

## Perlombongan Aturan Sekutuan / Mining Association Rule

Left-hand-side and right-hand-side

$$X \rightarrow Y$$

Tiga ukur asas memilih aturan sekutuan

1. Support

$$\text{support}(X \Rightarrow Y) = P(X \cap Y) = \frac{n_{XY}}{N}$$

2. Confidence

$$\text{confidence}(X \Rightarrow Y) = P(Y | X) = \frac{P(X \cap Y)}{P(X)} = \frac{\left(\frac{n_{XY}}{N}\right)}{\left(\frac{n_X}{N}\right)}$$

3. Lift

$$\text{lift}(X \Rightarrow Y) = \frac{\text{confidence}(X \Rightarrow Y)}{P(Y)} = \frac{P(X \cap Y)}{P(Y)P(X)} = \frac{\left(\frac{n_{XY}}{N}\right)}{\left(\frac{n_X}{N}\right)\left(\frac{n_Y}{N}\right)}$$

- $\text{lift}(X \rightarrow Y) = 1$  , X and Y tidak bersandar
- $\text{lift}(X \rightarrow Y) > 1$  , X dan Y mempunyai kesan pelengkap
- $\text{lift}(X \rightarrow Y) < 1$  , X dan Y mempunyai kesan pengganti

Metric	What it Measures	Focus	Interpretation
<b>Support</b>	Frequency of the itemset	How common the rule is	Absolute measure of occurrence
<b>Confidence</b>	Reliability of the rule	How strong the rule is	Conditional probability

Metric	What it Measures	Focus	Interpretation
<b>Lift</b>	Strength of association	Rule's importance	Relative to random chance

## Algorithma Apriori

import data transaksi

```
tdata = read.transactions("E:/Master-Data-Science/Semester_1/Data_Mining/Data/groceries.csv", sep=',')
head(tdata,10)
```

```
## transactions in sparse format with
## 10 transactions (rows) and
## 169 items (columns)
```

```
class(tdata)
```

```
## [1] "transactions"
## attr(,"package")
## [1] "arules"
```

Deskriptif data

```
inspect(head(tdata,12))
```

```
##      items
## [1] {citrus fruit,
##      margarine,
##      ready soups,
##      semi-finished bread}
## [2] {coffee,
##      tropical fruit,
##      yogurt}
## [3] {whole milk}
## [4] {cream cheese,
##      meat spreads,
##      pip fruit,
##      yogurt}
## [5] {condensed milk,
##      long life bakery product,
##      other vegetables,
##      whole milk}
## [6] {abrasive cleaner,
##      butter,
##      rice,
##      whole milk,
##      yogurt}
## [7] {rolls/buns}
## [8] {bottled beer,
```

```
##      liquor (appetizer),
##      other vegetables,
##      rolls/buns,
##      UHT-milk}
## [9] {pot plants}
## [10] {cereals,
##      whole milk}
## [11] {bottled water,
##      chocolate,
##      other vegetables,
##      tropical fruit,
##      white bread}
## [12] {bottled water,
##      butter,
##      citrus fruit,
##      curd,
##      dishes,
##      flour,
##      tropical fruit,
##      whole milk,
##      yogurt}
```

```
LIST(head(tdata,10))
```

```
## [[1]]
## [1] "citrus fruit"          "margarine"          "ready soups"
## [4] "semi-finished bread"
##
## [[2]]
## [1] "coffee"              "tropical fruit" "yogurt"
##
## [[3]]
## [1] "whole milk"
##
## [[4]]
## [1] "cream cheese" "meat spreads" "pip fruit"      "yogurt"
##
## [[5]]
## [1] "condensed milk"          "long life bakery product"
## [3] "other vegetables"        "whole milk"
##
## [[6]]
## [1] "abrasive cleaner" "butter"          "rice"          "whole milk"
## [5] "yogurt"
##
## [[7]]
## [1] "rolls/buns"
##
## [[8]]
## [1] "bottled beer"          "liquor (appetizer)" "other vegetables"
## [4] "rolls/buns"          "UHT-milk"
##
## [[9]]
## [1] "pot plants"
```

```
##
## [[10]]
## [1] "cereals"      "whole milk"
```

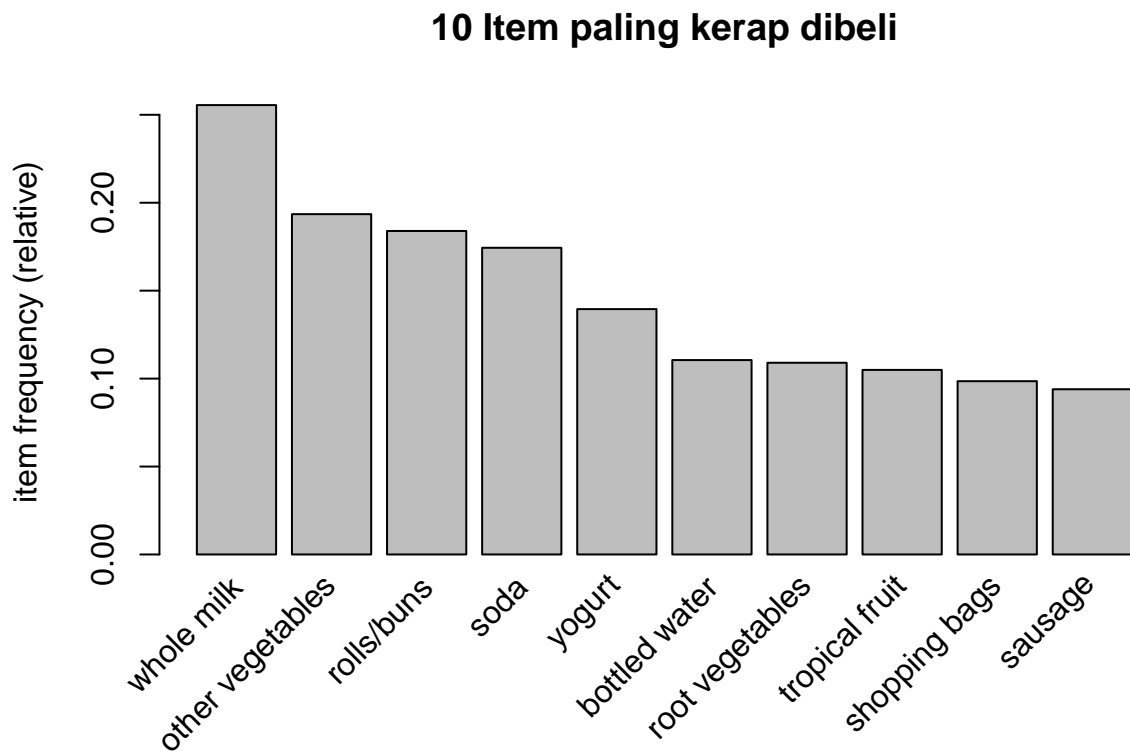
Bilangan item bagi setiap transaksi

```
size(head(tdata,10))
```

```
## [1] 4 3 1 4 4 5 1 5 1 2
```

Bagaimana untuk melihat item yang paling kerap dibeli?

```
itemFrequencyPlot(tdata, topN=10,
                  main='10 Item paling kerap dibeli')
```



Bagaimana untuk mendapatkan A turan Sekutuan yang signifikan bagi cadangan produk?

Perlu setkan nilai minimum ambang bagi sokongan dan keyakinan

Support = 0.01, Confidence = 0.5

```
Aturan.S1 = apriori(tdata,
                     parameter=list(supp=0.01, conf=0.3))
```

```
## Apriori
##
## Parameter specification:
## confidence minval smax arem aval originalSupport maxtime support minlen
##          0.3    0.1    1 none FALSE             TRUE        5    0.01    1
## maxlen target  ext
##          10 rules TRUE
##
## Algorithmic control:
## filter tree heap memopt load sort verbose
##       0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 98
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[169 item(s), 9835 transaction(s)] done [0.00s].
## sorting and recoding items ... [88 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 done [0.00s].
## writing ... [125 rule(s)] done [0.00s].
## creating S4 object ... done [0.00s].
```

```
inspect(Aturan.S1)
```

	lhs	rhs	support	confidence	coverage	lift	count
## [1]	{hard cheese}	=> {whole milk}	0.01006609	0.4107884	0.02450432	1.607682	9
## [2]	{butter milk}	=> {other vegetables}	0.01037112	0.3709091	0.02796136	1.916916	10
## [3]	{butter milk}	=> {whole milk}	0.01159126	0.4145455	0.02796136	1.622385	10
## [4]	{ham}	=> {whole milk}	0.01148958	0.4414062	0.02602949	1.727509	10
## [5]	{sliced cheese}	=> {whole milk}	0.01077783	0.4398340	0.02450432	1.721356	10
## [6]	{oil}	=> {whole milk}	0.01128622	0.4021739	0.02806304	1.573968	10
## [7]	{onions}	=> {other vegetables}	0.01423488	0.4590164	0.03101169	2.372268	14
## [8]	{onions}	=> {whole milk}	0.01209964	0.3901639	0.03101169	1.526965	10
## [9]	{berries}	=> {yogurt}	0.01057448	0.3180428	0.03324860	2.279848	10
## [10]	{berries}	=> {other vegetables}	0.01026945	0.3088685	0.03324860	1.596280	10
## [11]	{berries}	=> {whole milk}	0.01179461	0.3547401	0.03324860	1.388328	10
## [12]	{hamburger meat}	=> {other vegetables}	0.01382816	0.4159021	0.03324860	2.149447	13
## [13]	{hamburger meat}	=> {whole milk}	0.01474326	0.4434251	0.03324860	1.735410	14
## [14]	{hygiene articles}	=> {whole milk}	0.01281139	0.3888889	0.03294357	1.521975	13
## [15]	{sugar}	=> {other vegetables}	0.01077783	0.3183183	0.03385867	1.645119	10
## [16]	{sugar}	=> {whole milk}	0.01504830	0.4444444	0.03385867	1.739400	14
## [17]	{waffles}	=> {whole milk}	0.01270971	0.3306878	0.03843416	1.294196	13
## [18]	{long life bakery product}	=> {whole milk}	0.01352313	0.3614130	0.03741739	1.414444	13
## [19]	{dessert}	=> {other vegetables}	0.01159126	0.3123288	0.03711235	1.614164	10
## [20]	{dessert}	=> {whole milk}	0.01372649	0.3698630	0.03711235	1.447514	13
## [21]	{cream cheese}	=> {yogurt}	0.01240468	0.3128205	0.03965430	2.242412	13
## [22]	{cream cheese}	=> {other vegetables}	0.01372649	0.3461538	0.03965430	1.788977	13
## [23]	{cream cheese}	=> {whole milk}	0.01647178	0.4153846	0.03965430	1.625670	16
## [24]	{chicken}	=> {other vegetables}	0.01789527	0.4170616	0.04290798	2.155439	17

