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19BCE1027_LAB 09

Implementation:

Install and import the library(arulesViz) and Show the Visual output of Association Rules for your data. Assume your own dataset (may be downloaded) unsing below link wherever necessary.

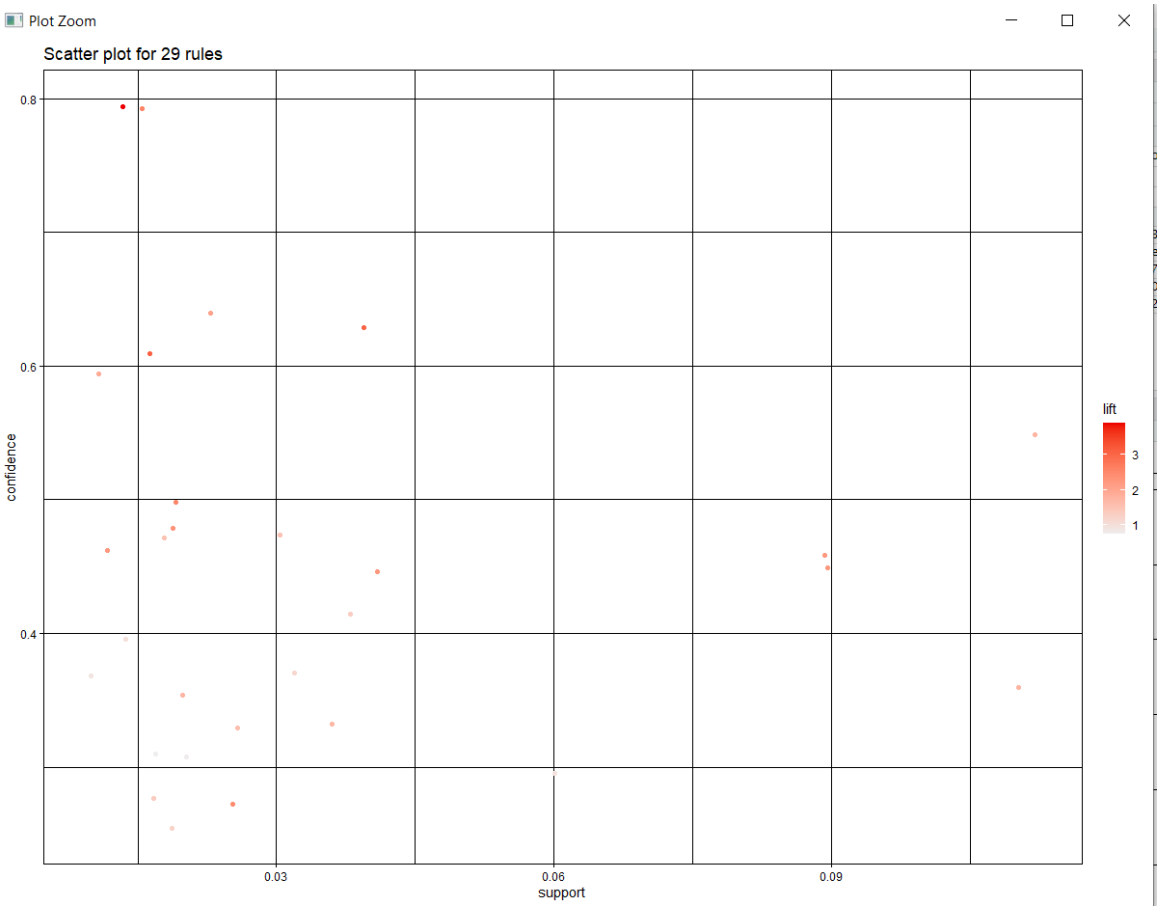
```
library(arules)

library(arulesViz)

library(knitr)

library(magrittr)

library(dplyr)

library(plotly)

med=read.csv("https://umich.instructure.com/files/1678540/download?download_frd=1", stringsAsFactors = FALSE)

med=med[, -1]

write.csv(med, "medication.csv", row.names=F)

kable(med[1:5, ])

med<-read.transactions("medication.csv", sep = ",", skip = 1, rm.duplicates=TRUE)

summary(med)

inspect(med[1:5,])

apriori(med)

med_rule=apriori(med, parameter=list(support=0.01, confidence=0.25, minlen=2))

print(med_rule)

summary(med_rule)

plot(sort(med_rule))

sortedRule = sort(med_rule)
```

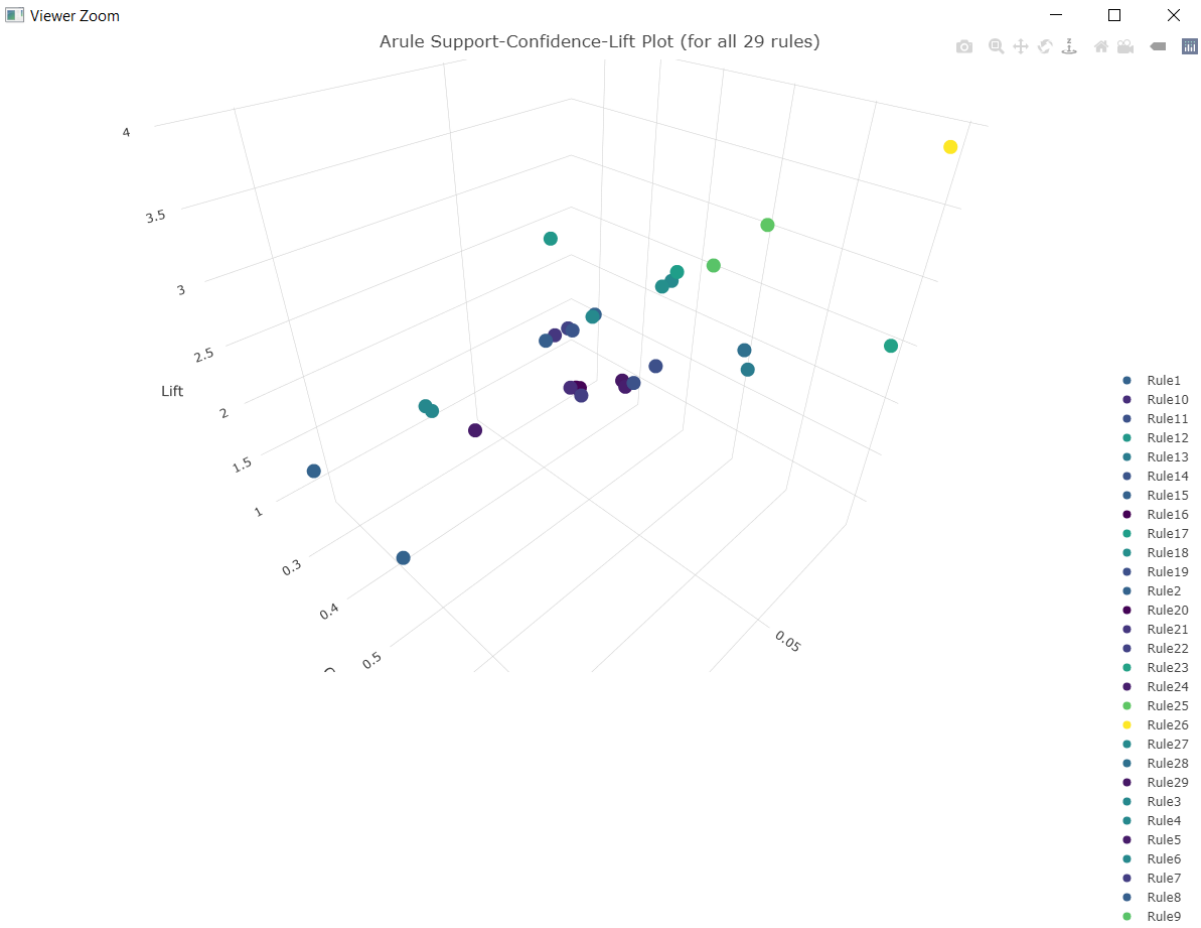
```
x1   = sortedRule@quality$support

y1   = sortedRule@quality$confidence

z1   = sortedRule@quality$lift

col1 = sortedRule@quality$count

ruleNames <- paste0("Rule", c(1:length(sortedRule@quality$support)))

plot_ly(x = ~x1, y = ~y1, z = ~z1, color = ~z1, name=ruleNames) %>%

  add_markers() %>%

  layout(title=paste0("Arule Support-Confidence-Lift Plot (for all ",
length(sortedRule@quality$support), " rules)"),

         scene = list(xaxis = list(title = 'Support'),

                      yaxis = list(title = 'Confidence'),

                      zaxis = list(title = 'Lift'))) %>%

  hide_colorbar()

inspect(med_rule[1:29])

inspect(sort(med_rule, by="lift")[1:29])
```

```
> kable(med[1:5, ])


|MEDICATION_DESC.1                  |MEDICATION_DESC.2                  |MEDICATION_DESC.3 |MEDICATION_DESC.4          |MEDICATION_DESC. |
|:----------------------------------|:----------------------------------|:-----------------|:--------------------------|:----------------|
