Quiz STQD6414

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Soalan 1

a) Terangkan objektif utama analisis faktor

Objektif utama analisis faktor adalah untuk menurunkan dimensi data dengan cara mencari faktor-faktor pendam dalam pemboleh ubah data asal.

b) Nyatakan peranan pemboleh ubah pendam dalam analisis faktor.

Peranan faktor pendam dalam analisis faktor adalah bagi menerangkan kovarians antara pembolehubah tercerap dalam bentuk dimensi yang lebih kecil.

c) Diberi set data *FACars.csv* yang menerangkan 14 atribut berkaitan skor keutamaan pelanggan bagi tingkahlaku pembelian kereta. Jalankan analisis faktor terhadap set data ini berdasarkan arahan-arahan berikut:

i) Skalakan data bagi setiap atribut.

```
data = read.csv('FACars.csv')
head(data)
```

```
##   Price Safety Exterior_Looks Space_comfort Technology After_Sales_Service
## 1     4      4              5             4          3                    4
## 2     3      5              3             3          4                    4
## 3     4      4              3             4          5                    5
## 4     4      4              4             3          3                    4
## 5     5      5              4             4          5                    4
## 6     4      4              5             3          4                    5
##   Resale_Value Fuel_Type Fuel_Efficiency Color Maintenance Test_drive
## 1            5         4               4     2           4          2
## 2            3         4               3     4           3          2
## 3            5         4               5     4           5          4
## 4            5         5               4     4           4          2
## 5            5         3               4     5           5          5
## 6            3         4               3     2           3          2
##   Product_reviews Testimonials
## 1               4            3
## 2               2            2
## 3               4            3
```

```
## 4               5            3
## 5               5            2
## 6               2            3
```

```
str(data)
```

```
## 'data.frame':    90 obs. of  14 variables:
##  $ Price              : int  4 3 4 4 5 4 3 4 5 4 ...
##  $ Safety             : int  4 5 4 4 5 4 4 3 4 4 ...
##  $ Exterior_Looks     : int  5 3 3 4 4 5 3 4 5 3 ...
##  $ Space_comfort      : int  4 3 4 3 4 3 4 4 4 3 ...
##  $ Technology         : int  3 4 5 3 5 4 3 5 3 5 ...
##  $ After_Sales_Service: int  4 4 5 4 4 5 5 4 5 4 ...
##  $ Resale_Value       : int  5 3 5 5 5 3 3 5 5 5 ...
##  $ Fuel_Type          : int  4 4 4 5 3 4 4 4 4 5 ...
##  $ Fuel_Efficiency    : int  4 3 5 4 4 3 5 4 4 4 ...
##  $ Color              : int  2 4 4 4 5 2 4 4 4 5 ...
##  $ Maintenance        : int  4 3 5 4 5 3 3 5 4 5 ...
##  $ Test_drive         : int  2 2 4 2 5 2 5 2 2 2 ...
##  $ Product_reviews    : int  4 2 4 5 5 2 2 4 4 2 ...
##  $ Testimonials       : int  3 2 3 3 2 3 4 4 4 4 ...
```

```
z_score = scale(data)
z_score
```

```
##             Price     Safety Exterior_Looks Space_comfort Technology
##  [1,] -0.2847042 -0.3127334      1.4446432      0.000000 -1.3237313
##  [2,] -1.9929292  1.2509337     -1.0085245     -1.530394 -0.1781946
##  [3,] -0.2847042 -0.3127334     -1.0085245      0.000000  0.9673421
##  [4,] -0.2847042 -0.3127334      0.2180593     -1.530394 -1.3237313
##  [5,]  1.4235209  1.2509337      0.2180593      0.000000  0.9673421
##  [6,] -0.2847042 -0.3127334      1.4446432     -1.530394 -0.1781946
##  [7,] -1.9929292 -0.3127334     -1.0085245      0.000000 -1.3237313
##  [8,] -0.2847042 -1.8764006      0.2180593      0.000000  0.9673421
##  [9,]  1.4235209 -0.3127334      1.4446432      0.000000 -1.3237313
## [10,] -0.2847042 -0.3127334     -1.0085245     -1.530394  0.9673421
## [11,]  1.4235209 -0.3127334     -1.0085245      0.000000  0.9673421
## [12,] -0.2847042 -1.8764006      0.2180593     -1.530394  0.9673421
## [13,] -0.2847042 -0.3127334      1.4446432      0.000000 -1.3237313
## [14,]  1.4235209  1.2509337     -1.0085245      0.000000  0.9673421
## [15,] -0.2847042 -1.8764006      0.2180593     -1.530394 -0.1781946
## [16,]  1.4235209 -0.3127334     -1.0085245      0.000000 -1.3237313
## [17,] -0.2847042 -0.3127334      0.2180593      0.000000 -0.1781946
## [18,] -0.2847042 -0.3127334     -1.0085245      0.000000  0.9673421
## [19,]  1.4235209  1.2509337     -1.0085245     -1.530394  0.9673421
## [20,] -0.2847042 -0.3127334     -1.0085245      0.000000 -0.1781946
## [21,]  1.4235209 -0.3127334      0.2180593      0.000000  0.9673421
## [22,] -0.2847042 -1.8764006     -1.0085245     -1.530394  0.9673421
## [23,] -0.2847042 -0.3127334     -1.0085245      0.000000  0.9673421
## [24,]  1.4235209 -0.3127334     -1.0085245      0.000000  0.9673421
## [25,] -0.2847042 -0.3127334      0.2180593      0.000000 -0.1781946
## [26,]  1.4235209 -1.8764006      1.4446432     -1.530394 -1.3237313
## [27,] -1.9929292  1.2509337     -1.0085245      0.000000 -0.1781946
```

```
## [28,] -0.2847042 -0.3127334     -1.0085245      0.000000  0.9673421
## [29,] -0.2847042 -0.3127334     -1.0085245     -1.530394  0.9673421
## [30,]  1.4235209 -1.8764006      0.2180593      0.000000 -0.1781946
## [31,] -0.2847042 -0.3127334      1.4446432      0.000000 -1.3237313
## [32,]  1.4235209  1.2509337     -1.0085245      0.000000 -0.1781946
## [33,] -1.9929292  1.2509337     -1.0085245      0.000000 -0.1781946
## [34,]  1.4235209 -0.3127334      1.4446432      1.530394  0.9673421
## [35,] -0.2847042  1.2509337      0.2180593     -1.530394 -0.1781946
## [36,]  1.4235209 -0.3127334     -1.0085245      0.000000 -0.1781946
## [37,]  1.4235209 -1.8764006     -2.2351083      1.530394 -0.1781946
## [38,] -0.2847042 -0.3127334      1.4446432      0.000000 -1.3237313
## [39,] -0.2847042 -0.3127334     -1.0085245     -3.060788 -2.4692679
## [40,] -1.9929292 -0.3127334     -1.0085245      0.000000 -0.1781946
## [41,] -0.2847042  1.2509337      0.2180593      0.000000 -0.1781946
## [42,] -0.2847042  1.2509337     -1.0085245     -1.530394 -2.4692679
## [43,] -0.2847042  1.2509337      0.2180593      1.530394 -0.1781946
## [44,] -0.2847042  1.2509337      0.2180593      1.530394  0.9673421
## [45,] -0.2847042  1.2509337      0.2180593      0.000000 -1.3237313
## [46,] -0.2847042 -0.3127334      0.2180593      0.000000 -0.1781946
## [47,]  1.4235209  1.2509337      1.4446432      1.530394  0.9673421
## [48,] -0.2847042 -0.3127334      0.2180593      0.000000  0.9673421
## [49,] -0.2847042 -0.3127334      0.2180593      0.000000 -0.1781946
## [50,] -0.2847042 -1.8764006      0.2180593      0.000000 -0.1781946
## [51,] -0.2847042 -0.3127334     -1.0085245     -1.530394 -0.1781946
## [52,] -0.2847042 -0.3127334      0.2180593      0.000000 -0.1781946
## [53,]  1.4235209  1.2509337     -3.4616921      1.530394 -3.6148046
## [54,] -0.2847042  1.2509337      1.4446432      1.530394  0.9673421
## [55,]  1.4235209 -1.8764006      0.2180593     -1.530394 -2.4692679
## [56,]  1.4235209  1.2509337      0.2180593      0.000000 -0.1781946
## [57,] -0.2847042 -0.3127334      0.2180593      0.000000 -0.1781946
## [58,] -0.2847042 -0.3127334      0.2180593      0.000000 -0.1781946
## [59,] -1.9929292  1.2509337      1.4446432      1.530394  0.9673421
## [60,]  1.4235209 -0.3127334      1.4446432      0.000000  0.9673421
## [61,] -0.2847042  1.2509337     -1.0085245      1.530394  0.9673421
## [62,]  1.4235209 -0.3127334      0.2180593      0.000000 -0.1781946
## [63,]  1.4235209  1.2509337      1.4446432      1.530394  0.9673421
## [64,] -1.9929292  1.2509337      0.2180593      0.000000 -1.3237313
## [65,]  1.4235209  