## [25]	{chicken}	=> {whole milk}	0.01759024	0.4099526	0.04290798	1.604411	1
## [26]	{white bread}	=> {other vegetables}	0.01372649	0.3260870	0.04209456	1.685268	1
## [27]	{white bread}	=> {whole milk}	0.01708185	0.4057971	0.04209456	1.588147	1
## [28]	{chocolate}	=> {whole milk}	0.01667514	0.3360656	0.04961871	1.315243	1
## [29]	{coffee}	=> {whole milk}	0.01870869	0.3222417	0.05805796	1.261141	1
## [30]	{frozen vegetables}	=> {other vegetables}	0.01779359	0.3699789	0.04809354	1.912108	1
## [31]	{frozen vegetables}	=> {whole milk}	0.02043721	0.4249471	0.04809354	1.663094	2
## [32]	{beef}	=> {root vegetables}	0.01738688	0.3313953	0.05246568	3.040367	1
## [33]	{beef}	=> {other vegetables}	0.01972547	0.3759690	0.05246568	1.943066	1
## [34]	{beef}	=> {whole milk}	0.02125064	0.4050388	0.05246568	1.585180	2
## [35]	{curd}	=> {yogurt}	0.01728521	0.3244275	0.05327911	2.325615	1
## [36]	{curd}	=> {other vegetables}	0.01718353	0.3225191	0.05327911	1.666829	1
## [37]	{curd}	=> {whole milk}	0.02613116	0.4904580	0.05327911	1.919481	2
## [38]	{napkins}	=> {whole milk}	0.01972547	0.3766990	0.05236401	1.474268	1
## [39]	{pork}	=> {other vegetables}	0.02165735	0.3756614	0.05765125	1.941476	2
## [40]	{pork}	=> {whole milk}	0.02216573	0.3844797	0.05765125	1.504719	2
## [41]	{frankfurter}	=> {rolls/buns}	0.01921708	0.3258621	0.05897306	1.771616	1
## [42]	{frankfurter}	=> {whole milk}	0.02053889	0.3482759	0.05897306	1.363029	2
## [43]	{brown bread}	=> {whole milk}	0.02521607	0.3887147	0.06487036	1.521293	2
## [44]	{margarine}	=> {other vegetables}	0.01972547	0.3368056	0.05856634	1.740663	1
## [45]	{margarine}	=> {whole milk}	0.02419929	0.4131944	0.05856634	1.617098	2
## [46]	{butter}	=> {other vegetables}	0.02003050	0.3614679	0.05541434	1.868122	1
## [47]	{butter}	=> {whole milk}	0.02755465	0.4972477	0.05541434	1.946053	2
## [48]	{newspapers}	=> {whole milk}	0.02735130	0.3426752	0.07981698	1.341110	2
## [49]	{domestic eggs}	=> {other vegetables}	0.02226741	0.3509615	0.06344687	1.813824	2
## [50]	{domestic eggs}	=> {whole milk}	0.02999492	0.4727564	0.06344687	1.850203	2
## [51]	{fruit/vegetable juice}	=> {whole milk}	0.02663955	0.3684951	0.07229283	1.442160	2
## [52]	{whipped/sour cream}	=> {other vegetables}	0.02887646	0.4028369	0.07168277	2.081924	2
## [53]	{whipped/sour cream}	=> {whole milk}	0.03223183	0.4496454	0.07168277	1.759754	3
## [54]	{pip fruit}	=> {other vegetables}	0.02613116	0.3454301	0.07564820	1.785237	2
## [55]	{pip fruit}	=> {whole milk}	0.03009659	0.3978495	0.07564820	1.557043	2
## [56]	{pastry}	=> {whole milk}	0.03324860	0.3737143	0.08896797	1.462587	3
## [57]	{citrus fruit}	=> {other vegetables}	0.02887646	0.3488943	0.08276563	1.803140	2
## [58]	{citrus fruit}	=> {whole milk}	0.03050330	0.3685504	0.08276563	1.442377	3
## [59]	{sausage}	=> {rolls/buns}	0.03060498	0.3257576	0.09395018	1.771048	3
## [60]	{sausage}	=> {whole milk}	0.02989324	0.3181818	0.09395018	1.245252	2
## [61]	{bottled water}	=> {whole milk}	0.03436706	0.3109476	0.11052364	1.216940	3
## [62]	{tropical fruit}	=> {other vegetables}	0.03589222	0.3420543	0.10493137	1.767790	3
## [63]	{tropical fruit}	=> {whole milk}	0.04229792	0.4031008	0.10493137	1.577595	4
## [64]	{root vegetables}	=> {other vegetables}	0.04738180	0.4347015	0.10899847	2.246605	4
## [65]	{root vegetables}	=> {whole milk}	0.04890696	0.4486940	0.10899847	1.756031	4
## [66]	{yogurt}	=> {other vegetables}	0.04341637	0.3112245	0.13950178	1.608457	4
## [67]	{yogurt}	=> {whole milk}	0.05602440	0.4016035	0.13950178	1.571735	5
## [68]	{rolls/buns}	=> {whole milk}	0.05663447	0.3079049	0.18393493	1.205032	5
## [69]	{other vegetables}	=> {whole milk}	0.07483477	0.3867578	0.19349263	1.513634	7
## [70]	{curd,						
##	yogurt}	=> {whole milk}	0.01006609	0.5823529	0.01728521	2.279125	9
## [71]	{curd,						
##	whole milk}	=> {yogurt}	0.01006609	0.3852140	0.02613116	2.761356	9
## [72]	{other vegetables,						
##	pork}	=> {whole milk}	0.01016777	0.4694836	0.02165735	1.837394	10
## [73]	{pork,						
##	whole milk}	=> {other vegetables}	0.01016777	0.4587156	0.02216573	2.370714	10
## [74]	{butter,						

##	other vegetables}	=> {whole milk}	0.01148958	0.5736041	0.02003050	2.244885	1
## [75]	{butter,						
##	whole milk}	=> {other vegetables}	0.01148958	0.4169742	0.02755465	2.154987	1
## [76]	{domestic eggs,						
##	other vegetables}	=> {whole milk}	0.01230300	0.5525114	0.02226741	2.162336	1
## [77]	{domestic eggs,						
##	whole milk}	=> {other vegetables}	0.01230300	0.4101695	0.02999492	2.119820	1
## [78]	{fruit/vegetable juice,						
##	other vegetables}	=> {whole milk}	0.01047280	0.4975845	0.02104728	1.947371	1
## [79]	{fruit/vegetable juice,						
##	whole milk}	=> {other vegetables}	0.01047280	0.3931298	0.02663955	2.031756	1
## [80]	{whipped/sour cream,						
##	yogurt}	=> {other vegetables}	0.01016777	0.4901961	0.02074225	2.533410	1
## [81]	{other vegetables,						
##	whipped/sour cream}	=> {yogurt}	0.01016777	0.3521127	0.02887646	2.524073	1
## [82]	{whipped/sour cream,						
##	yogurt}	=> {whole milk}	0.01087951	0.5245098	0.02074225	2.052747	1
## [83]	{whipped/sour cream,						
##	whole milk}	=> {yogurt}	0.01087951	0.3375394	0.03223183	2.419607	1
## [84]	{other vegetables,						
##	whipped/sour cream}	=> {whole milk}	0.01464159	0.5070423	0.02887646	1.984385	1
## [85]	{whipped/sour cream,						
##	whole milk}	=> {other vegetables}	0.01464159	0.4542587	0.03223183	2.347679	1
## [86]	{other vegetables,						
##	pip fruit}	=> {whole milk}	0.01352313	0.5175097	0.02613116	2.025351	1
## [87]	{pip fruit,						
##	whole milk}	=> {other vegetables}	0.01352313	0.4493243	0.03009659	2.322178	1
## [88]	{other vegetables,						
##	pastry}	=> {whole milk}	0.01057448	0.4684685	0.02257245	1.833421	1
## [89]	{pastry,						
##	whole milk}	=> {other vegetables}	0.01057448	0.3180428	0.03324860	1.643695	1
## [90]	{citrus fruit,						
##	root vegetables}	=> {other vegetables}	0.01037112	0.5862069	0.01769192	3.029608	1
## [91]	{citrus fruit,						
##	other vegetables}	=> {root vegetables}	0.01037112	0.3591549	0.02887646	3.295045	1
## [92]	{citrus fruit,						
##	yogurt}	=> {whole milk}	0.01026945	0.4741784	0.02165735	1.855768	1
## [93]	{citrus fruit,						
##	whole milk}	=> {yogurt}	0.01026945	0.3366667	0.03050330	2.413350	1
## [94]	{citrus fruit,						
##	other vegetables}	=> {whole milk}	0.01301474	0.4507042	0.02887646	1.763898	1
## [95]	{citrus fruit,						
##	whole milk}	=> {other vegetables}	0.01301474	0.4266667	0.03050330	2.205080	1
## [96]	{other vegetables,						
##	sausage}	=> {whole milk}	0.01016777	0.3773585	0.02694459	1.476849	1
## [97]	{sausage,						
##	whole milk}	=> {other vegetables}	0.01016777	0.3401361	0.02989324	1.757876	1
## [98]	{bottled water,						
##	other vegetables}	=> {whole milk}	0.01077783	0.4344262	0.02480935	1.700192	1
## [99]	{bottled water,						
##	whole milk}	=> {other vegetables}	0.01077783	0.3136095	0.03436706	1.620783	1
## [100]	{root vegetables,						
##	tropical fruit}	=> {other vegetables}	0.01230300	0.5845411	0.02104728	3.020999	1
## [101]	{other vegetables,						

##	tropical fruit}	=> {root vegetables}	0.01230300	0.3427762	0.03589222	3.144780	1
## [102]	{root vegetables,						
##	tropical fruit}	=> {whole milk}	0.01199797	0.5700483	0.02104728	2.230969	1
## [103]	{tropical fruit,						
##	yogurt}	=> {other vegetables}	0.01230300	0.4201389	0.02928317	2.171343	1
## [104]	{other vegetables,						
##	tropical fruit}	=> {yogurt}	0.01230300	0.3427762	0.03589222	2.457146	1
## [105]	{tropical fruit,						
##	yogurt}	=> {whole milk}	0.01514997	0.5173611	0.02928317	2.024770	1
## [106]	{tropical fruit,						
##	whole milk}	=> {yogurt}	0.01514997	0.3581731	0.04229792	2.567516	1
## [107]	{rolls/buns,						
##	tropical fruit}	=> {whole milk}	0.01098119	0.4462810	0.02460600	1.746587	1
## [108]	{other vegetables,						
##	tropical fruit}	=> {whole milk}	0.01708185	0.4759207	0.03589222	1.862587	1
## [109]	{tropical fruit,						
##	whole milk}	=> {other vegetables}	0.01708185	0.4038462	0.04229792	2.087140	1
## [110]	{root vegetables,						
##	yogurt}	=> {other vegetables}	0.01291307	0.5000000	0.02582613	2.584078	1
## [111]	{root vegetables,						
##	yogurt}	=> {whole milk}	0.01453991	0.5629921	0.02582613	2.203354	1
## [112]	{rolls/buns,						
##	root vegetables}	=> {other vegetables}	0.01220132	0.5020921	0.02430097	2.594890	1
## [113]	{rolls/buns,						
##	root vegetables}	=> {whole milk}	0.01270971	0.5230126	0.02430097	2.046888	1
## [114]	{other vegetables,						
##	root vegetables}	=> {whole milk}	0.02318251	0.4892704	0.04738180	1.914833	2
## [115]	{root vegetables,						
##	whole milk}	=> {other vegetables}	0.02318251	0.4740125	0.04890696	2.449770	2
## [116]	{other vegetables,						
##	whole milk}	=> {root vegetables}	0.02318251	0.3097826	0.07483477	2.842082	2
## [117]	{soda,						
##	yogurt}	=> {whole milk}	0.01047280	0.3828996	0.02735130	1.498535	1
## [118]	{other vegetables,						
##	soda}	=> {whole milk}	0.01392984	0.4254658	0.03274021	1.665124	1
## [119]	{soda,						
##	whole milk}	=> {other vegetables}	0.01392984	0.3477157	0.04006101	1.797049	1
## [120]	{rolls/buns,						
##	yogurt}	=> {other vegetables}	0.01148958	0.3343195	0.03436706	1.727815	1
## [121]	{rolls/buns,						
##	yogurt}	=> {whole milk}	0.01555669	0.4526627	0.03436706	1.771563	1
## [122]	{other vegetables,						
##	yogurt}	=> {whole milk}	0.02226741	0.5128806	0.04341637	2.007235	2
## [123]	{whole milk,						
##	yogurt}	=> {other vegetables}	0.02226741	0.3974592	0.05602440	2.054131	2
## [124]	{other vegetables,						
##	rolls/buns}	=> {whole milk}	0.01789527	0.4200477	0.04260295	1.643919	1
## [125]	{rolls/buns,						
##	whole milk}	=> {other vegetables}	0.01789527	0.3159785	0.05663447	1.633026	1



