

# HW\_AssociationRule

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## 1

```
setwd("C:/Users/sy/Documents/bda")
```

```
## 1  
rds <- readRDS("products.rds")  
  
library("arules")
```

```
## Warning: 패키지 'arules'는 R 버전 4.2.2에서 작성되었습니다
```

```
## 필요한 패키지를 로딩중입니다: Matrix
```

```
##  
## 다음의 패키지를 부착합니다: 'arules'
```

```
## The following objects are masked from 'package:base':  
##  
##      abbreviate, write
```

```
rds.trans <- as(rds, "transactions")
```

## 2

```
rds.trans
```

```
## transactions in sparse format with  
## 131209 transactions (rows) and  
## 39123 items (columns)
```

```
inspect(head(rds.trans, 3))
```

```
##      items
## [1] {Bag of Organic Bananas,
##      Bulgarian Yogurt,
##      Cucumber Kirby,
##      Lightly Smoked Sardines in Olive Oil,
##      Organic 4% Milk Fat Whole Milk Cottage Cheese,
##      Organic Celery Hearts,
##      Organic Hass Avocado,
##      Organic Whole String Cheese}
## [2] {Asparagus,
##      Cage Free Extra Large Grade AA Eggs,
##      Grated Pecorino Romano Cheese,
##      Organic Garnet Sweet Potato (Yam),
##      Organic Half & Half,
##      Prosciutto, Americano,
##      Spring Water,
##      Super Greens Salad}
## [3] {Bunched Cilantro,
##      Flat Parsley, Bunch,
##      Fresh Dill,
##      Green Peas,
##      Organic Baby Arugula,
##      Organic Biologique Limes,
##      Organic Hot House Tomato,
##      Organic Raw Unfiltered Apple Cider Vinegar,
##      Shelled Pistachios}
```

### 3

```
rules <- apriori(rds.trans, parameter = list(supp = 0.002,
                                             conf = 0.25,
                                             maxlen = 2,
                                             target = "rules"))
```

```
## Apriori
##
## Parameter specification:
## confidence minval smax arem aval originalSupport maxtime support minlen
##      0.25    0.1    1 none FALSE                TRUE      5    0.002    1
## maxlen target  ext
##      2   rules TRUE
##
## Algorithmic control:
## filter tree heap memopt load sort verbose
##    0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 262
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[39123 item(s), 131209 transaction(s)] done [0.83s].
## sorting and recoding items ... [848 item(s)] done [0.02s].
## creating transaction tree ... done [0.07s].
## checking subsets of size 1 2
```

```
## Warning in apriori(rds.trans, parameter = list(supp = 0.002, conf = 0.25, :  
## Mining stopped (maxlen reached). Only patterns up to a length of 2 returned!
```

```
## done [0.02s].  
## writing ... [83 rule(s)] done [0.00s].  
## creating S4 object ... done [0.02s].
```

## 4

```
is.redundant(rules)
```

```
## [1] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [13] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [25] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [37] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [49] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [61] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [73] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
```

```
inspect(rules[is.redundant(rules)])  
inspect(rules[!is.redundant(rules)])
```