|acetaminophen uh                   |cefazolin ivpb uh                  |NA                |NA                         |NA               |
|docusate                           |fioricet                           |heparin injection |ondansetron injection uh   |simvastatin      |
|hydrocodone acetaminophen 5mg 325mg|NA                                 |NA                |NA                         |NA               |
|fentanyl injection uh              |NA                                 |NA                |NA                         |NA               |
|cefazolin ivpb uh                  |hydrocodone acetaminophen 5mg 325mg|NA                |NA                         |NA               |
> med<-read.transactions("medication.csv", sep = ",", skip = 1, rm.duplicates=TRUE)
distribution of transactions with duplicates:
items
  1   2   3
 79 166 248
> summary(med)
transactions as itemMatrix in sparse format with
 528 rows (elements/itemsets/transactions) and
 88 columns (items) and a density of 0.02085486

most frequent items:
              fentanyl injection uh  hydrocodone acetaminophen 5mg 325mg                   cefazolin ivpb uh
                                211                                 165                                 108
                  heparin injection hydrocodone acetamin 75mg 500mg 15ml                             (Other)
                                105                                  60                                 320

element (itemset/transaction) length distribution:
sizes
  1   2   3   4   5
248 166  79  23  12

   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  1.000   1.000   2.000   1.835   2.000   5.000

includes extended item information - examples:
                        labels
1                    09 nacl
2                09 nacl bolus
3 acetaminophen  multiroute    uh
> inspect(med[1:5,])
    items
[1] {acetaminophen uh,cefazolin ivpb uh}
[2] {docusate,fioricet,heparin injection,ondansetron injection uh,simvastatin}