Lihat aturan dengan tertib lif menurun

```
Aturan.S2 = sort(Aturan.S1, by='lift',
                 decreasing = T)
inspect(Aturan.S2)
```

	lhs	rhs	support	confidence	coverage	lift	count
## [1]	{citrus fruit,	=> {root vegetables}	0.01037112	0.3591549	0.02887646	3.295045	10
## [2]	{other vegetables,	=> {root vegetables}	0.01230300	0.3427762	0.03589222	3.144780	10
## [3]	{beef}	=> {root vegetables}	0.01738688	0.3313953	0.05246568	3.040367	10
## [4]	{citrus fruit,	=> {other vegetables}	0.01037112	0.5862069	0.01769192	3.029608	10
## [5]	{root vegetables,	=> {other vegetables}	0.01230300	0.5845411	0.02104728	3.020999	10
## [6]	{other vegetables,	=> {root vegetables}	0.02318251	0.3097826	0.07483477	2.842082	23
## [7]	{curd,	=> {yogurt}	0.01006609	0.3852140	0.02613116	2.761356	9
## [8]	{rolls/buns,	=> {other vegetables}	0.01220132	0.5020921	0.02430097	2.594890	10
## [9]	{root vegetables,	=> {other vegetables}	0.01291307	0.5000000	0.02582613	2.584078	10
## [10]	{tropical fruit,	=> {yogurt}	0.01514997	0.3581731	0.04229792	2.567516	10
## [11]	{whipped/sour cream,	=> {other vegetables}	0.01016777	0.4901961	0.02074225	2.533410	10
## [12]	{other vegetables,	=> {yogurt}	0.01016777	0.3521127	0.02887646	2.524073	10
## [13]	{other vegetables,	=> {yogurt}	0.01230300	0.3427762	0.03589222	2.457146	10
## [14]	{root vegetables,	=> {other vegetables}	0.02318251	0.4740125	0.04890696	2.449770	23
## [15]	{whipped/sour cream,	=> {yogurt}	0.01087951	0.3375394	0.03223183	2.419607	10
## [16]	{citrus fruit,	=> {yogurt}	0.01026945	0.3366667	0.03050330	2.413350	10
## [17]	{onions}	=> {other vegetables}	0.01423488	0.4590164	0.03101169	2.372268	10
## [18]	{pork,	=> {other vegetables}	0.01016777	0.4587156	0.02216573	2.370714	10
## [19]	{whipped/sour cream,	=> {other vegetables}	0.01464159	0.4542587	0.03223183	2.347679	10
## [20]	{curd}	=> {yogurt}	0.01728521	0.3244275	0.05327911	2.325615	10
## [21]	{pip fruit,	=> {other vegetables}	0.01352313	0.4493243	0.03009659	2.322178	10
## [22]	{berries}	=> {yogurt}	0.01057448	0.3180428	0.03324860	2.279848	10
## [23]	{curd,	=> {whole milk}	0.01006609	0.5823529	0.01728521	2.279125	9
## [24]	{root vegetables}	=> {other vegetables}	0.04738180	0.4347015	0.10899847	2.246605	40
## [25]	{butter,	=> {whole milk}	0.01148958	0.5736041	0.02003050	2.244885	10
## [26]	{cream cheese}	=> {yogurt}	0.01240468	0.3128205	0.03965430	2.242412	10

## [27]	{root vegetables, tropical fruit}	=> {whole milk}	0.01199797	0.5700483	0.02104728	2.230969	1
## [28]	{citrus fruit, whole milk}	=> {other vegetables}	0.01301474	0.4266667	0.03050330	2.205080	1
## [29]	{root vegetables, yogurt}	=> {whole milk}	0.01453991	0.5629921	0.02582613	2.203354	1
## [30]	{tropical fruit, yogurt}	=> {other vegetables}	0.01230300	0.4201389	0.02928317	2.171343	1
## [31]	{domestic eggs, other vegetables}	=> {whole milk}	0.01230300	0.5525114	0.02226741	2.162336	1
## [32]	{chicken}	=> {other vegetables}	0.01789527	0.4170616	0.04290798	2.155439	1
## [33]	{butter, whole milk}	=> {other vegetables}	0.01148958	0.4169742	0.02755465	2.154987	1
## [34]	{hamburger meat}	=> {other vegetables}	0.01382816	0.4159021	0.03324860	2.149447	1
## [35]	{domestic eggs, whole milk}	=> {other vegetables}	0.01230300	0.4101695	0.02999492	2.119820	1
## [36]	{tropical fruit, whole milk}	=> {other vegetables}	0.01708185	0.4038462	0.04229792	2.087140	1
## [37]	{whipped/sour cream}	=> {other vegetables}	0.02887646	0.4028369	0.07168277	2.081924	2
## [38]	{whole milk, yogurt}	=> {other vegetables}	0.02226741	0.3974592	0.05602440	2.054131	2
## [39]	{whipped/sour cream, yogurt}	=> {whole milk}	0.01087951	0.5245098	0.02074225	2.052747	1
## [40]	{rolls/buns, root vegetables}	=> {whole milk}	0.01270971	0.5230126	0.02430097	2.046888	1
## [41]	{fruit/vegetable juice, whole milk}	=> {other vegetables}	0.01047280	0.3931298	0.02663955	2.031756	1
## [42]	{other vegetables, pip fruit}	=> {whole milk}	0.01352313	0.5175097	0.02613116	2.025351	1
## [43]	{tropical fruit, yogurt}	=> {whole milk}	0.01514997	0.5173611	0.02928317	2.024770	1
## [44]	{other vegetables, yogurt}	=> {whole milk}	0.02226741	0.5128806	0.04341637	2.007235	2
## [45]	{other vegetables, whipped/sour cream}	=> {whole milk}	0.01464159	0.5070423	0.02887646	1.984385	1
## [46]	{fruit/vegetable juice, other vegetables}	=> {whole milk}	0.01047280	0.4975845	0.02104728	1.947371	1
## [47]	{butter}	=> {whole milk}	0.02755465	0.4972477	0.05541434	1.946053	2
## [48]	{beef}	=> {other vegetables}	0.01972547	0.3759690	0.05246568	1.943066	1
## [49]	{pork}	=> {other vegetables}	0.02165735	0.3756614	0.05765125	1.941476	2
## [50]	{curd}	=> {whole milk}	0.02613116	0.4904580	0.05327911	1.919481	2
## [51]	{butter milk}	=> {other vegetables}	0.01037112	0.3709091	0.02796136	1.916916	1
## [52]	{other vegetables, root vegetables}	=> {whole milk}	0.02318251	0.4892704	0.04738180	1.914833	2
## [53]	{frozen vegetables}	=> {other vegetables}	0.01779359	0.3699789	0.04809354	1.912108	1
## [54]	{butter}	=> {other vegetables}	0.02003050	0.3614679	0.05541434	1.868122	1
## [55]	{other vegetables, tropical fruit}	=> {whole milk}	0.01708185	0.4759207	0.03589222	1.862587	1
## [56]	{citrus fruit, yogurt}	=> {whole milk}	0.01026945	0.4741784	0.02165735	1.855768	1
## [57]	{domestic eggs}	=> {whole milk}	0.02999492	0.4727564	0.06344687	1.850203	2
## [58]	{other vegetables, pork}	=> {whole milk}	0.01016777	0.4694836	0.02165735	1.837394	1
## [59]	{other vegetables,						

##	pastry}	=> {whole milk}	0.01057448	0.4684685	0.02257245	1.833421	1
## [60]	{domestic eggs}	=> {other vegetables}	0.02226741	0.3509615	0.06344687	1.813824	2
## [61]	{citrus fruit}	=> {other vegetables}	0.02887646	0.3488943	0.08276563	1.803140	2
## [62]	{soda,						
##	whole milk}	=> {other vegetables}	0.01392984	0.3477157	0.04006101	1.797049	1
## [63]	{cream cheese}	=> {other vegetables}	0.01372649	0.3461538	0.03965430	1.788977	1
## [64]	{pip fruit}	=> {other vegetables}	0.02613116	0.3454301	0.07564820	1.785237	2
## [65]	{frankfurter}	=> {rolls/buns}	0.01921708	0.3258621	0.05897306	1.771616	1
## [66]	{rolls/buns,						
##	yogurt}	=> {whole milk}	0.01555669	0.4526627	0.03436706	1.771563	1
## [67]	{sausage}	=> {rolls/buns}	0.03060498	0.3257576	0.09395018	1.771048	3
## [68]	{tropical fruit}	=> {other vegetables}	0.03589222	0.3420543	0.10493137	1.767790	3
## [69]	{citrus fruit,						
##	other vegetables}	=> {whole milk}	0.01301474	0.4507042	0.02887646	1.763898	1
## [70]	{whipped/sour cream}	=> {whole milk}	0.03223183	0.4496454	0.07168277	1.759754	3
## [71]	{sausage,						
##	whole milk}	=> {other vegetables}	0.01016777	0.3401361	0.02989324	1.757876	1
## [72]	{root vegetables}	=> {whole milk}	0.04890696	0.4486940	0.10899847	1.756031	4
## [73]	{rolls/buns,						
##	tropical fruit}	=> {whole milk}	0.01098119	0.4462810	0.02460600	1.746587	1
## [74]	{margarine}	=> {other vegetables}	0.01972547	0.3368056	0.05856634	1.740663	1
## [75]	{sugar}	=> {whole milk}	0.01504830	0.4444444	0.03385867	1.739400	1
## [76]	{hamburger meat}	=> {whole milk}	0.01474326	0.4434251	0.03324860	1.735410	1
## [77]	{rolls/buns,						
##	yogurt}	=> {other vegetables}	0.01148958	0.3343195	0.03436706	1.727815	1
## [78]	{ham}	=> {whole milk}	0.01148958	0.4414062	0.02602949	1.727509	1
## [79]	{sliced cheese}	=> {whole milk}	0.01077783	0.4398340	0.02450432	1.721356	1
## [80]	{bottled water,						
##	other vegetables}	=> {whole milk}	0.01077783	0.4344262	0.02480935	1.700192	1
## [81]	{white bread}	=> {other vegetables}	0.01372649	0.3260870	0.04209456	1.685268	1
## [82]	{curd}	=> {other vegetables}	0.01718353	0.3225191	0.05327911	1.666829	1
## [83]	{other vegetables,						
##	soda}	=> {whole milk}	0.01392984	0.4254658	0.03274021	1.665124	1
## [84]	{frozen vegetables}	=> {whole milk}	0.02043721	0.4249471	0.04809354	1.663094	2
## [85]	{sugar}	=> {other vegetables}	0.01077783	0.3183183	0.03385867	1.645119	1
## [86]	{other vegetables,						
##	rolls/buns}	=> {whole milk}	0.01789527	0.4200477	0.04260295	1.643919	1
## [87]	{pastry,						
##	whole milk}	=> {other vegetables}	0.01057448	0.3180428	0.03324860	1.643695	1
## [88]	{rolls/buns,						
##	whole milk}	=> {other vegetables}	0.01789527	0.3159785	0.05663447	1.633026	1
## [89]	{cream cheese}	=> {whole milk}	0.01647178	0.4153846	0.03965430	1.625670	1
## [90]	{butter milk}	=> {whole milk}	0.01159126	0.4145455	0.02796136	1.622385	1
## [91]	{bottled water,						
##	whole milk}	=> {other vegetables}	0.01077783	0.3136095	0.03436706	1.620783	1
## [92]	{margarine}	=> {whole milk}	0.02419929	0.4131944	0.05856634	1.617098	2
## [93]	{dessert}	=> {other vegetables}	0.01159126	0.3123288	0.03711235	1.614164	1
## [94]	{yogurt}	=> {other vegetables}	0.04341637	0.3112245	0.13950178	1.608457	4
## [95]	{hard cheese}	=> {whole milk}	0.01006609	0.4107884	0.02450432	1.607682	9
## [96]	{chicken}	=> {whole milk}	0.01759024	0.4099526	0.04290798	1.604411	1
## [97]	{berries}	=> {other vegetables}	0.01026945	0.3088685	0.03324860	1.596280	1
## [98]	{white bread}	=> {whole milk}	0.01708185	0.4057971	0.04209456	1.588147	1
## [99]	{beef}	=> {whole milk}	0.02125064	0.4050388	0.05246568	1.585180	2
## [100]	{tropical fruit}	=> {whole milk}	0.04229792	0.4031008	0.10493137	1.577595	4