1.2509337      0.2180593      1.530394  0.9673421
## [66,]  1.4235209  1.2509337      0.2180593      1.530394  0.9673421
## [67,] -1.9929292  1.2509337      0.2180593      0.000000  0.9673421
## [68,] -0.2847042 -0.3127334      0.2180593      1.530394 -0.1781946
## [69,] -0.2847042 -0.3127334      0.2180593      0.000000 -0.1781946
## [70,] -0.2847042 -0.3127334      1.4446432      0.000000 -1.3237313
## [71,] -0.2847042 -0.3127334      0.2180593      1.530394  0.9673421
## [72,] -0.2847042 -0.3127334      0.2180593      0.000000  0.9673421
## [73,] -0.2847042  1.2509337     -2.2351083      0.000000  0.9673421
## [74,] -1.9929292 -0.3127334      0.2180593      0.000000  0.9673421
## [75,] -0.2847042 -0.3127334      0.2180593     -1.530394 -0.1781946
## [76,] -0.2847042 -0.3127334      1.4446432      0.000000  0.9673421
## [77,] -0.2847042 -0.3127334      1.4446432      1.530394  0.9673421
## [78,]  1.4235209 -0.3127334      0.2180593      0.000000 -0.1781946
## [79,] -0.2847042 -0.3127334      0.2180593      0.000000 -0.1781946
## [80,] -0.2847042  1.2509337      0.2180593      0.000000 -0.1781946
## [81,] -0.2847042 -0.3127334      1.4446432      1.530394 -0.1781946
```

```
## [82,] -0.2847042 -0.3127334      0.2180593      1.530394  0.9673421
## [83,] -0.2847042  1.2509337      1.4446432      0.000000 -0.1781946
## [84,] -0.2847042  1.2509337      0.2180593     -1.530394 -0.1781946
## [85,] -0.2847042 -0.3127334      0.2180593      1.530394 -0.1781946
## [86,] -0.2847042 -0.3127334     -1.0085245      0.000000  0.9673421
## [87,] -0.2847042 -1.8764006      0.2180593      0.000000  0.9673421
## [88,] -0.2847042 -1.8764006      0.2180593      0.000000 -0.1781946
## [89,] -0.2847042 -0.3127334     -1.0085245      0.000000 -0.1781946
## [90,] -0.2847042  1.2509337     -1.0085245      0.000000 -1.3237313
##       After_Sales_Service Resale_Value Fuel_Type Fuel_Efficiency      Color
##  [1,]          -0.6309169    1.0871259 -0.137326       0.161851 -1.8806856
##  [2,]          -0.6309169   -0.5572662 -0.137326      -1.052031  0.2893362
##  [3,]           0.9037458    1.0871259 -0.137326       1.375733  0.2893362
##  [4,]          -0.6309169    1.0871259  1.407591       0.161851  0.2893362
##  [5,]          -0.6309169    1.0871259 -1.682243       0.161851  1.3743472
##  [6,]           0.9037458   -0.5572662 -0.137326      -1.052031 -1.8806856
##  [7,]           0.9037458   -0.5572662 -0.137326       1.375733  0.2893362
##  [8,]          -0.6309169    1.0871259 -0.137326       0.161851  0.2893362
##  [9,]           0.9037458    1.0871259 -0.137326       0.161851  0.2893362
## [10,]          -0.6309169    1.0871259  1.407591       0.161851  1.3743472
## [11,]           0.9037458    1.0871259 -1.682243       0.161851  0.2893362
## [12,]           0.9037458    1.0871259 -0.137326       0.161851  1.3743472
## [13,]          -0.6309169    1.0871259 -0.137326       0.161851 -1.8806856
## [14,]           0.9037458   -0.5572662 -0.137326      -1.052031  1.3743472
## [15,]          -0.6309169    1.0871259 -0.137326       0.161851  0.2893362
## [16,]           0.9037458    1.0871259  1.407591       1.375733  1.3743472
## [17,]          -0.6309169    1.0871259 -1.682243       0.161851 -1.8806856
## [18,]           0.9037458   -0.5572662 -0.137326       1.375733  0.2893362
## [19,]           0.9037458    1.0871259 -0.137326       1.375733  1.3743472
## [20,]           0.9037458    1.0871259 -0.137326       1.375733  0.2893362
## [21,]           0.9037458    1.0871259  1.407591       0.161851  0.2893362
## [22,]          -0.6309169    1.0871259 -1.682243       0.161851  1.3743472
## [23,]           0.9037458    1.0871259 -0.137326       1.375733  0.2893362
## [24,]           0.9037458    1.0871259 -0.137326       1.375733  0.2893362
## [25,]           0.9037458    