[3] {hydrocodone acetaminophen 5mg 325mg}
[4] {fentanyl injection uh}
[5] {cefazolin ivpb uh,hydrocodone acetaminophen 5mg 325mg}
```

```
> inspect(med[1:5,])
    items
[1] {acetaminophen uh,cefazolin ivpb uh}
[2] {docusate,fioricet,heparin injection,ondansetron injection uh,simvastatin}
[3] {hydrocodone acetaminophen 5mg 325mg}
[4] {fentanyl injection uh}
[5] {cefazolin ivpb uh,hydrocodone acetaminophen 5mg 325mg}
> apriori(med)
Apriori

Parameter specification:
 confidence minval smax arem  aval originalSupport maxtime support minlen maxlen target  ext
        0.8    0.1    1 none FALSE            TRUE       5     0.1      1     10  rules TRUE

Algorithmic control:
 filter tree heap memopt load sort verbose
    0.1 TRUE TRUE  FALSE TRUE    2    TRUE

Absolute minimum support count: 52

set item appearances ...[0 item(s)] done [0.00s].
set transactions ...[88 item(s), 528 transaction(s)] done [0.00s].
sorting and recoding items ... [5 item(s)] done [0.00s].
creating transaction tree ... done [0.00s].
checking subsets of size 1 2 done [0.00s].
writing ... [0 rule(s)] done [0.00s].
creating S4 object  ... done [0.00s].
set of 0 rules
> med_rule=apriori(med, parameter=list(support=0.01, confidence=0.25, minlen=2))
Apriori

Parameter specification:
 confidence minval smax arem  aval originalSupport maxtime support minlen maxlen target  ext
       0.25    0.1    1 none FALSE            TRUE       5    0.01      2     10  rules TRUE

Algorithmic control:
 filter tree heap memopt load sort verbose
    0.1 TRUE TRUE  FALSE TRUE    2    TRUE

Absolute minimum support count: 5

set item appearances ...[0 item(s)] done [0.00s].
set transactions ...[88 item(s), 528 transaction(s)] done [0.00s].
sorting and recoding items ... [16 item(s)] done [0.00s].
creating transaction tree ... done [0.00s].
checking subsets of size 1 2 3 4 done [0.00s].
writing ... [29 rule(s)] done [0.00s].
creating S4 object  ... done [0.00s].