## [101]	{oil}	=> {whole milk}	0.01128622	0.4021739	0.02806304	1.573968	1
## [102]	{yogurt}	=> {whole milk}	0.05602440	0.4016035	0.13950178	1.571735	5
## [103]	{pip fruit}	=> {whole milk}	0.03009659	0.3978495	0.07564820	1.557043	2
## [104]	{onions}	=> {whole milk}	0.01209964	0.3901639	0.03101169	1.526965	1
## [105]	{hygiene articles}	=> {whole milk}	0.01281139	0.3888889	0.03294357	1.521975	1
## [106]	{brown bread}	=> {whole milk}	0.02521607	0.3887147	0.06487036	1.521293	2
## [107]	{other vegetables}	=> {whole milk}	0.07483477	0.3867578	0.19349263	1.513634	7
## [108]	{pork}	=> {whole milk}	0.02216573	0.3844797	0.05765125	1.504719	2
## [109]	{soda,						
##	yogurt}	=> {whole milk}	0.01047280	0.3828996	0.02735130	1.498535	1
## [110]	{other vegetables,						
##	sausage}	=> {whole milk}	0.01016777	0.3773585	0.02694459	1.476849	1
## [111]	{napkins}	=> {whole milk}	0.01972547	0.3766990	0.05236401	1.474268	1
## [112]	{pastry}	=> {whole milk}	0.03324860	0.3737143	0.08896797	1.462587	3
## [113]	{dessert}	=> {whole milk}	0.01372649	0.3698630	0.03711235	1.447514	1
## [114]	{citrus fruit}	=> {whole milk}	0.03050330	0.3685504	0.08276563	1.442377	3
## [115]	{fruit/vegetable juice}	=> {whole milk}	0.02663955	0.3684951	0.07229283	1.442160	2
## [116]	{long life bakery product}	=> {whole milk}	0.01352313	0.3614130	0.03741739	1.414444	1
## [117]	{berries}	=> {whole milk}	0.01179461	0.3547401	0.03324860	1.388328	1
## [118]	{frankfurter}	=> {whole milk}	0.02053889	0.3482759	0.05897306	1.363029	2
## [119]	{newspapers}	=> {whole milk}	0.02735130	0.3426752	0.07981698	1.341110	2
## [120]	{chocolate}	=> {whole milk}	0.01667514	0.3360656	0.04961871	1.315243	1
## [121]	{waffles}	=> {whole milk}	0.01270971	0.3306878	0.03843416	1.294196	1
## [122]	{coffee}	=> {whole milk}	0.01870869	0.3222417	0.05805796	1.261141	1
## [123]	{sausage}	=> {whole milk}	0.02989324	0.3181818	0.09395018	1.245252	2
## [124]	{bottled water}	=> {whole milk}	0.03436706	0.3109476	0.11052364	1.216940	3
## [125]	{rolls/buns}	=> {whole milk}	0.05663447	0.3079049	0.18393493	1.205032	5

Lihat aturan dengan tertib keyakinan menurun

```
Aturan.S3 = sort(Aturan.S1, by='confidence',
                 decreasing = T)
inspect(Aturan.S3)
```

##	lhs	rhs	support	confidence	coverage	lift	count
## [1]	{citrus fruit,						
##	root vegetables}	=> {other vegetables}	0.01037112	0.5862069	0.01769192	3.029608	1
## [2]	{root vegetables,						
##	tropical fruit}	=> {other vegetables}	0.01230300	0.5845411	0.02104728	3.020999	1
## [3]	{curd,						
##	yogurt}	=> {whole milk}	0.01006609	0.5823529	0.01728521	2.279125	9
## [4]	{butter,						
##	other vegetables}	=> {whole milk}	0.01148958	0.5736041	0.02003050	2.244885	1
## [5]	{root vegetables,						
##	tropical fruit}	=> {whole milk}	0.01199797	0.5700483	0.02104728	2.230969	1
## [6]	{root vegetables,						
##	yogurt}	=> {whole milk}	0.01453991	0.5629921	0.02582613	2.203354	1
## [7]	{domestic eggs,						
##	other vegetables}	=> {whole milk}	0.01230300	0.5525114	0.02226741	2.162336	1
## [8]	{whipped/sour cream,						
##	yogurt}	=> {whole milk}	0.01087951	0.5245098	0.02074225	2.052747	1
## [9]	{rolls/buns,						

##	root vegetables}	=> {whole milk}	0.01270971	0.5230126	0.02430097	2.046888	1
## [10]	{other vegetables,						
##	pip fruit}	=> {whole milk}	0.01352313	0.5175097	0.02613116	2.025351	1
## [11]	{tropical fruit,						
##	yogurt}	=> {whole milk}	0.01514997	0.5173611	0.02928317	2.024770	1
## [12]	{other vegetables,						
##	yogurt}	=> {whole milk}	0.02226741	0.5128806	0.04341637	2.007235	2
## [13]	{other vegetables,						
##	whipped/sour cream}	=> {whole milk}	0.01464159	0.5070423	0.02887646	1.984385	1
## [14]	{rolls/buns,						
##	root vegetables}	=> {other vegetables}	0.01220132	0.5020921	0.02430097	2.594890	1
## [15]	{root vegetables,						
##	yogurt}	=> {other vegetables}	0.01291307	0.5000000	0.02582613	2.584078	1
## [16]	{fruit/vegetable juice,						
##	other vegetables}	=> {whole milk}	0.01047280	0.4975845	0.02104728	1.947371	1
## [17]	{butter}	=> {whole milk}	0.02755465	0.4972477	0.05541434	1.946053	2
## [18]	{curd}	=> {whole milk}	0.02613116	0.4904580	0.05327911	1.919481	2
## [19]	{whipped/sour cream,						
##	yogurt}	=> {other vegetables}	0.01016777	0.4901961	0.02074225	2.533410	1
## [20]	{other vegetables,						
##	root vegetables}	=> {whole milk}	0.02318251	0.4892704	0.04738180	1.914833	2
## [21]	{other vegetables,						
##	tropical fruit}	=> {whole milk}	0.01708185	0.4759207	0.03589222	1.862587	1
## [22]	{citrus fruit,						
##	yogurt}	=> {whole milk}	0.01026945	0.4741784	0.02165735	1.855768	1
## [23]	{root vegetables,						
##	whole milk}	=> {other vegetables}	0.02318251	0.4740125	0.04890696	2.449770	2
## [24]	{domestic eggs}	=> {whole milk}	0.02999492	0.4727564	0.06344687	1.850203	2
## [25]	{other vegetables,						
##	pork}	=> {whole milk}	0.01016777	0.4694836	0.02165735	1.837394	1
## [26]	{other vegetables,						
##	pastry}	=> {whole milk}	0.01057448	0.4684685	0.02257245	1.833421	1
## [27]	{onions}	=> {other vegetables}	0.01423488	0.4590164	0.03101169	2.372268	1
## [28]	{pork,						
##	whole milk}	=> {other vegetables}	0.01016777	0.4587156	0.02216573	2.370714	1
## [29]	{whipped/sour cream,						
##	whole milk}	=> {other vegetables}	0.01464159	0.4542587	0.03223183	2.347679	1
## [30]	{rolls/buns,						
##	yogurt}	=> {whole milk}	0.01555669	0.4526627	0.03436706	1.771563	1
## [31]	{citrus fruit,						
##	other vegetables}	=> {whole milk}	0.01301474	0.4507042	0.02887646	1.763898	1
## [32]	{whipped/sour cream}	=> {whole milk}	0.03223183	0.4496454	0.07168277	1.759754	3
## [33]	{pip fruit,						
##	whole milk}	=> {other vegetables}	0.01352313	0.4493243	0.03009659	2.322178	1
## [34]	{root vegetables}	=> {whole milk}	0.04890696	0.4486940	0.10899847	1.756031	4
## [35]	{rolls/buns,						
##	tropical fruit}	=> {whole milk}	0.01098119	0.4462810	0.02460600	1.746587	1
## [36]	{sugar}	=> {whole milk}	0.01504830	0.4444444	0.03385867	1.739400	1
## [37]	{hamburger meat}	=> {whole milk}	0.01474326	0.4434251	0.03324860	1.735410	1
## [38]	{ham}	=> {whole milk}	0.01148958	0.4414062	0.02602949	1.727509	1
## [39]	{sliced cheese}	=> {whole milk}	0.01077783	0.4398340	0.02450432	1.721356	1
## [40]	{root vegetables}	=> {other vegetables}	0.04738180	0.4347015	0.10899847	2.246605	4
## [41]	{bottled water,						
##	other vegetables}	=> {whole milk}	0.01077783	0.4344262	0.02480935	1.700192	1

## [42]	{citrus fruit, whole milk}	=> {other vegetables}	0.01301474	0.4266667	0.03050330	2.205080	1
## [43]	{other vegetables, soda}	=> {whole milk}	0.01392984	0.4254658	0.03274021	1.665124	1
## [44]	{frozen vegetables}	=> {whole milk}	0.02043721	0.4249471	0.04809354	1.663094	2
## [45]	{tropical fruit, yogurt}	=> {other vegetables}	0.01230300	0.4201389	0.02928317	2.171343	1
## [46]	{other vegetables, rolls/buns}	=> {whole milk}	0.01789527	0.4200477	0.04260295	1.643919	1
## [47]	{chicken}	=> {other vegetables}	0.01789527	0.4170616	0.04290798	2.155439	1
## [48]	{butter, whole milk}	=> {other vegetables}	0.01148958	0.4169742	0.02755465	2.154987	1
## [49]	{hamburger meat}	=> {other vegetables}	0.01382816	0.4159021	0.03324860	2.149447	1
## [50]	{cream cheese}	=> {whole milk}	0.01647178	0.4153846	0.03965430	1.625670	1
## [51]	{butter milk}	=> {whole milk}	0.01159126	0.4145455	0.02796136	1.622385	1
## [52]	{margarine}	=> {whole milk}	0.02419929	0.4131944	0.05856634	1.617098	2
## [53]	{hard cheese}	=> {whole milk}	0.01006609	0.4107884	0.02450432	1.607682	9
## [54]	{domestic eggs, whole milk}	=> {other vegetables}	0.01230300	0.4101695	0.02999492	2.119820	1
## [55]	{chicken}	=> {whole milk}	0.01759024	0.4099526	0.04290798	1.604411	1
## [56]	{white bread}	=> {whole milk}	0.01708185	0.4057971	0.04209456	1.588147	1
## [57]	{beef}	=> {whole milk}	0.02125064	0.4050388	0.05246568	1.585180	2
## [58]	{tropical fruit, whole milk}	=> {other vegetables}	0.01708185	0.4038462	0.04229792	2.087140	1
## [59]	{tropical fruit}	=> {whole milk}	0.04229792	0.4031008	0.10493137	1.577595	4
## [60]	{whipped/sour cream}	=> {other vegetables}	0.02887646	0.4028369	0.07168277	2.081924	2
## [61]	{oil}	=> {whole milk}	0.01128622	0.4021739	0.02806304	1.573968	1
## [62]	{yogurt}	=> {whole milk}	0.05602440	0.4016035	0.13950178	1.571735	5
## [63]	{pip fruit}	=> {whole milk}	0.03009659	0.3978495	0.07564820	1.557043	2
## [64]	{whole milk, yogurt}	=> {other vegetables}	0.02226741	0.3974592	0.05602440	2.054131	2
## [65]	{fruit/vegetable juice, whole milk}	=> {other vegetables}	0.01047280	0.3931298	0.02663955	2.031756	1
## [66]	{onions}	=> {whole milk}	0.01209964	0.3901639	0.03101169	1.526965	1
## [67]	{hygiene articles}	=> {whole milk}	0.01281139	0.3888889	0.03294357	1.521975	1
## [68]	{brown bread}	=> {whole milk}	0.02521607	0.3887147	0.06487036	1.521293	2
## [69]	{other vegetables}	=> {whole milk}	0.07483477	0.3867578	0.19349263	1.513634	7
## [70]	{curd, whole milk}	=> {yogurt}	0.01006609	0.3852140	0.02613116	2.761356	9
## [71]	{pork}	=> {whole milk}	0.02216573	0.3844797	0.05765125	1.504719	2
## [72]	{soda, yogurt}	=> {whole milk}	0.01047280	0.3828996	0.02735130	1.498535	1
## [73]	{other vegetables, sausage}	=> {whole milk}	0.01016777	0.3773585	0.02694459	1.476849	1
## [74]	{napkins}	=> {whole milk}	0.01972547	0.3766990	0.05236401	1.474268	1
## [75]	{beef}	=> {other vegetables}	0.01972547	0.3759690	0.05246568	1.943066	1
## [76]	{pork}	=> {other vegetables}	0.02165735	0.3756614	0.05765125	1.941476	2
## [77]	{pastry}	=> {whole milk}	0.03324860	0.3737143	0.08896797	1.462587	3
## [78]	{butter milk}	=> {other vegetables}	0.01037112	0.3709091	0.02796136	1.916916	1
## [79]	{frozen vegetables}	=> {other vegetables}	0.01779359	0.3699789	0.04809354	1.912108	1
## [80]	{dessert}	=> {whole milk}	0.01372649	0.3698630	0.03711235	1.447514	1
## [81]	{citrus fruit}	=> {whole milk}	0.03050330	0.3685504	0.08276563	1.442377	3
## [82]	{fruit/vegetable juice}	=> {whole milk}	0.02663955	0.3684951	0.07229283	1.442160	2
## [83]	{butter}	=> {other vegetables}	0.02003050	0.3614679	0.05541434	1.868122	1