##	lhs						rhs
	support	confidence	coverage	lift	count		
## [1]	{Clementines}						=> {Bag of Organic Ban
anas}	0.002598907	0.2524056	0.010296550	2.139399	341		
## [2]	{Blackberries}						=> {Raspberries}
	0.002248321	0.2739090	0.008208278	10.960453	295		
## [3]	{Blackberries}						=> {Strawberries}
	0.002194971	0.2674095	0.008208278	5.402915	288		
## [4]	{Organic Large Green Asparagus}						=> {Bag of Organic Ban
anas}	0.002004436	0.3602740	0.005563643	3.053694	263		
## [5]	{Gala Apples}						=> {Banana}
	0.002804686	0.3837331	0.007308950	2.688734	368		
## [6]	{Total 0% Greek Yogurt}						=> {Banana}
	0.002202593	0.2762906	0.007972014	1.935908	289		
## [7]	{Organic Hothouse Cucumbers}						=> {Bag of Organic Ban
anas}	0.002019679	0.2861771	0.007057443	2.425647	265		
## [8]	{Total 2% with Strawberry Lowfat Greek Strained Yogurt}						=> {Banana}
	0.002225457	0.3001028	0.007415650	2.102755	292		
## [9]	{Organic Bartlett Pear}						=> {Organic Strawberri
es}	0.002057786	0.2755102	0.007469000	3.318287	270		
## [10]	{Organic Bartlett Pear}						=> {Bag of Organic Ban
anas}	0.002515071	0.3367347	0.007469000	2.854175	330		
## [11]	{Organic Bell Pepper}						=> {Organic Red Bell P
epper}	0.002134000	0.2969247	0.007187007	16.280482	280		
## [12]	{Vanilla Almond Breeze Almond Milk}						=> {Banana}
	0.002880900	0.2960063	0.009732564	2.074051	378		
## [13]	{Organic Reduced Fat Milk}						=> {Banana}
	0.002713229	0.2951907	0.009191443	2.068337	356		
## [14]	{Frozen Organic Wild Blueberries}						=> {Bag of Organic Ban
anas}	0.002591286	0.3192488	0.008116821	2.705964	340		
## [15]	{100% Raw Coconut Water}						=> {Bag of Organic Ban
anas}	0.002766579	0.2796610	0.009892614	2.370416	363		
## [16]	{Green Beans}						=> {Banana}
	0.002522693	0.2853448	0.008840857	1.999349	331		
## [17]	{Bartlett Pears}						=> {Banana}
	0.003551586	0.3860812	0.009199064	2.705187	466		
## [18]	{Granny Smith Apples}						=> {Banana}
	0.003307700	0.3147208	0.010509950	2.205180	434		
## [19]	{Organic Roasted Turkey Breast}						=> {Bag of Organic Ban
anas}	0.002393129	0.2796082	0.008558864	2.369968	314		
## [20]	{Yellow Bell Pepper}						=> {Orange Bell Peppe
r}	0.003018086	0.3396226	0.008886586	23.906409	396		
## [21]	{Yellow Bell Pepper}						=> {Banana}
	0.002598907	0.2924528	0.008886586	2.049153	341		
## [22]	{No Salt Added Black Beans}						=> {Banana}
	0.002606529	0.2736000	0.009526786	1.917056	342		
## [23]	{Unsweetened Original Almond Breeze Almond Milk}						=> {Banana}
	0.003330564	0.2982935	0.011165393	2.090078	437		
## [24]	{Organic Whole Strawberries}						=> {Bag of Organic Ban
anas}	0.002941871	0.3182193	0.009244793	2.697237	386		
## [25]	{Honey Nut Cheerios}						=> {Banana}
	0.002522693	0.2717570	0.009282900	1.904142	331		
## [26]	{Cantaloupe}						=> {Organic Strawberri
es}	0.002515071	0.2716049	0.009260036	3.271251	330		
## [27]	{Cantaloupe}						=> {Bag of Organic Ban

anas}	0.002370264	0.2559671	0.009260036	2.169586	311	
## [28] {Cantaloupe}						=> {Banana}
0.002522693	0.2724280	0.009260036	1.908843	331		
## [29] {Organic Baby Broccoli}						=> {Bag of Organic Ban
anas}	0.002682743	0.2605477	0.010296550	2.208411	352	
## [30] {Russet Potato}						=> {Banana}
0.002979979	0.2757405	0.010807185	1.932053	391		
## [31] {Clementines, Bag}						=> {Banana}
0.003551586	0.3152909	0.011264471	2.209175	466		
## [32] {Organic Sticks Low Moisture Part Skim Mozzarella String Cheese}						=> {Bag of Organic Ban
anas}	0.002682743	0.2622951	0.010227957	2.223222	352	
## [33] {Red Raspberries}						=> {Banana}
0.003345807	0.2940388	0.011378793	2.060266	439		
## [34] {Grape White/Green Seedless}						=> {Banana}
0.003063814	0.2632613	0.011637921	1.844615	402		
## [35] {Organic Broccoli}						=> {Bag of Organic Ban
anas}	0.004001250	0.3176044	0.012598221	2.692025	525	
## [36] {Organic Grade A Free Range Large Brown Eggs}						=> {Bag of Organic Ban
anas}	0.003391536	0.2518393	0.013467064	2.134598	445	
## [37] {Organic Black Beans}						=> {Bag of Organic Ban
anas}	0.003140029	0.2614213	0.012011371	2.215816	412	
## [38] {Lime Sparkling Water}						=> {Sparkling Water Gr
apefruit}	0.003848821	0.2568667	0.014983728	10.033709	505	
## [39] {Organic Lacinato (Dinosaur) Kale}						=> {Bag of Organic Ban
anas}	0.003460128	0.2578081	0.013421335	2.185190	454	
## [40] {Boneless Skinless Chicken Breasts}						=> {Banana}
0.004466157	0.2806513	0.015913543	1.966463	586		
## [41] {Organic Carrot Bunch}						=> {Bag of Organic Ban
anas}	0.003543964	0.2669346	0.013276528	2.262546	465	
## [42] {Organic Unsweetened Almond Milk}						=> {Bag of Organic Ban
anas}	0.004664314	0.2812500	0.016584228	2.383884	612	
## [43] {Roma Tomato}						=> {Banana}
0.004359457	0.2928827	0.014884650	2.052166	572		
## [44] {Bunched Cilantro}						=> {Limes}
0.004252757	0.2906250	0.014633143	6.320672	558		
## [45] {Jalapeno Peppers}						=> {Limes}
0.004168921	0.2880463	0.014473093	6.264590	547		
## [46] {Organic Navel Orange}						=> {Bag of Organic Ban
anas}	0.005525536	0.3661616	0.015090428	3.103598	725	
## [47] {Orange Bell Pepper}						=> {Banana}
0.003711636	0.2612661	0.014206343	1.830635	487		
## [48] {Organic Kiwi}						=> {Organic Strawberri
es}	0.003940278	0.2750000	0.014328285	3.312142	517	
## [49] {Organic Kiwi}						=> {Bag of Organic Ban
anas}	0.004984414	0.3478723	0.014328285	2.948578	654	
## [50] {Organic D'Anjou Pears}						=> {Organic Strawberri
es}	0.003643043	0.2525092	0.014427364	3.041260	478	
## [51] {Organic D'Anjou Pears}						=> {Bag of Organic Ban
anas}	0.004603343	0.3190703	0.014427364	2.704450	604	
## [52] {Red Vine Tomato}						=> {Banana}
0.004527128	0.2658908	0.017026271	1.863039	594		
## [53] {Organic Whole String Cheese}						=> {Organic Strawberri
es}	0.003925036	0.2584044	0.015189507	3.112262	515	
## [54] {Organic Whole String Cheese}						=> {Bag of Organic Ban
anas}	0.004473778	0.2945309	0.015189507	2.496453	587	
## [55] {Blueberries}						=> {Banana}