1.0871259  1.407591       0.161851  0.2893362
## [26,]          -0.6309169    1.0871259 -1.682243       0.161851  1.3743472
## [27,]           0.9037458   -0.5572662 -0.137326      -1.052031  0.2893362
## [28,]          -0.6309169   -0.5572662 -0.137326       1.375733  0.2893362
## [29,]           0.9037458    1.0871259  1.407591       0.161851  1.3743472
## [30,]           0.9037458    1.0871259 -1.682243       0.161851  0.2893362
## [31,]           0.9037458    1.0871259 -0.137326       0.161851 -1.8806856
## [32,]          -0.6309169    1.0871259 -0.137326      -1.052031  0.2893362
## [33,]           0.9037458    0.2649299 -0.137326      -2.265913 -1.8806856
## [34,]           0.9037458    1.0871259  1.407591       1.375733 -2.9656965
## [35,]           0.9037458    1.0871259 -1.682243       0.161851 -0.7956747
## [36,]          -0.6309169    0.2649299 -0.137326       0.161851  0.2893362
## [37,]          -0.6309169    1.0871259  1.407591       1.375733  0.2893362
## [38,]          -0.6309169   -0.5572662 -0.137326      -1.052031 -1.8806856
## [39,]          -3.7002423    0.2649299 -1.682243      -2.265913 -0.7956747
## [40,]          -0.6309169   -1.3794623 -1.682243       0.161851 -0.7956747
## [41,]           0.9037458    0.2649299  1.407591       1.375733  0.2893362
## [42,]           0.9037458   -0.5572662 -1.682243       0.161851  0.2893362
## [43,]           0.9037458    0.2649299  1.407591       1.375733  1.3743472
## [44,]           0.9037458    0.2649299  1.407591       0.161851  0.2893362
```

```
## [45,]          -2.1655796   -2.2016584 -0.137326       -1.052031 -0.7956747
## [46,]          -2.1655796    0.2649299 -0.137326        0.161851  0.2893362
## [47,]           0.9037458    1.0871259  1.407591        1.375733  1.3743472
## [48,]          -0.6309169   -0.5572662 -1.682243       -1.052031  0.2893362
## [49,]          -0.6309169   -0.5572662 -0.137326        0.161851  0.2893362
## [50,]          -2.1655796    0.2649299  1.407591       -1.052031 -0.7956747
## [51,]          -0.6309169   -1.3794623 -0.137326        0.161851 -0.7956747
## [52,]          -2.1655796   -1.3794623 -0.137326       -1.052031  0.2893362
## [53,]           0.9037458    1.0871259  1.407591        1.375733  1.3743472
## [54,]           0.9037458    0.2649299  1.407591        0.161851  0.2893362
## [55,]          -2.1655796    0.2649299 -0.137326        0.161851  0.2893362
## [56,]          -0.6309169    0.2649299 -0.137326       -1.052031 -0.7956747
## [57,]          -0.6309169    0.2649299 -0.137326        0.161851 -0.7956747
## [58,]          -0.6309169    0.2649299 -1.682243        0.161851  0.2893362
## [59,]           0.9037458   -0.5572662  1.407591        0.161851  0.2893362
## [60,]          -0.6309169   -0.5572662  1.407591        0.161851  0.2893362
## [61,]          -0.6309169   -2.2016584  1.407591       -3.479796 -0.7956747
## [62,]          -0.6309169    0.2649299 -0.137326       -1.052031 -0.7956747
## [63,]          -0.6309169    0.2649299  1.407591       -2.265913 -2.9656965
## [64,]          -0.6309169    0.2649299 -1.682243       -1.052031  1.3743472
## [65,]           0.9037458   -0.5572662  1.407591        1.375733 -0.7956747
## [66,]           0.9037458   -0.5572662  1.407591        1.375733 -0.7956747
## [67,]          -0.6309169   -0.5572662 -0.137326       -1.052031  0.2893362
## [68,]          -0.6309169   -1.3794623 -0.137326       -1.052031  0.2893362
## [69,]          -0.6309169   -1.3794623 -0.137326       -1.052031 -0.7956747
## [70,]          -0.6309169   -0.5572662 -0.137326        0.161851  1.3743472
## [71,]           0.9037458   -1.3794623 -0.137326        0.161851  0.2893362
## [72,]          -0.6309169   -0.5572662 -0.137326       -1.052031  0.2893362
## [73,]          -0.6309169   -0.5572662 -0.137326        0.161851  