## [84]	{long life bakery product}	=> {whole milk}	0.01352313	0.3614130	0.03741739	1.414444	1.
## [85]	{citrus fruit,						
##	other vegetables}	=> {root vegetables}	0.01037112	0.3591549	0.02887646	3.295045	1.
## [86]	{tropical fruit,						
##	whole milk}	=> {yogurt}	0.01514997	0.3581731	0.04229792	2.567516	1.
## [87]	{berries}	=> {whole milk}	0.01179461	0.3547401	0.03324860	1.388328	1.
## [88]	{other vegetables,						
##	whipped/sour cream}	=> {yogurt}	0.01016777	0.3521127	0.02887646	2.524073	1.
## [89]	{domestic eggs}	=> {other vegetables}	0.02226741	0.3509615	0.06344687	1.813824	2.
## [90]	{citrus fruit}	=> {other vegetables}	0.02887646	0.3488943	0.08276563	1.803140	2.
## [91]	{frankfurter}	=> {whole milk}	0.02053889	0.3482759	0.05897306	1.363029	2.
## [92]	{soda,						
##	whole milk}	=> {other vegetables}	0.01392984	0.3477157	0.04006101	1.797049	1.
## [93]	{cream cheese}	=> {other vegetables}	0.01372649	0.3461538	0.03965430	1.788977	1.
## [94]	{pip fruit}	=> {other vegetables}	0.02613116	0.3454301	0.07564820	1.785237	2.
## [95]	{other vegetables,						
##	tropical fruit}	=> {root vegetables}	0.01230300	0.3427762	0.03589222	3.144780	1.
## [96]	{other vegetables,						
##	tropical fruit}	=> {yogurt}	0.01230300	0.3427762	0.03589222	2.457146	1.
## [97]	{newspapers}	=> {whole milk}	0.02735130	0.3426752	0.07981698	1.341110	2.
## [98]	{tropical fruit}	=> {other vegetables}	0.03589222	0.3420543	0.10493137	1.767790	3.
## [99]	{sausage,						
##	whole milk}	=> {other vegetables}	0.01016777	0.3401361	0.02989324	1.757876	1.
## [100]	{whipped/sour cream,						
##	whole milk}	=> {yogurt}	0.01087951	0.3375394	0.03223183	2.419607	1.
## [101]	{margarine}	=> {other vegetables}	0.01972547	0.3368056	0.05856634	1.740663	1.
## [102]	{citrus fruit,						
##	whole milk}	=> {yogurt}	0.01026945	0.3366667	0.03050330	2.413350	1.
## [103]	{chocolate}	=> {whole milk}	0.01667514	0.3360656	0.04961871	1.315243	1.
## [104]	{rolls/buns,						
##	yogurt}	=> {other vegetables}	0.01148958	0.3343195	0.03436706	1.727815	1.
## [105]	{beef}	=> {root vegetables}	0.01738688	0.3313953	0.05246568	3.040367	1.
## [106]	{waffles}	=> {whole milk}	0.01270971	0.3306878	0.03843416	1.294196	1.
## [107]	{white bread}	=> {other vegetables}	0.01372649	0.3260870	0.04209456	1.685268	1.
## [108]	{frankfurter}	=> {rolls/buns}	0.01921708	0.3258621	0.05897306	1.771616	1.
## [109]	{sausage}	=> {rolls/buns}	0.03060498	0.3257576	0.09395018	1.771048	3.
## [110]	{curd}	=> {yogurt}	0.01728521	0.3244275	0.05327911	2.325615	1.
## [111]	{curd}	=> {other vegetables}	0.01718353	0.3225191	0.05327911	1.666829	1.
## [112]	{coffee}	=> {whole milk}	0.01870869	0.3222417	0.05805796	1.261141	1.
## [113]	{sugar}	=> {other vegetables}	0.01077783	0.3183183	0.03385867	1.645119	1.
## [114]	{sausage}	=> {whole milk}	0.02989324	0.3181818	0.09395018	1.245252	2.
## [115]	{berries}	=> {yogurt}	0.01057448	0.3180428	0.03324860	2.279848	1.
## [116]	{pastry,						
##	whole milk}	=> {other vegetables}	0.01057448	0.3180428	0.03324860	1.643695	1.
## [117]	{rolls/buns,						
##	whole milk}	=> {other vegetables}	0.01789527	0.3159785	0.05663447	1.633026	1.
## [118]	{bottled water,						
##	whole milk}	=> {other vegetables}	0.01077783	0.3136095	0.03436706	1.620783	1.
## [119]	{cream cheese}	=> {yogurt}	0.01240468	0.3128205	0.03965430	2.242412	1.
## [120]	{dessert}	=> {other vegetables}	0.01159126	0.3123288	0.03711235	1.614164	1.
## [121]	{yogurt}	=> {other vegetables}	0.04341637	0.3112245	0.13950178	1.608457	4.
## [122]	{bottled water}	=> {whole milk}	0.03436706	0.3109476	0.11052364	1.216940	3.
## [123]	{other vegetables,						
##	whole milk}	=> {root vegetables}	0.02318251	0.3097826	0.07483477	2.842082	2.

```
## [124] {berries} => {other vegetables} 0.01026945 0.3088685 0.03324860 1.596280 1
## [125] {rolls/buns} => {whole milk} 0.05663447 0.3079049 0.18393493 1.205032 5
```

Lihat aturan dengan tertib support menurun

```
Aturan.S4 = sort(Aturan.S1, by='support',
                 decreasing = T)
inspect(Aturan.S4)
```

##	lhs	rhs	support	confidence	coverage	lift	count
## [1]	{other vegetables}	=> {whole milk}	0.07483477	0.3867578	0.19349263	1.513634	7
## [2]	{rolls/buns}	=> {whole milk}	0.05663447	0.3079049	0.18393493	1.205032	5
## [3]	{yogurt}	=> {whole milk}	0.05602440	0.4016035	0.13950178	1.571735	5
## [4]	{root vegetables}	=> {whole milk}	0.04890696	0.4486940	0.10899847	1.756031	4
## [5]	{root vegetables}	=> {other vegetables}	0.04738180	0.4347015	0.10899847	2.246605	4
## [6]	{yogurt}	=> {other vegetables}	0.04341637	0.3112245	0.13950178	1.608457	4
## [7]	{tropical fruit}	=> {whole milk}	0.04229792	0.4031008	0.10493137	1.577595	4
## [8]	{tropical fruit}	=> {other vegetables}	0.03589222	0.3420543	0.10493137	1.767790	3
## [9]	{bottled water}	=> {whole milk}	0.03436706	0.3109476	0.11052364	1.216940	3
## [10]	{pastry}	=> {whole milk}	0.03324860	0.3737143	0.08896797	1.462587	3
## [11]	{whipped/sour cream}	=> {whole milk}	0.03223183	0.4496454	0.07168277	1.759754	3
## [12]	{sausage}	=> {rolls/buns}	0.03060498	0.3257576	0.09395018	1.771048	3
## [13]	{citrus fruit}	=> {whole milk}	0.03050330	0.3685504	0.08276563	1.442377	3
## [14]	{pip fruit}	=> {whole milk}	0.03009659	0.3978495	0.07564820	1.557043	2
## [15]	{domestic eggs}	=> {whole milk}	0.02999492	0.4727564	0.06344687	1.850203	2
## [16]	{sausage}	=> {whole milk}	0.02989324	0.3181818	0.09395018	1.245252	2
## [17]	{whipped/sour cream}	=> {other vegetables}	0.02887646	0.4028369	0.07168277	2.081924	2
## [18]	{citrus fruit}	=> {other vegetables}	0.02887646	0.3488943	0.08276563	1.803140	2
## [19]	{butter}	=> {whole milk}	0.02755465	0.4972477	0.05541434	1.946053	2
## [20]	{newspapers}	=> {whole milk}	0.02735130	0.3426752	0.07981698	1.341110	2
## [21]	{fruit/vegetable juice}	=> {whole milk}	0.02663955	0.3684951	0.07229283	1.442160	2
## [22]	{curd}	=> {whole milk}	0.02613116	0.4904580	0.05327911	1.919481	2
## [23]	{pip fruit}	=> {other vegetables}	0.02613116	0.3454301	0.07564820	1.785237	2
## [24]	{brown bread}	=> {whole milk}	0.02521607	0.3887147	0.06487036	1.521293	2
## [25]	{margarine}	=> {whole milk}	0.02419929	0.4131944	0.05856634	1.617098	2
## [26]	{other vegetables, root vegetables}	=> {whole milk}	0.02318251	0.4892704	0.04738180	1.914833	2
## [27]	{root vegetables, whole milk}	=> {other vegetables}	0.02318251	0.4740125	0.04890696	2.449770	2
## [28]	{other vegetables, whole milk}	=> {root vegetables}	0.02318251	0.3097826	0.07483477	2.842082	2
## [29]	{domestic eggs}	=> {other vegetables}	0.02226741	0.3509615	0.06344687	1.813824	2
## [30]	{other vegetables, yogurt}	=> {whole milk}	0.02226741	0.5128806	0.04341637	2.007235	2
## [31]	{whole milk, yogurt}	=> {other vegetables}	0.02226741	0.3974592	0.05602440	2.054131	2
## [32]	{pork}	=> {whole milk}	0.02216573	0.3844797	0.05765125	1.504719	2
## [33]	{pork}	=> {other vegetables}	0.02165735	0.3756614	0.05765125	1.941476	2
## [34]	{beef}	=> {whole milk}	0.02125064	0.4050388	0.05246568	1.585180	2
## [35]	{frankfurter}	=> {whole milk}	0.02053889	0.3482759	0.05897306	1.363029	2
## [36]	{frozen vegetables}	=> {whole milk}	0.02043721	0.4249471	0.04809354	1.663094	2
## [37]	{butter}	=> {other vegetables}	0.02003050	0.3614679	0.05541434	1.868122	1