0.005456943	0.3082221	0.017704578	2.159645	716		
## [56] {Apple Honeycrisp Organic}						=> {Bag of Organic Ban
anas}	0.005235921	0.3050622	0.017163457	2.585717	687	
## [57] {Cucumber Kirby}						=> {Banana}
0.005662721	0.3079155	0.018390507	2.157496	743		
## [58] {100% Whole Wheat Bread}						=> {Banana}
0.004786257	0.2732811	0.017514042	1.914821	628		
## [59] {Organic Granny Smith Apple}						=> {Bag of Organic Ban
anas}	0.004953928	0.2781344	0.017811278	2.357476	650	
## [60] {Organic Peeled Whole Baby Carrots}						=> {Banana}
0.004923443	0.2626016	0.018748714	1.839992	646		
## [61] {Organic Red Bell Pepper}						=> {Bag of Organic Ban
anas}	0.004793878	0.2628500	0.018238078	2.227925	629	
## [62] {Organic Tomato Cluster}						=> {Bag of Organic Ban
anas}	0.004839607	0.2501970	0.019343185	2.120678	635	
## [63] {Organic Gala Apples}						=> {Bag of Organic Ban
anas}	0.006173357	0.2883588	0.021408592	2.444139	810	
## [64] {Organic Large Extra Fancy Fuji Apple}						=> {Bag of Organic Ban
anas}	0.007415650	0.3365617	0.022033550	2.852709	973	
## [65] {Broccoli Crown}						=> {Banana}
0.007049821	0.3154843	0.022346028	2.210530	925		
## [66] {Red Peppers}						=> {Banana}
0.006386757	0.2884682	0.022140250	2.021234	838		
## [67] {Small Hass Avocado}						=> {Banana}
0.006592536	0.2787625	0.023649292	1.953228	865		
## [68] {Organic Fuji Apple}						=> {Banana}
0.009221928	0.3715075	0.024822992	2.603072	1210		
## [69] {Honeycrisp Apple}						=> {Banana}
0.009381978	0.3466629	0.027063692	2.428991	1231		
## [70] {Organic Lemon}						=> {Bag of Organic Ban
anas}	0.008132064	0.3044223	0.026713107	2.580293	1067	
## [71] {Yellow Onions}						=> {Banana}
0.008162550	0.2846890	0.028671814	1.994754	1071		
## [72] {Organic Cilantro}						=> {Limes}
0.007674778	0.2855927	0.026873157	6.211228	1007		
## [73] {Seedless Red Grapes}						=> {Banana}
0.008856100	0.2862774	0.030935378	2.005883	1162		
## [74] {Organic Blueberries}						=> {Organic Strawberri
es}	0.009671593	0.2555377	0.037848013	3.077735	1269	
## [75] {Organic Cucumber}						=> {Bag of Organic Ban
anas}	0.009663971	0.2748754	0.035157649	2.329853	1268	
## [76] {Strawberries}						=> {Banana}
0.014846543	0.2999692	0.049493556	2.101819	1948		
## [77] {Organic Raspberries}						=> {Organic Strawberri
es}	0.012727785	0.3011179	0.042268442	3.626710	1670	
## [78] {Organic Raspberries}						=> {Bag of Organic Ban
anas}	0.013566143	0.3209520	0.042268442	2.720400	1780	
## [79] {Limes}						=> {Large Lemon}
0.012156178	0.2643792	0.045980078	4.264159	1595		
## [80] {Organic Avocado}						=> {Banana}
0.016889085	0.2990957	0.056467163	2.095698	2216		
## [81] {Organic Hass Avocado}						=> {Bag of Organic Ban
anas}	0.018443857	0.3318250	0.055583077	2.812560	2420	
## [82] {Large Lemon}						=> {Banana}
0.016447043	0.2652735	0.062000320	1.858714	2158		

```
## [83] {Organic Strawberries}                                     => {Bag of Organic Ban
anas}      0.023428271  0.2821737 0.083027841  2.391714  3074
```