> print(med_rule)
> summary(med_rule)
set of 29 rules

rule length distribution (lhs + rhs):sizes
 2  3  4
13 12  4

   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   2.00    2.00    3.00    2.69    3.00    4.00

summary of quality measures:
    support         confidence        coverage            lift            count
 Min.   :0.01136   Min.   :0.2500   Min.   :0.01894   Min.   :0.7583   Min.   : 6.00
 1st Qu.:0.01705   1st Qu.:0.3390   1st Qu.:0.03788   1st Qu.:1.3333   1st Qu.: 9.00
 Median :0.01894   Median :0.4444   Median :0.06250   Median :1.7481   Median :10.00
 Mean   :0.03448   Mean   :0.4491   Mean   :0.08392   Mean   :1.8636   Mean   :18.21
 3rd Qu.:0.03788   3rd Qu.:0.5000   3rd Qu.:0.08902   3rd Qu.:2.2564   3rd Qu.:20.00
 Max.   :0.11174   Max.   :0.8000   Max.   :0.31250   Max.   :3.9111   Max.   :59.00

mining info:
 data ntransactions support confidence
  med           528    0.01       0.25
```

```
> inspect(med_rule[1:29])
     lhs                                                rhs                                                support confidence   coverage      lift count
[1]  {acetaminophen uh}                                 => {cefazolin ivpb uh}                             0.01136364  0.4615385 0.02462121 2.2564103     6
[2]  {ampicillin sulbactam ivpb uh}                     => {heparin injection}                             0.01893939  0.3448276 0.05492424 1.7339901    10
[3]  {ondansetron injection uh}                         => {heparin injection}                             0.01704545  0.2727273 0.06250000 1.3714286     9
[4]  {ondansetron injection uh}                         => {fentanyl injection uh}                         0.01893939  0.3030303 0.06250000 0.7582938    10
[5]  {ondansetron injection uh}                         => {hydrocodone acetaminophen 5mg 325mg}           0.03030303  0.4848485 0.06250000 1.5515152    16
[6]  {clindamycin ivpb uh}                              => {hydrocodone acetamin 75mg 500mg 15ml}          0.02462121  0.2765957 0.08901515 2.4340426    13
[7]  {clindamycin ivpb uh}                              => {heparin injection}                             0.03977273  0.4468085 0.08901515 2.2468085    21
[8]  {clindamycin ivpb uh}                              => {hydrocodone acetaminophen 5mg 325mg}           0.03219697  0.3617021 0.08901515 1.1574468    17
[9]  {cefazolin ivpb uh}                                => {heparin injection}                             0.09090909  0.4444444 0.20454545 2.2349206    48
[10] {heparin injection}                                => {cefazolin ivpb uh}                             0.09090909  0.4571429 0.19886364 2.2349206    48
[11] {cefazolin ivpb uh}                                => {hydrocodone acetaminophen 5mg 325mg}           0.11174242  0.5462963 0.20454545 1.7481481    59
[12] {hydrocodone acetaminophen 5mg 325mg}              => {cefazolin ivpb uh}                             0.11174242  0.3575758 0.31250000 1.7481481    59
[13] {heparin injection}                                => {hydrocodone acetaminophen 5mg 325mg}           0.06060606  0.3047619 0.19886364 0.9752381    32
[14] {fentanyl injection uh,
      ondansetron injection uh}                         => {hydrocodone acetaminophen 5mg 325mg}           0.01136364  0.6000000 0.01893939 1.9200000     6
[15] {hydrocodone acetaminophen 5mg 325mg,
      ondansetron injection uh}                         => {fentanyl injection uh}                         0.01136364  0.3750000 0.03030303 0.9383886     6
[16] {cefazolin ivpb uh,
      fentanyl injection uh}                            => {heparin injection}                             0.01893939  0.5000000 0.03787879 2.5142857    10
[17] {fentanyl injection uh,
      heparin injection}                                => {cefazolin ivpb uh}                             0.01893939  0.4761905 0.03977273 2.3280423    10
[18] {cefazolin ivpb uh,