## [38]	{beef}	=> {other vegetables}	0.01972547	0.3759690	0.05246568	1.943066	1.943066
## [39]	{napkins}	=> {whole milk}	0.01972547	0.3766990	0.05236401	1.474268	1.474268
## [40]	{margarine}	=> {other vegetables}	0.01972547	0.3368056	0.05856634	1.740663	1.740663
## [41]	{frankfurter}	=> {rolls/buns}	0.01921708	0.3258621	0.05897306	1.771616	1.771616
## [42]	{coffee}	=> {whole milk}	0.01870869	0.3222417	0.05805796	1.261141	1.261141
## [43]	{chicken}	=> {other vegetables}	0.01789527	0.4170616	0.04290798	2.155439	2.155439
## [44]	{other vegetables, rolls/buns}	=> {whole milk}	0.01789527	0.4200477	0.04260295	1.643919	1.643919
## [45]	{rolls/buns, whole milk}	=> {other vegetables}	0.01789527	0.3159785	0.05663447	1.633026	1.633026
## [46]	{frozen vegetables}	=> {other vegetables}	0.01779359	0.3699789	0.04809354	1.912108	1.912108
## [47]	{chicken}	=> {whole milk}	0.01759024	0.4099526	0.04290798	1.604411	1.604411
## [48]	{beef}	=> {root vegetables}	0.01738688	0.3313953	0.05246568	3.040367	3.040367
## [49]	{curd}	=> {yogurt}	0.01728521	0.3244275	0.05327911	2.325615	2.325615
## [50]	{curd}	=> {other vegetables}	0.01718353	0.3225191	0.05327911	1.666829	1.666829
## [51]	{white bread}	=> {whole milk}	0.01708185	0.4057971	0.04209456	1.588147	1.588147
## [52]	{other vegetables, tropical fruit}	=> {whole milk}	0.01708185	0.4759207	0.03589222	1.862587	1.862587
## [53]	{tropical fruit, whole milk}	=> {other vegetables}	0.01708185	0.4038462	0.04229792	2.087140	2.087140
## [54]	{chocolate}	=> {whole milk}	0.01667514	0.3360656	0.04961871	1.315243	1.315243
## [55]	{cream cheese}	=> {whole milk}	0.01647178	0.4153846	0.03965430	1.625670	1.625670
## [56]	{rolls/buns, yogurt}	=> {whole milk}	0.01555669	0.4526627	0.03436706	1.771563	1.771563
## [57]	{tropical fruit, yogurt}	=> {whole milk}	0.01514997	0.5173611	0.02928317	2.024770	2.024770
## [58]	{tropical fruit, whole milk}	=> {yogurt}	0.01514997	0.3581731	0.04229792	2.567516	2.567516
## [59]	{sugar}	=> {whole milk}	0.01504830	0.4444444	0.03385867	1.739400	1.739400
## [60]	{hamburger meat}	=> {whole milk}	0.01474326	0.4434251	0.03324860	1.735410	1.735410
## [61]	{other vegetables, whipped/sour cream}	=> {whole milk}	0.01464159	0.5070423	0.02887646	1.984385	1.984385
## [62]	{whipped/sour cream, whole milk}	=> {other vegetables}	0.01464159	0.4542587	0.03223183	2.347679	2.347679
## [63]	{root vegetables, yogurt}	=> {whole milk}	0.01453991	0.5629921	0.02582613	2.203354	2.203354
## [64]	{onions}	=> {other vegetables}	0.01423488	0.4590164	0.03101169	2.372268	2.372268
## [65]	{other vegetables, soda}	=> {whole milk}	0.01392984	0.4254658	0.03274021	1.665124	1.665124
## [66]	{soda, whole milk}	=> {other vegetables}	0.01392984	0.3477157	0.04006101	1.797049	1.797049
## [67]	{hamburger meat}	=> {other vegetables}	0.01382816	0.4159021	0.03324860	2.149447	2.149447
## [68]	{dessert}	=> {whole milk}	0.01372649	0.3698630	0.03711235	1.447514	1.447514
## [69]	{cream cheese}	=> {other vegetables}	0.01372649	0.3461538	0.03965430	1.788977	1.788977
## [70]	{white bread}	=> {other vegetables}	0.01372649	0.3260870	0.04209456	1.685268	1.685268
## [71]	{long life bakery product}	=> {whole milk}	0.01352313	0.3614130	0.03741739	1.414444	1.414444
## [72]	{other vegetables, pip fruit}	=> {whole milk}	0.01352313	0.5175097	0.02613116	2.025351	2.025351
## [73]	{pip fruit, whole milk}	=> {other vegetables}	0.01352313	0.4493243	0.03009659	2.322178	2.322178
## [74]	{citrus fruit, other vegetables}	=> {whole milk}	0.01301474	0.4507042	0.02887646	1.763898	1.763898
## [75]	{citrus fruit, whole milk}	=> {other vegetables}	0.01301474	0.4266667	0.03050330	2.205080	2.205080

## [76]	{root vegetables, yogurt}	=> {other vegetables}	0.01291307	0.5000000	0.02582613	2.584078	1.
## [77]	{hygiene articles}	=> {whole milk}	0.01281139	0.3888889	0.03294357	1.521975	1.
## [78]	{waffles}	=> {whole milk}	0.01270971	0.3306878	0.03843416	1.294196	1.
## [79]	{rolls/buns, root vegetables}	=> {whole milk}	0.01270971	0.5230126	0.02430097	2.046888	1.
## [80]	{cream cheese}	=> {yogurt}	0.01240468	0.3128205	0.03965430	2.242412	1.
## [81]	{domestic eggs, other vegetables}	=> {whole milk}	0.01230300	0.5525114	0.02226741	2.162336	1.
## [82]	{domestic eggs, whole milk}	=> {other vegetables}	0.01230300	0.4101695	0.02999492	2.119820	1.
## [83]	{root vegetables, tropical fruit}	=> {other vegetables}	0.01230300	0.5845411	0.02104728	3.020999	1.
## [84]	{other vegetables, tropical fruit}	=> {root vegetables}	0.01230300	0.3427762	0.03589222	3.144780	1.
## [85]	{tropical fruit, yogurt}	=> {other vegetables}	0.01230300	0.4201389	0.02928317	2.171343	1.
## [86]	{other vegetables, tropical fruit}	=> {yogurt}	0.01230300	0.3427762	0.03589222	2.457146	1.
## [87]	{rolls/buns, root vegetables}	=> {other vegetables}	0.01220132	0.5020921	0.02430097	2.594890	1.
## [88]	{onions}	=> {whole milk}	0.01209964	0.3901639	0.03101169	1.526965	1.
## [89]	{root vegetables, tropical fruit}	=> {whole milk}	0.01199797	0.5700483	0.02104728	2.230969	1.
## [90]	{berries}	=> {whole milk}	0.01179461	0.3547401	0.03324860	1.388328	1.
## [91]	{butter milk}	=> {whole milk}	0.01159126	0.4145455	0.02796136	1.622385	1.
## [92]	{dessert}	=> {other vegetables}	0.01159126	0.3123288	0.03711235	1.614164	1.
## [93]	{ham}	=> {whole milk}	0.01148958	0.4414062	0.02602949	1.727509	1.
## [94]	{butter, other vegetables}	=> {whole milk}	0.01148958	0.5736041	0.02003050	2.244885	1.
## [95]	{butter, whole milk}	=> {other vegetables}	0.01148958	0.4169742	0.02755465	2.154987	1.
## [96]	{rolls/buns, yogurt}	=> {other vegetables}	0.01148958	0.3343195	0.03436706	1.727815	1.
## [97]	{oil}	=> {whole milk}	0.01128622	0.4021739	0.02806304	1.573968	1.
## [98]	{rolls/buns, tropical fruit}	=> {whole milk}	0.01098119	0.4462810	0.02460600	1.746587	1.
## [99]	{whipped/sour cream, yogurt}	=> {whole milk}	0.01087951	0.5245098	0.02074225	2.052747	1.
## [100]	{whipped/sour cream, whole milk}	=> {yogurt}	0.01087951	0.3375394	0.03223183	2.419607	1.
## [101]	{sliced cheese}	=> {whole milk}	0.01077783	0.4398340	0.02450432	1.721356	1.
## [102]	{sugar}	=> {other vegetables}	0.01077783	0.3183183	0.03385867	1.645119	1.
## [103]	{bottled water, other vegetables}	=> {whole milk}	0.01077783	0.4344262	0.02480935	1.700192	1.
## [104]	{bottled water, whole milk}	=> {other vegetables}	0.01077783	0.3136095	0.03436706	1.620783	1.
## [105]	{berries}	=> {yogurt}	0.01057448	0.3180428	0.03324860	2.279848	1.
## [106]	{other vegetables, pastry}	=> {whole milk}	0.01057448	0.4684685	0.02257245	1.833421	1.
## [107]	{pastry, whole milk}	=> {other vegetables}	0.01057448	0.3180428	0.03324860	1.643695	1.
## [108]	{fruit/vegetable juice, other vegetables}	=> {whole milk}	0.01047280	0.4975845	0.02104728	1.947371	1.

```

## [109] {fruit/vegetable juice,
##         whole milk}      => {other vegetables} 0.01047280 0.3931298 0.02663955 2.031756 1
## [110] {soda,
##         yogurt}          => {whole milk}      0.01047280 0.3828996 0.02735130 1.498535 1
## [111] {butter milk}          => {other vegetables} 0.01037112 0.3709091 0.02796136 1.916916 1
## [112] {citrus fruit,
##         root vegetables} => {other vegetables} 0.01037112 0.5862069 0.01769192 3.029608 1
## [113] {citrus fruit,
##         other vegetables} => {root vegetables} 0.01037112 0.3591549 0.02887646 3.295045 1
## [114] {berries}            => {other vegetables} 0.01026945 0.3088685 0.03324860 1.596280 1
## [115] {citrus fruit,
##         yogurt}          => {whole milk}      0.01026945 0.4741784 0.02165735 1.855768 1
## [116] {citrus fruit,
##         whole milk}      => {yogurt}          0.01026945 0.3366667 0.03050330 2.413350 1
## [117] {other vegetables,
##         pork}            => {whole milk}      0.01016777 0.4694836 0.02165735 1.837394 1
## [118] {pork,
##         whole milk}      => {other vegetables} 0.01016777 0.4587156 0.02216573 2.370714 1
## [119] {whipped/sour cream,
##         yogurt}          => {other vegetables} 0.01016777 0.4901961 0.02074225 2.533410 1
## [120] {other vegetables,
##         whipped/sour cream} => {yogurt}          0.01016777 0.3521127 0.02887646 2.524073 1
## [121] {other vegetables,
##         sausage}         => {whole milk}      0.01016777 0.3773585 0.02694459 1.476849 1
## [122] {sausage,
##         whole milk}      => {other vegetables} 0.01016777 0.3401361 0.02989324 1.757876 1
## [123] {hard cheese}         => {whole milk}      0.01006609 0.4107884 0.02450432 1.607682 9
## [124] {curd,
##         yogurt}          => {whole milk}      0.01006609 0.5823529 0.01728521 2.279125 9
## [125] {curd,
##         whole milk}      => {yogurt}          0.01006609 0.3852140 0.02613116 2.761356 9

```

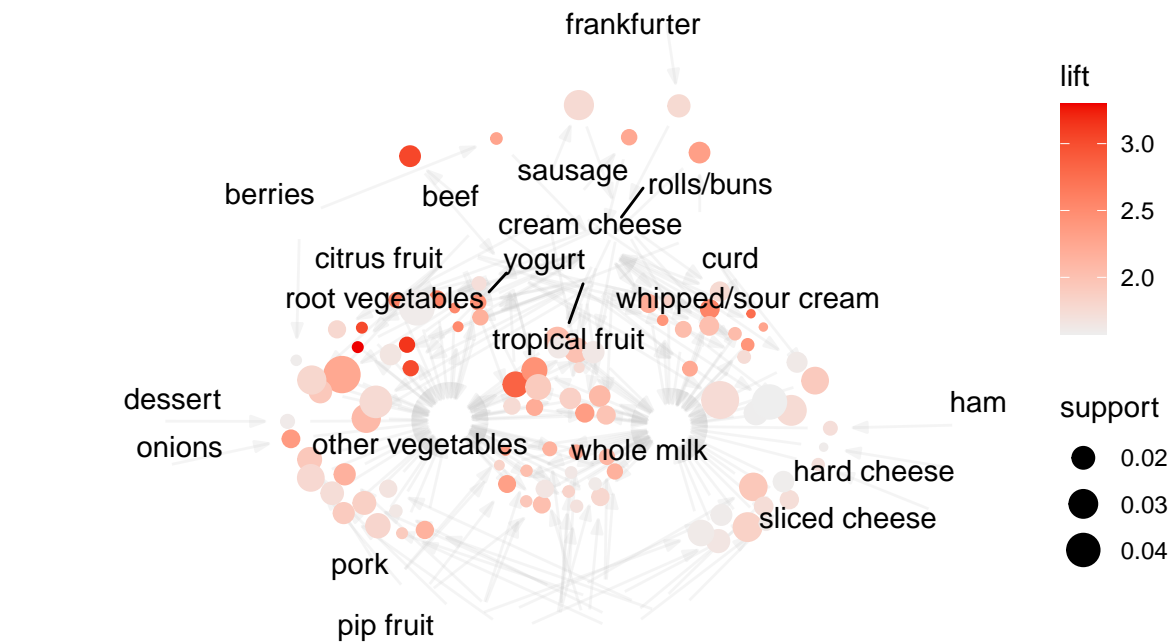
Bagaimana untuk mengvisualkan corak dan pola bagi aturan sekutuan yang signifikan?

