriori -I -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0 -c -1
Relation: vote
Instances: 435
Attributes: 17

- handicapped-infants
- water-project-cost-sharing
- adoption-of-the-budget-resolution
- physician-fee-freeze
- el-salvador-aid
- religious-groups-in-schools
- anti-satellite-test-ban
- aid-to-nicaraguan-contras
- mx-missile
- immigration

synfuels-corporation-cutback
education-spending
superfund-right-to-sue
crime
duty-free-exports
export-administration-act-south-africa
Class
=== Associator model (full training set) ===

Apriori
=======

Minimum support: 0.45 (196 instances)
Minimum metric <confidence>: 0.9
Number of cycles performed: 11

Generated sets of large itemsets:

Size of set of large itemsets L(1): 20

Large Itemsets L(1):
handicapped-infants=n 236
adoption-of-the-budget-resolution=y 253
physician-fee-freeze=n 247
el-salvador-aid=n 208
el-salvador-aid=y 212
religious-groups-in-schools=y 272
anti-satellite-test-ban=y 239
aid-to-nicaraguan-contras=y 242
mx-missile=n 206
mx-missile=y 207
immigration=n 212
immigration=y 216
synfuels-corporation-cutback=n 264
education-spending=n 233
superfund-right-to-sue=n 201
superfund-right-to-sue=y 209
crime=y 248
duty-free-exports=n 233
export-administration-act-south-africa=y 269
Class=democrat 267

Size of set of large itemsets L(2): 17

Large Itemsets L(2):
adoption-of-the-budget-resolution=y physician-fee-freeze=n 219
adoption-of-the-budget-resolution=y anti-satellite-test-ban=y 201

adoption-of-the-budget-resolution=y aid-to-nicaraguan-contras=y 215
adoption-of-the-budget-resolution=y education-spending=n 201
adoption-of-the-budget-resolution=y Class=democrat 231
physician-fee-freeze=n anti-satellite-test-ban=y 197
physician-fee-freeze=n aid-to-nicaraguan-contras=y 211
physician-fee-freeze=n education-spending=n 202
physician-fee-freeze=n Class=democrat 245
el-salvador-aid=n aid-to-nicaraguan-contras=y 204
el-salvador-aid=n Class=democrat 200
el-salvador-aid=y religious-groups-in-schools=y 197
religious-groups-in-schools=y crime=y 214
anti-satellite-test-ban=y aid-to-nicaraguan-contras=y 210
anti-satellite-test-ban=y Class=democrat 200
aid-to-nicaraguan-contras=y Class=democrat 218
education-spending=n Class=democrat 213

Size of set of large itemsets L(3): 6

Large Itemsets L(3):
adoption-of-the-budget-resolution=y physician-fee-freeze=n aid-to-nicaraguan-contras=y 198
adoption-of-the-budget-resolution=y physician-fee-freeze=n Class=democrat 219
adoption-of-the-budget-resolution=y aid-to-nicaraguan-contras=y Class=democrat 203
physician-fee-freeze=n aid-to-nicaraguan-contras=y Class=democrat 210
physician-fee-freeze=n education-spending=n Class=democrat 201
el-salvador-aid=n aid-to-nicaraguan-contras=y Class=democrat 197

Size of set of large itemsets L(4): 1

Large Itemsets L(4):
adoption-of-the-budget-resolution=y physician-fee-freeze=n aid-to-nicaraguan-contras=y Class=democrat 198

Best rules found:

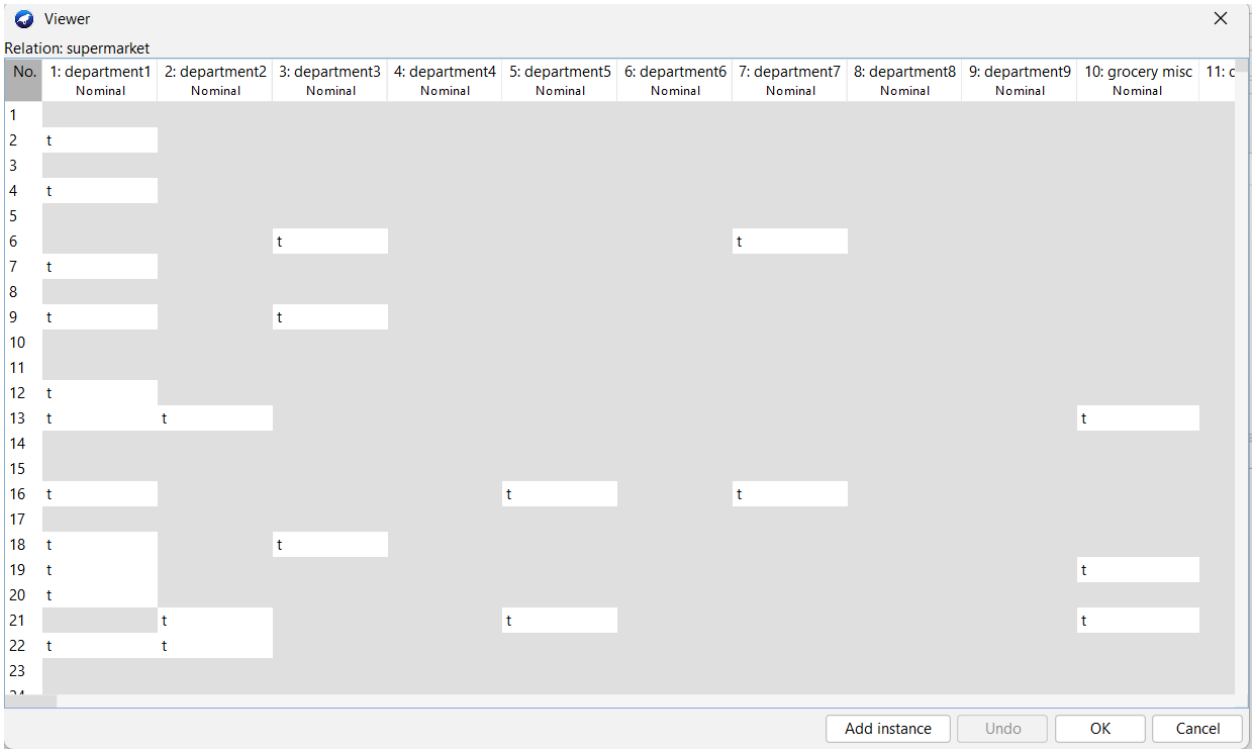
1. adoption-of-the-budget-resolution=y physician-fee-freeze=n 219 ==> Class=democrat 219 <conf:(1)> lift:(1.63) lev:(0.19) [84] conv:(84.58)
2. adoption-of-the-budget-resolution=y physician-fee-freeze=n aid-to-nicaraguan-contras=y 198 ==> Class=democrat 198 <conf:(1)> lift:(1.63) lev:(0.18) [76] conv:(76.47)
3. physician-fee-freeze=n aid-to-nicaraguan-contras=y 211 ==> Class=democrat 210 <conf:(1)> lift:(1.62) lev:(0.19) [80] conv:(40.74)
4. physician-fee-freeze=n education-spending=n 202 ==> Class=democrat 201 <conf:(1)> lift:(1.62) lev:(0.18) [77] conv:(39.01)
5. physician-fee-freeze=n 247 ==> Class=democrat 245 <conf:(0.99)> lift:(1.62) lev:(0.21) [93] conv:(31.8)
6. el-salvador-aid=n Class=democrat 200 ==> aid-to-nicaraguan-contras=y 197 <conf:(0.98)> lift:(1.77) lev:(0.2) [85] conv:(22.18)
7. el-salvador-aid=n 208 ==> aid-to-nicaraguan-contras=y 204 <conf:(0.98)> lift:(1.76) lev:(0.2) [88] conv:(18.46)

8. adoption-of-the-budget-resolution=y aid-to-nicaraguan-contras=y Class=democrat 203 ==> physician-fee-freeze=n 198 <conf:(0.98)> lift:(1.72) lev:(0.19) [82] conv:(14.62)
9. el-salvador-aid=n aid-to-nicaraguan-contras=y 204 ==> Class=democrat 197 <conf:(0.97)> lift:(1.57) lev:(0.17) [71] conv:(9.85)
10. aid-to-nicaraguan-contras=y Class=democrat 218 ==> physician-fee-freeze=n 210 <conf:(0.96)> lift:(1.7) lev:(0.2) [86] conv:(10.47)

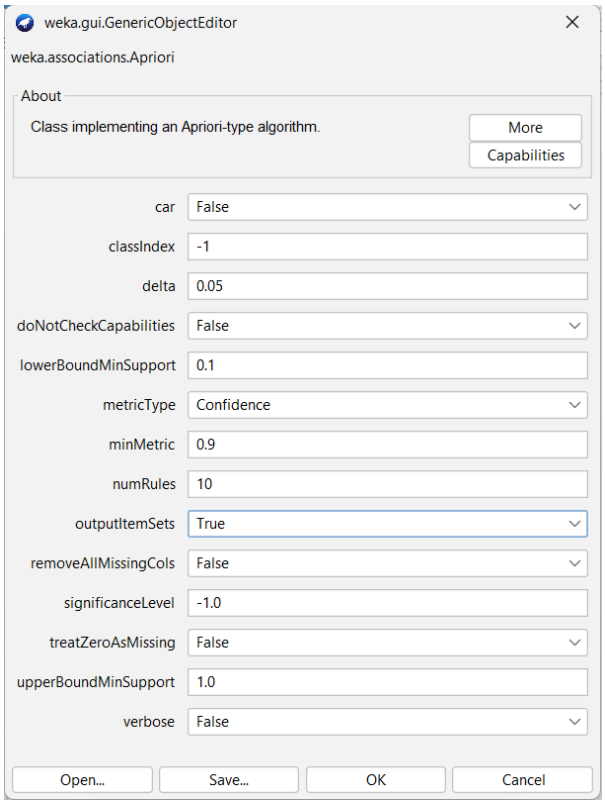
Exercise 5

Supermarket dataset

Viewing the supermarket dataset in WEKA:



Configuration:



Log output:

=== Run information ===

Scheme: weka.associations.Apriori -I -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0 -c -1
Relation: supermarket
Instances: 4627
Attributes: 217
[list of attributes omitted]
=== Associator model (full training set) ===

Apriori
=======

Minimum support: 0.15 (694 instances)
Minimum metric <confidence>: 0.9
Number of cycles performed: 17

Generated sets of large itemsets:

Size of set of large itemsets L(1): 44
Large Itemsets L(1):
department1=t 1047
bread and cake=t 3330
baking needs=t 2795

juice-sat-cord-ms=t 2463
.
.
.

Size of set of large itemsets L(2): 380
Large Itemsets L(2):
department1=t bread and cake=t 794
department1=t milk-cream=t 699
department1=t fruit=t 731
bread and cake=t baking needs=t 2191
bread and cake=t juice-sat-cord-ms=t 1869
.
.
.[ommited]

Size of set of large itemsets L(3): 910
Large Itemsets L(3):
bread and cake=t baking needs=t juice-sat-cord-ms=t 1291
bread and cake=t baking needs=t biscuits=t 1456
bread and cake=t baking needs=t canned fruit=t 762
bread and cake=t baking needs=t canned vegetables=t 939
bread and cake=t baking needs=t breakfast food=t 1074
.
.
.[ommited]

Size of set of large itemsets L(4): 633

Large Itemsets L(4):
bread and cake=t baking needs=t juice-sat-cord-ms=t biscuits=t 916
bread and cake=t baking needs=t juice-sat-cord-ms=t breakfast food=t 704
bread and cake=t baking needs=t juice-sat-cord-ms=t sauces-gravy-pkle=t 771
bread and cake=t baking needs=t juice-sat-cord-ms=t frozen foods=t 942
bread and cake=t baking needs=t juice-sat-cord-ms=t party snack foods=t 855
bread and cake=t baking needs=t juice-sat-cord-ms=t tissues-paper prd=t 820
.
.
.[ommited]

Size of set of large itemsets L(5): 105

Large Itemsets L(5):
bread and cake=t baking needs=t juice-sat-cord-ms=t biscuits=t frozen foods=t 730
bread and cake=t baking needs=t juice-sat-cord-ms=t biscuits=t fruit=t 706
bread and cake=t baking needs=t juice-sat-cord-ms=t frozen foods=t milk-cream=t 694
bread and cake=t baking needs=t juice-sat-cord-ms=t frozen foods=t fruit=t 716
bread and cake=t baking needs=t juice-sat-cord-ms=t frozen foods=t vegetables=t 720

bread and cake=t baking needs=t juice-sat-cord-ms=t milk-cream=t fruit=t 695
.
.
.[ommited]
Size of set of large itemsets L(6): 1

Large Itemsets L(6):
bread and cake=t baking needs=t biscuits=t frozen foods=t fruit=t vegetables=t 716

Best rules found:

1. biscuits=t frozen foods=t fruit=t total=high 788 ==> bread and cake=t 723 <conf:(0.92)> lift:(1.27) lev:(0.03) [155] conv:(3.35)
2. baking needs=t biscuits=t fruit=t total=high 760 ==> bread and cake=t 696 <conf:(0.92)> lift:(1.27) lev:(0.03) [149] conv:(3.28)
3. baking needs=t frozen foods=t fruit=t total=high 770 ==> bread and cake=t 705 <conf:(0.92)> lift:(1.27) lev:(0.03) [150] conv:(3.27)
4. biscuits=t fruit=t vegetables=t total=high 815 ==> bread and cake=t 746 <conf:(0.92)> lift:(1.27) lev:(0.03) [159] conv:(3.26)
5. party snack foods=t fruit=t total=high 854 ==> bread and cake=t 779 <conf:(0.91)> lift:(1.27) lev:(0.04) [164] conv:(3.15)
6. biscuits=t frozen foods=t vegetables=t total=high 797 ==> bread and cake=t 725 <conf:(0.91)> lift:(1.26) lev:(0.03) [151] conv:(3.06)
7. baking needs=t biscuits=t vegetables=t total=high 772 ==> bread and cake=t 701 <conf:(0.91)> lift:(1.26) lev:(0.03) [145] conv:(3.01)
8. biscuits=t fruit=t total=high 954 ==> bread and cake=t 866 <conf:(0.91)> lift:(1.26) lev:(0.04) [179] conv:(3)
9. frozen foods=t fruit=t vegetables=t total=high 834 ==> bread and cake=t 757 <conf:(0.91)> lift:(1.26) lev:(0.03) [156] conv:(3)
10. frozen foods=t fruit=t total=high 969 ==> bread and cake=t 877 <conf:(0.91)> lift:(1.26) lev:(0.04) [179] conv:(2.92)