      heparin injection}                                => {hydrocodone acetaminophen 5mg 325mg}           0.03787879  0.4166667 0.09090909 1.3333333    20
[19] {cefazolin ivpb uh,
      hydrocodone acetaminophen 5mg 325mg}              => {heparin injection}                             0.03787879  0.3389831 0.11174242 1.7046005    20
[20] {heparin injection,
      hydrocodone acetaminophen 5mg 325mg}              => {cefazolin ivpb uh}                             0.03787879  0.6250000 0.06060606 3.0555556    20
[21] {cefazolin ivpb uh,
      fentanyl injection uh}                            => {hydrocodone acetaminophen 5mg 325mg}           0.02462121  0.6500000 0.03787879 2.0800000    13
[22] {fentanyl injection uh,
      hydrocodone acetaminophen 5mg 325mg}              => {cefazolin ivpb uh}                             0.02462121  0.3250000 0.07575758 1.5888889    13
[23] {fentanyl injection uh,
      heparin injection}                                => {hydrocodone acetaminophen 5mg 325mg}           0.01893939  0.4761905 0.03977273 1.5238095    10
[24] {heparin injection,
      hydrocodone acetaminophen 5mg 325mg}              => {fentanyl injection uh}                         0.01893939  0.3125000 0.06060606 0.7819905    10
[25] {fentanyl injection uh,
      hydrocodone acetaminophen 5mg 325mg}              => {heparin injection}                             0.01893939  0.2500000 0.07575758 1.2571429    10
[26] {cefazolin ivpb uh,
      fentanyl injection uh,
      heparin injection}                                => {hydrocodone acetaminophen 5mg 325mg}           0.01515152  0.8000000 0.01893939 2.5600000     8
[27] {cefazolin ivpb uh,
      heparin injection,
      hydrocodone acetaminophen 5mg 325mg}              => {fentanyl injection uh}                         0.01515152  0.4000000 0.03787879 1.0009479     8
[28] {cefazolin ivpb uh,
      fentanyl injection uh,
      hydrocodone acetaminophen 5mg 325mg}              => {heparin injection}                             0.01515152  0.6153846 0.02462121 3.0945055     8
[29] {fentanyl injection uh,
      heparin injection,
      hydrocodone acetaminophen 5mg 325mg}              => {cefazolin ivpb uh}                             0.01515152  0.8000000 0.01893939 3.9111111     8
> inspect(sort(med_rule, by="lift")[1:29])
     lhs                                                rhs                                                support confidence   coverage      lift count
[1]  {fentanyl injection uh,
      heparin injection,
      hydrocodone acetaminophen 5mg 325mg}              => {cefazolin ivpb uh}                             0.01515152  0.8000000 0.01893939 3.9111111     8
[2]  {cefazolin ivpb uh,
      fentanyl injection uh,
      hydrocodone acetaminophen 5mg 325mg}              => {heparin injection}                             0.01515152  0.6153846 0.02462121 3.0945055     8
[3]  {heparin injection,
      hydrocodone acetaminophen 5mg 325mg}              => {cefazolin ivpb uh}                             0.03787879  0.6250000 0.06060606 3.0555556    20
[4]  {cefazolin ivpb uh,
      fentanyl injection uh,
      heparin injection}                                => {hydrocodone acetaminophen 5mg 325mg}           0.01515152  0.8000000 0.01893939 2.5600000     8
[5]  {cefazolin ivpb uh,
      fentanyl injection uh}                            => {heparin injection}                             0.01893939  0.5000000 0.03787879 2.5142857    10
[6]  {clindamycin ivpb uh}                              => {hydrocodone acetamin 75mg 500mg 15ml}          0.02462121  0.2765957 0.08901515 2.4340426    13
[7]  {fentanyl injection uh,
      heparin injection}                                => {cefazolin ivpb uh}                             0.01893939  0.4761905 0.03977273 2.3280423    10
[8]  {acetaminophen uh}                                 => {cefazolin ivpb uh}                             0.01136364  0.4615385 0.02462121 2.2564103     6