Plot rangkaian

```
plot(Aturan.S1, method='graph')
```

```
## Warning: Too many rules supplied. Only plotting the best 100 using 'lift'
## (change control parameter max if needed).
```

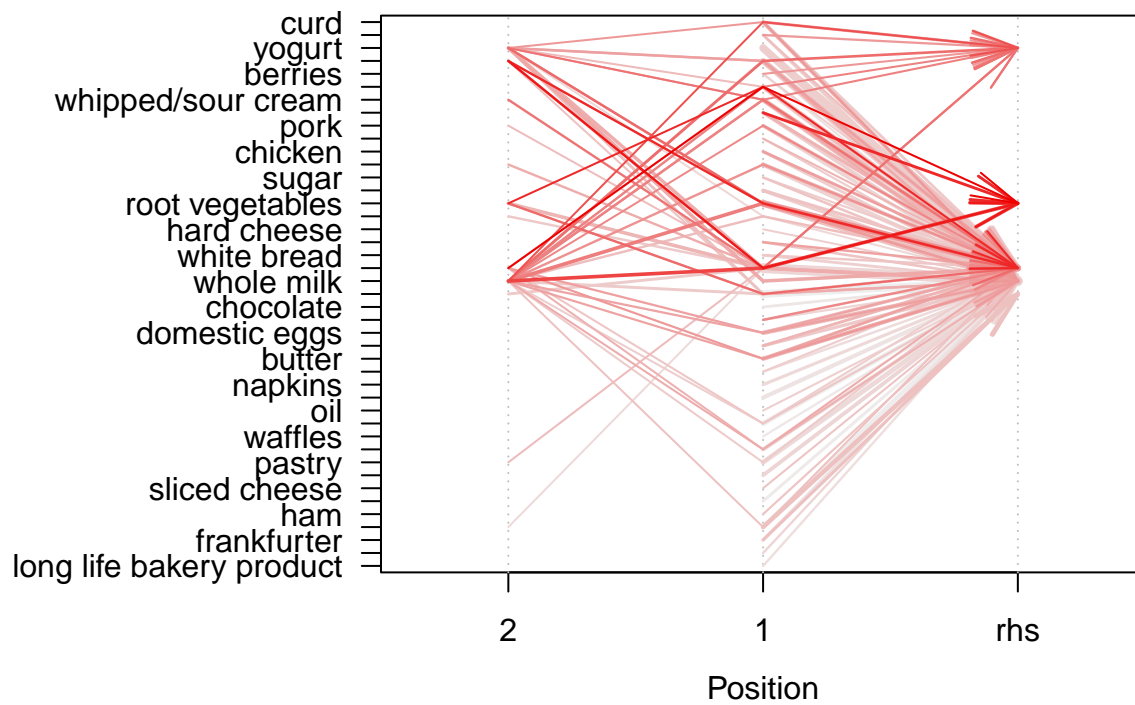
```
## Warning: ggrepel: 13 unlabeled data points (too many overlaps). Consider
## increasing max.overlaps
```



### Plot Koordinat Selari

```
plot(Aaturan.S1, method='paracoord',
      control=list(reorder=T))
```

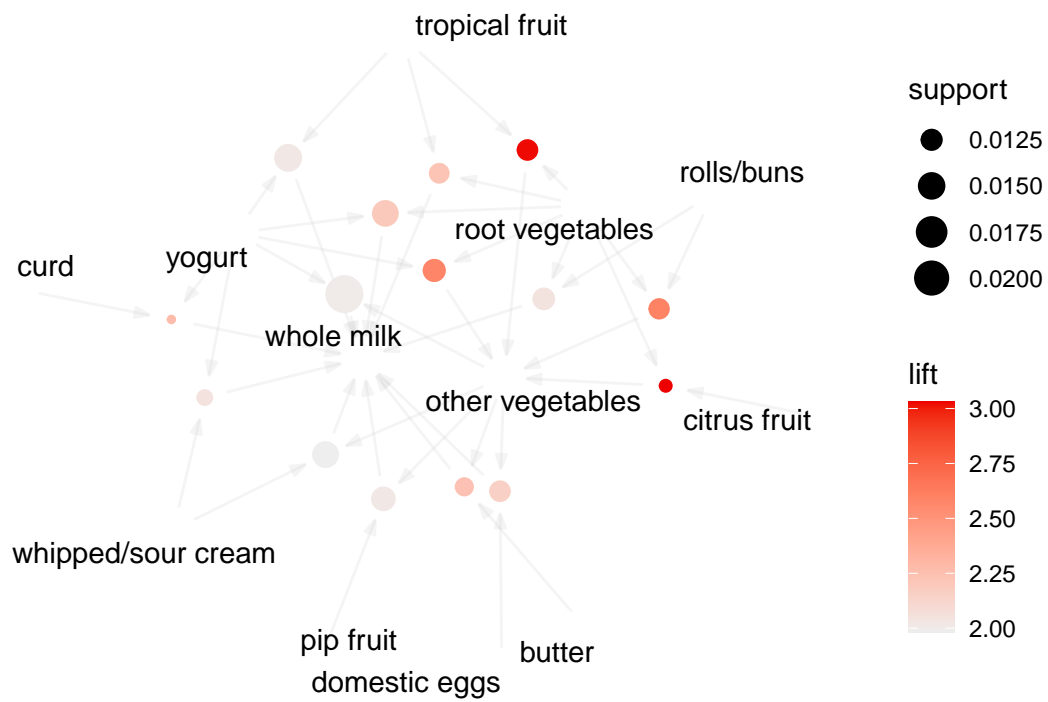
## Parallel coordinates plot for 125 rules



Jika bilangan aturan sekutuan yang diperoleh adalah terlalu banyak, perlu tinggikan nilai ambang ukuran untuk kekalkan aturan sekutuan yang lebih bermakna.

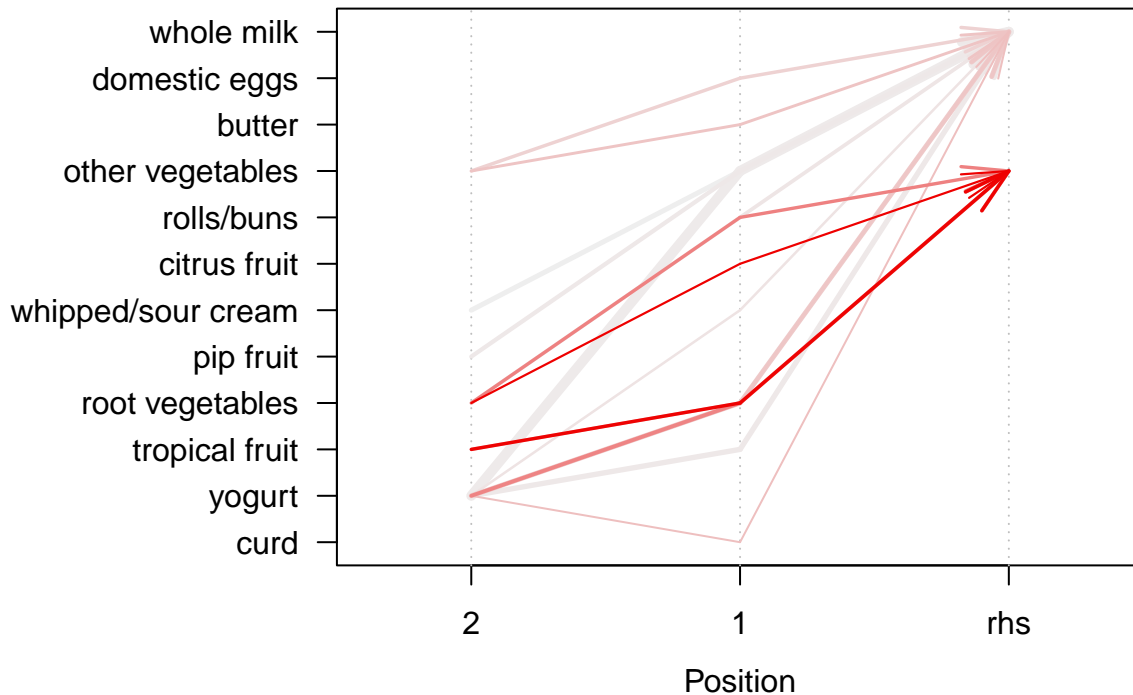
Support = 0.01, Confidence = 0.5

```
plot(Aturan.S5, method='graph')
```



```
plot(Aturan.S5, method='paracoord')
```

## Parallel coordinates plot for 15 rules



Bagaimana untuk mendapatkan Aturan Sekutuan yang berkait dengan item tertentu?

Kes 1: Dapatkan aturan yang mempengaruhi Aturan Sekutuan yang berkait dengan item Y (RHS)

Contoh: Barangan apa yang akan dibeli terlebih dahulu sebelum pelanggan membeli item “other vegetables”

```
inspect(Aturan.S6)
```

##	lhs	rhs	support
## [1]	{curd, yogurt}	=> {whole milk}	0.01006609
## [2]	{butter, other vegetables}	=> {whole milk}	0.01148958
## [3]	{domestic eggs, other vegetables}	=> {whole milk}	0.01230300
## [4]	{whipped/sour cream, yogurt}	=> {whole milk}	0.01087951
## [5]	{other vegetables, whipped/sour cream}	=> {whole milk}	0.01464159
## [6]	{other vegetables, pip fruit}	=> {whole milk}	0.01352313
## [7]	{root vegetables, tropical fruit}	=> {whole milk}	0.01199797
## [8]	{tropical fruit, yogurt}	=> {whole milk}	0.01514997
## [9]	{root vegetables, yogurt}	=> {whole milk}	0.01453991
## [10]	{rolls/buns, root vegetables}	=> {whole milk}	0.01270971
## [11]	{other vegetables, yogurt}	=> {whole milk}	0.02226741
##	confidence coverage lift count		
## [1]	0.5823529 0.01728521 2.279125 99		

```
## [2] 0.5736041 0.02003050 2.244885 113
## [3] 0.5525114 0.02226741 2.162336 121
## [4] 0.5245098 0.02074225 2.052747 107
## [5] 0.5070423 0.02887646 1.984385 144
## [6] 0.5175097 0.02613116 2.025351 133
## [7] 0.5700483 0.02104728 2.230969 118
## [8] 0.5173611 0.02928317 2.024770 149
## [9] 0.5629921 0.02582613 2.203354 143
## [10] 0.5230126 0.02430097 2.046888 125
## [11] 0.5128806 0.04341637 2.007235 219
```

Contoh: Barangan apa yang akan dibeli terlebih dahulu sebelum pelanggan membeli item “yogurt”

```
inspect(Aturan.S7)
```