5

```
inspect(head(sort(rules, by="lift"), 10))
```

##	lhs		rhs		support
## [1]	{Yellow Bell Pepper}	=>	{Orange Bell Pepper}		0.003018086
## [2]	{Organic Bell Pepper}	=>	{Organic Red Bell Pepper}		0.002134000
## [3]	{Blackberries}	=>	{Raspberries}		0.002248321
## [4]	{Lime Sparkling Water}	=>	{Sparkling Water Grapefruit}		0.003848821
## [5]	{Bunched Cilantro}	=>	{Limes}		0.004252757
## [6]	{Jalapeno Peppers}	=>	{Limes}		0.004168921
## [7]	{Organic Cilantro}	=>	{Limes}		0.007674778
## [8]	{Blackberries}	=>	{Strawberries}		0.002194971
## [9]	{Limes}	=>	{Large Lemon}		0.012156178
## [10]	{Organic Raspberries}	=>	{Organic Strawberries}		0.012727785
##	confidence	coverage	lift	count	
## [1]	0.3396226	0.008886586	23.906409	396	
## [2]	0.2969247	0.007187007	16.280482	280	
## [3]	0.2739090	0.008208278	10.960453	295	
## [4]	0.2568667	0.014983728	10.033709	505	
## [5]	0.2906250	0.014633143	6.320672	558	
## [6]	0.2880463	0.014473093	6.264590	547	
## [7]	0.2855927	0.026873157	6.211228	1007	
## [8]	0.2674095	0.008208278	5.402915	288	
## [9]	0.2643792	0.045980078	4.264159	1595	
## [10]	0.3011179	0.042268442	3.626710	1670	

## 6

[illegible]

```
## Apriori
##
## Parameter specification:
## confidence minval smax arem aval originalSupport maxtime support minlen
##          0.1    0.1    1 none FALSE          TRUE        5   0.001      1
## maxlen target  ext
##          2  rules TRUE
##
## Algorithmic control:
## filter tree heap memopt load sort verbose
##    0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 131
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[39123 item(s), 131209 transaction(s)] done [0.81s].
## sorting and recoding items ... [1865 item(s)] done [0.02s].
## creating transaction tree ... done [0.08s].
## checking subsets of size 1 2
```

```
## Warning in apriori(rds.trans, parameter = list(supp = 0.001, conf = 0.1, :
## Mining stopped (maxlen reached). Only patterns up to a length of 2 returned!
```

```
## done [0.04s].
## writing ... [1483 rule(s)] done [0.01s].
## creating S4 object ... done [0.03s].
```

```
Banana_rules <- subset(rules2, subset=lhs %in% 'Banana')
inspect(sort(Banana_rules[!is.redundant(Banana_rules)],
             by="confidence"))
```

```
##      lhs      rhs      support    confidence coverage lift
## [1] {Banana} => {Organic Avocado} 0.01688909 0.1183381 0.1427189 2.095698
## [2] {Banana} => {Organic Strawberries} 0.01656899 0.1160953 0.1427189 1.398269
## [3] {Banana} => {Large Lemon} 0.01644704 0.1152408 0.1427189 1.858714
## [4] {Banana} => {Organic Baby Spinach} 0.01524286 0.1068034 0.1427189 1.432294
## [5] {Banana} => {Strawberries} 0.01484654 0.1040265 0.1427189 2.101819
##      count
## [1] 2216
## [2] 2174
## [3] 2158
## [4] 2000
## [5] 1948
```