[9]  {clindamycin ivpb uh}                              => {heparin injection}                             0.03977273  0.4468085 0.08901515 2.2468085    21
[10] {cefazolin ivpb uh}                                => {heparin injection}                             0.09090909  0.4444444 0.20454545 2.2349206    48
[11] {heparin injection}                                => {cefazolin ivpb uh}                             0.09090909  0.4571429 0.19886364 2.2349206    48
[12] {cefazolin ivpb uh,
      fentanyl injection uh}                            => {hydrocodone acetaminophen 5mg 325mg}           0.02462121  0.6500000 0.03787879 2.0800000    13
[13] {fentanyl injection uh,
      ondansetron injection uh}                         => {hydrocodone acetaminophen 5mg 325mg}           0.01136364  0.6000000 0.01893939 1.9200000     6
[14] {cefazolin ivpb uh}                                => {hydrocodone acetaminophen 5mg 325mg}           0.11174242  0.5462963 0.20454545 1.7481481    59
[15] {hydrocodone acetaminophen 5mg 325mg}              => {cefazolin ivpb uh}                             0.11174242  0.3575758 0.31250000 1.7481481    59
[16] {ampicillin sulbactam ivpb uh}                     => {heparin injection}                             0.01893939  0.3448276 0.05492424 1.7339901    10
[17] {cefazolin ivpb uh,
      hydrocodone acetaminophen 5mg 325mg}              => {heparin injection}                             0.03787879  0.3389831 0.11174242 1.7046005    20
[18] {fentanyl injection uh,
      hydrocodone acetaminophen 5mg 325mg}              => {cefazolin ivpb uh}                             0.02462121  0.3250000 0.07575758 1.5888889    13
[19] {ondansetron injection uh}                         => {hydrocodone acetaminophen 5mg 325mg}           0.03030303  0.4848485 0.06250000 1.5515152    16
[20] {fentanyl injection uh,
      heparin injection}                                => {hydrocodone acetaminophen 5mg 325mg}           0.01893939  0.4761905 0.03977273 1.5238095    10
[21] {ondansetron injection uh}                         => {heparin injection}                             0.01704545  0.2727273 0.06250000 1.3714286     9
[22] {cefazolin ivpb uh,
      heparin injection}                                => {hydrocodone acetaminophen 5mg 325mg}           0.03787879  0.4166667 0.09090909 1.3333333    20
[23] {fentanyl injection uh,
      hydrocodone acetaminophen 5mg 325mg}              => {heparin injection}                             0.01893939  0.2500000 0.07575758 1.2571429    10
[24] {clindamycin ivpb uh}                              => {hydrocodone acetaminophen 5mg 325mg}           0.03219697  0.3617021 0.08901515 1.1574468    17
[25] {cefazolin ivpb uh,
      heparin injection,
      hydrocodone acetaminophen 5mg 325mg}              => {fentanyl injection uh}                         0.01515152  0.4000000 0.03787879 1.0009479     8
[26] {heparin injection}                                => {hydrocodone acetaminophen 5mg 325mg}           0.06060606  0.3047619 0.19886364 0.9752381    32
[27] {hydrocodone acetaminophen 5mg 325mg,
      ondansetron injection uh}                         => {fentanyl injection uh}                         0.01136364  0.3750000 0.03030303 0.9383886     6
[28] {heparin injection,
      hydrocodone acetaminophen 5mg 325mg}              => {fentanyl injection uh}                         0.01893939  0.3125000 0.06060606 0.7819905    10
[29] {ondansetron injection uh}                         => {fentanyl injection uh}                         0.01893939  0.3030303 0.06250000 0.7582938    10
```


Plot Zoom
Scatter plot for 29 rules
confidence
support
lift
0.8
0.6
0.4
0.03
0.06
0.09
3
2
1


Viewer Zoom
Arule Support-Confidence-Lift Plot (for all 29 rules)
Lift
4
3.5
3
2.5
2
1.5
1
0.3
0.4
0.5
0.05
Rule1
Rule10
Rule11
Rule12
Rule13
Rule14
Rule15
Rule16
Rule17
Rule18
Rule19
Rule2
Rule20
Rule21
Rule22
Rule23
Rule24
Rule25
Rule26
Rule27
Rule28
Rule29
Rule3
Rule4
Rule5
Rule6
Rule7
Rule8
Rule9