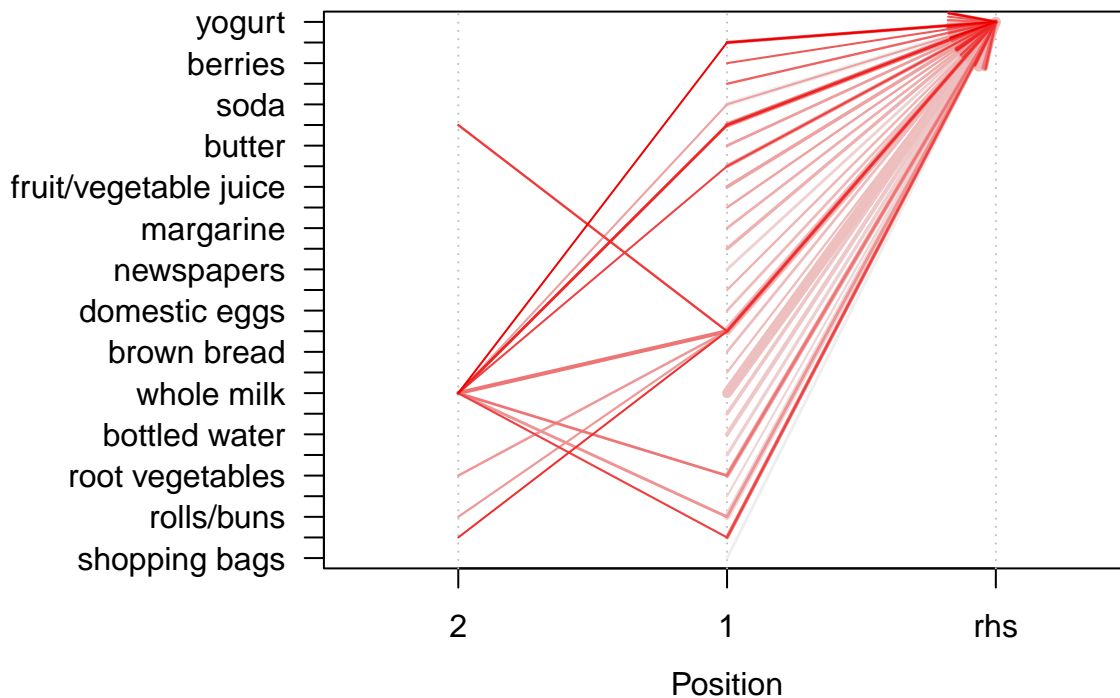
##	lhs	rhs	support	confidence
## [1]	{}	=> {yogurt}	0.13950178	0.1395018
## [2]	{berries}	=> {yogurt}	0.01057448	0.3180428
## [3]	{cream cheese}	=> {yogurt}	0.01240468	0.3128205
## [4]	{frozen vegetables}	=> {yogurt}	0.01240468	0.2579281
## [5]	{beef}	=> {yogurt}	0.01169293	0.2228682
## [6]	{curd}	=> {yogurt}	0.01728521	0.3244275
## [7]	{napkins}	=> {yogurt}	0.01230300	0.2349515
## [8]	{frankfurter}	=> {yogurt}	0.01118454	0.1896552
## [9]	{brown bread}	=> {yogurt}	0.01453991	0.2241379
## [10]	{margarine}	=> {yogurt}	0.01423488	0.2430556
## [11]	{butter}	=> {yogurt}	0.01464159	0.2642202
## [12]	{newspapers}	=> {yogurt}	0.01535333	0.1923567
## [13]	{domestic eggs}	=> {yogurt}	0.01433655	0.2259615
## [14]	{fruit/vegetable juice}	=> {yogurt}	0.01870869	0.2587904
## [15]	{whipped/sour cream}	=> {yogurt}	0.02074225	0.2893617
## [16]	{pip fruit}	=> {yogurt}	0.01799695	0.2379032
## [17]	{pastry}	=> {yogurt}	0.01769192	0.1988571
## [18]	{citrus fruit}	=> {yogurt}	0.02165735	0.2616708
## [19]	{shopping bags}	=> {yogurt}	0.01525165	0.1547988
## [20]	{sausage}	=> {yogurt}	0.01962379	0.2088745
## [21]	{bottled water}	=> {yogurt}	0.02297916	0.2079117
## [22]	{tropical fruit}	=> {yogurt}	0.02928317	0.2790698
## [23]	{root vegetables}	=> {yogurt}	0.02582613	0.2369403
## [24]	{soda}	=> {yogurt}	0.02735130	0.1568513
## [25]	{rolls/buns}	=> {yogurt}	0.03436706	0.1868436
## [26]	{other vegetables}	=> {yogurt}	0.04341637	0.2243826
## [27]	{whole milk}	=> {yogurt}	0.05602440	0.2192598
## [28]	{curd, whole milk}	=> {yogurt}	0.01006609	0.3852140
## [29]	{other vegetables, whipped/sour cream}	=> {yogurt}	0.01016777	0.3521127
## [30]	{whipped/sour cream, whole milk}	=> {yogurt}	0.01087951	0.3375394
## [31]	{citrus fruit, whole milk}	=> {yogurt}	0.01026945	0.3366667
## [32]	{other vegetables, tropical fruit}	=> {yogurt}	0.01230300	0.3427762
## [33]	{tropical fruit, whole milk}	=> {yogurt}	0.01514997	0.3581731
## [34]	{other vegetables, root vegetables}	=> {yogurt}	0.01291307	0.2725322
## [35]	{root vegetables, whole milk}	=> {yogurt}	0.01453991	0.2972973
## [36]	{soda, whole milk}	=> {yogurt}	0.01047280	0.2614213
## [37]	{other vegetables, rolls/buns}	=> {yogurt}	0.01148958	0.2696897



```
## [38] {rolls/buns, whole milk}      => {yogurt} 0.01555669 0.2746858
## [39] {other vegetables, whole milk} => {yogurt} 0.02226741 0.2975543
##      coverage    lift      count
## [1] 1.00000000 1.000000 1372
## [2] 0.03324860 2.279848  104
## [3] 0.03965430 2.242412  122
## [4] 0.04809354 1.848924  122
## [5] 0.05246568 1.597601  115
## [6] 0.05327911 2.325615  170
## [7] 0.05236401 1.684218  121
## [8] 0.05897306 1.359518  110
## [9] 0.06487036 1.606703  143
## [10] 0.05856634 1.742312  140
## [11] 0.05541434 1.894027  144
## [12] 0.07981698 1.378883  151
## [13] 0.06344687 1.619775  141
## [14] 0.07229283 1.855105  184
## [15] 0.07168277 2.074251  204
## [16] 0.07564820 1.705378  177
## [17] 0.08896797 1.425481  174
## [18] 0.08276563 1.875752  213
## [19] 0.09852567 1.109654  150
## [20] 0.09395018 1.497289  193
## [21] 0.11052364 1.490387  226
## [22] 0.10493137 2.000475  288
## [23] 0.10899847 1.698475  254
## [24] 0.17437722 1.124368  269
## [25] 0.18393493 1.339363  338
## [26] 0.19349263 1.608457  427
## [27] 0.25551601 1.571735  551
## [28] 0.02613116 2.761356   99
## [29] 0.02887646 2.524073  100
## [30] 0.03223183 2.419607  107
## [31] 0.03050330 2.413350  101
## [32] 0.03589222 2.457146  121
## [33] 0.04229792 2.567516  149
## [34] 0.04738180 1.953611  127
## [35] 0.04890696 2.131136  143
## [36] 0.04006101 1.873964  103
## [37] 0.04260295 1.933235  113
## [38] 0.05663447 1.969049  153
## [39] 0.07483477 2.132979  219
```

```
plot(Aturan.S7, method='paracoord',
     control=list(reorder=T))
```

## Parallel coordinates plot for 38 rules



Kes 2: dapatkan aturan bagi produk apa yang biasa dibeli selepas pembelian item X (LHS)

Barangan apa yang akan dibeli selepas membeli “yogurt”.

```
inspect(Aturan.S8)
```

##	lhs	rhs	support	confidence	coverage
## [1]	{}	=> {bottled beer}	0.08052872	0.08052872	1.0000000
## [2]	{}	=> {pastry}	0.08896797	0.08896797	1.0000000
## [3]	{}	=> {citrus fruit}	0.08276563	0.08276563	1.0000000
## [4]	{}	=> {shopping bags}	0.09852567	0.09852567	1.0000000
## [5]	{}	=> {sausage}	0.09395018	0.09395018	1.0000000
## [6]	{}	=> {bottled water}	0.11052364	0.11052364	1.0000000
## [7]	{}	=> {tropical fruit}	0.10493137	0.10493137	1.0000000
## [8]	{}	=> {root vegetables}	0.10899847	0.10899847	1.0000000
## [9]	{}	=> {soda}	0.17437722	0.17437722	1.0000000
## [10]	{}	=> {rolls/buns}	0.18393493	0.18393493	1.0000000
## [11]	{}	=> {other vegetables}	0.19349263	0.19349263	1.0000000
## [12]	{}	=> {whole milk}	0.25551601	0.25551601	1.0000000
## [13]	{yogurt}	=> {cream cheese}	0.01240468	0.08892128	0.1395018
## [14]	{yogurt}	=> {frozen vegetables}	0.01240468	0.08892128	0.1395018
## [15]	{yogurt}	=> {beef}	0.01169293	0.08381924	0.1395018
## [16]	{yogurt}	=> {curd}	0.01728521	0.12390671	0.1395018
## [17]	{yogurt}	=> {napkins}	0.01230300	0.08819242	0.1395018
## [18]	{yogurt}	=> {frankfurter}	0.01118454	0.08017493	0.1395018

```

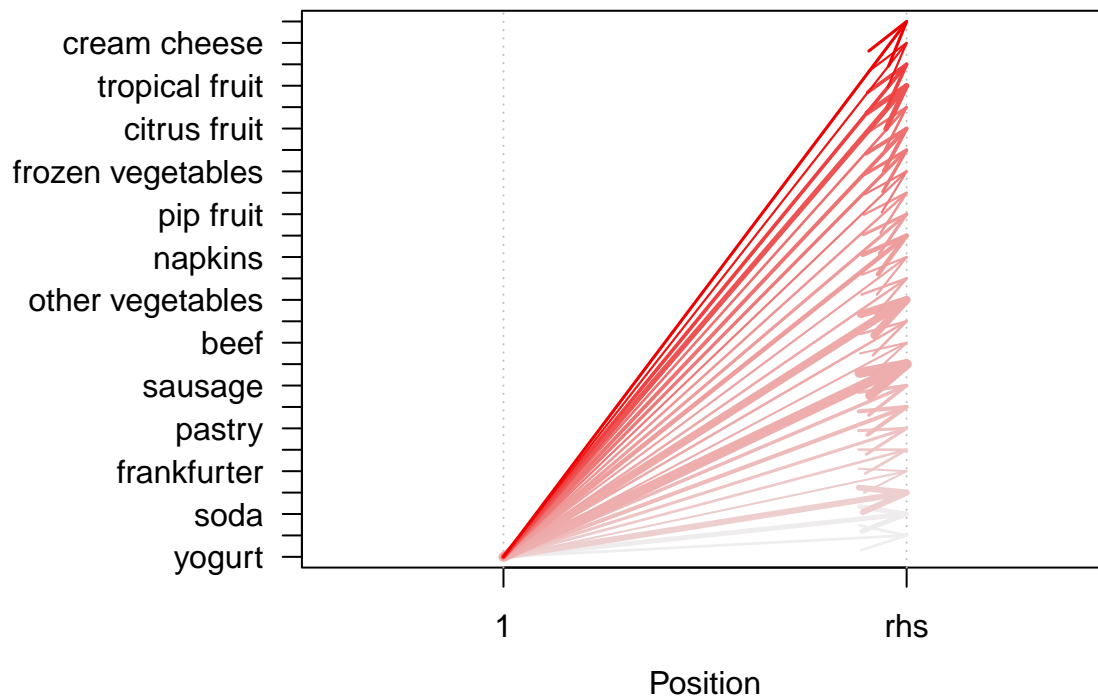
## [19] {yogurt} => {brown bread}      0.01453991 0.10422741 0.1395018
## [20] {yogurt} => {margarine}        0.01423488 0.10204082 0.1395018
## [21] {yogurt} => {butter}           0.01464159 0.10495627 0.1395018
## [22] {yogurt} => {newspapers}       0.01535333 0.11005831 0.1395018
## [23] {yogurt} => {domestic eggs}    0.01433655 0.10276968 0.1395018
## [24] {yogurt} => {fruit/vegetable juice} 0.01870869 0.13411079 0.1395018
## [25] {yogurt} => {whipped/sour cream} 0.02074225 0.14868805 0.1395018
## [26] {yogurt} => {pip fruit}       0.01799695 0.12900875 0.1395018
## [27] {yogurt} => {pastry}          0.01769192 0.12682216 0.1395018
## [28] {yogurt} => {citrus fruit}     0.02165735 0.15524781 0.1395018
## [29] {yogurt} => {shopping bags}    0.01525165 0.10932945 0.1395018
## [30] {yogurt} => {sausage}         0.01962379 0.14067055 0.1395018
## [31] {yogurt} => {bottled water}    0.02297916 0.16472303 0.1395018
## [32] {yogurt} => {tropical fruit}   0.02928317 0.20991254 0.1395018
## [33] {yogurt} => {root vegetables}  0.02582613 0.18513120 0.1395018
## [34] {yogurt} => {soda}            0.02735130 0.19606414 0.1395018
## [35] {yogurt} => {rolls/buns}      0.03436706 0.24635569 0.1395018
## [36] {yogurt} => {other vegetables} 0.04341637 0.31122449 0.1395018
## [37] {yogurt} => {whole milk}      0.05602440 0.40160350 0.1395018
##      lift      count
## [1] 1.000000    792
## [2] 1.000000    875
## [3] 1.000000    814
## [4] 1.000000    969
## [5] 1.000000    924
## [6] 1.000000   1087
## [7] 1.000000   1032
## [8] 1.000000   1072
## [9] 1.000000   1715
## [10] 1.000000   1809
## [11] 1.000000   1903
## [12] 1.000000   2513
## [13] 2.242412    122
## [14] 1.848924    122
## [15] 1.597601    115
## [16] 2.325615    170
## [17] 1.684218    121
## [18] 1.359518    110
## [19] 1.606703    143
## [20] 1.742312    140
## [21] 1.894027    144
## [22] 1.378883    151
## [23] 1.619775    141
## [24] 1.855105    184
## [25] 2.074251    204
## [26] 1.705378    177
## [27] 1.425481    174
## [28] 1.875752    213
## [29] 1.109654    150
## [30] 1.497289    193
## [31] 1.490387    226
## [32] 2.000475    288
## [33] 1.698475    254
## [34] 1.124368    269

```

```
## [35] 1.339363 338  
## [36] 1.608457 427  
## [37] 1.571735 551
```

```
plot(Aturan.S8, method='paracoord',  
     control=list(reorder=T))
```

### Parallel coordinates plot for 25 rules



```
plot(Aturan.S8, method='graph')
```