0.2893362
## [74,]           0.9037458   -2.2016584  1.407591       -1.052031 -0.7956747
## [75,]          -0.6309169    0.2649299 -1.682243       -1.052031 -0.7956747
## [76,]           0.9037458   -2.2016584 -0.137326        0.161851  0.2893362
## [77,]           0.9037458    1.0871259 -0.137326       -1.052031 -0.7956747
## [78,]           0.9037458   -0.5572662 -0.137326        1.375733  0.2893362
## [79,]           0.9037458   -1.3794623 -0.137326        0.161851  1.3743472
## [80,]           0.9037458   -1.3794623 -0.137326        0.161851 -0.7956747
## [81,]           0.9037458   -1.3794623 -0.137326        1.375733  0.2893362
## [82,]           0.9037458   -2.2016584  1.407591       -1.052031 -0.7956747
## [83,]           0.9037458   -0.5572662 -0.137326       -1.052031 -0.7956747
## [84,]          -0.6309169    0.2649299 -1.682243        0.161851  0.2893362
## [85,]          -0.6309169   -0.5572662 -0.137326        0.161851  0.2893362
## [86,]          -0.6309169    0.2649299 -0.137326        0.161851  0.2893362
## [87,]          -0.6309169   -0.5572662 -0.137326        0.161851  1.3743472
## [88,]           0.9037458   -0.5572662 -0.137326        0.161851 -0.7956747
## [89,]           0.9037458   -0.5572662 -0.137326        0.161851  0.2893362
## [90,]          -0.6309169   -1.3794623 -0.137326        0.161851  0.2893362
##       Maintenance Test_drive Product_reviews Testimonials
##  [1,]  0.01439992 -1.2886903      -0.1499158   -1.0067644
##  [2,] -1.28159290 -1.2886903      -2.3986528   -2.1537112
##  [3,]  1.31039274  0.5094822      -0.1499158   -1.0067644
##  [4,]  0.01439992 -1.2886903       0.9744527   -1.0067644
##  [5,]  1.31039274  1.4085684       0.9744527   -2.1537112
##  [6,] -1.28159290 -1.2886903      -2.3986528   -1.0067644
##  [7,] -1.28159290  1.4085684      -2.3986528    0.1401824
```

```
##  [8,]  1.31039274 -1.2886903      -0.1499158    0.1401824
##  [9,]  0.01439992 -1.2886903      -0.1499158    0.1401824
## [10,]  1.31039274 -1.2886903      -2.3986528    0.1401824
## [11,]  0.01439992 -1.2886903       0.9744527    0.1401824
## [12,]  1.31039274  1.4085684       0.9744527    0.1401824
## [13,]  1.31039274  1.4085684      -0.1499158   -1.0067644
## [14,]  0.01439992 -1.2886903      -1.2742843   -1.0067644
## [15,]  1.31039274  1.4085684       0.9744527    0.1401824
## [16,]  0.01439992 -1.2886903       0.9744527   -1.0067644
## [17,]  1.31039274  1.4085684       0.9744527    0.1401824
## [18,]  1.31039274  0.5094822      -0.1499158    0.1401824
## [19,]  1.31039274 -1.2886903      -0.1499158    0.1401824
## [20,]  1.31039274 -1.2886903      -0.1499158   -1.0067644
## [21,]  1.31039274  1.4085684      -1.2742843   -1.0067644
## [22,]  0.01439992  0.5094822       0.9744527    0.1401824
## [23,]  1.31039274  0.5094822      -0.1499158   -1.0067644
## [24,]  0.01439992 -1.2886903       0.9744527   -1.0067644
## [25,]  1.31039274  1.4085684       0.9744527    0.1401824
## [26,]  1.31039274  1.4085684      -0.1499158    0.1401824
## [27,]  0.01439992 -1.2886903      -2.3986528   -1.0067644
## [28,]  1.31039274  0.5094822      -0.1499158   -1.0067644
## [29,]  0.01439992 -1.2886903       0.9744527    0.1401824
## [30,]  1.31039274 -1.2886903       0.9744527    0.1401824
## [31,]  0.01439992  1.4085684      -0.1499158   -2.1537112
## [32,] -1.28159290  0.5094822      -2.3986528   -2.1537112
## [33,] -1.28159290 -1.2886903      -1.2742843    0.1401824
## [34,] -1.28159290  0.5094822       0.9744527    1.2871292
## [35,]  0.01439992  0.5094822      -0.1499158    1.2871292
## [36,]  1.31039274 -0.3896040       0.9744527   -1.0067644
## [37,]  1.31039274 -0.3896040       0.9744527   -1.0067644
## [38,] -1.28159290  0.5094822      -0.1499158    0.1401824
## [39,] -2.57758573 -1.2886903      -2.3986528    0.1401824
## [40,] -1.28159290 -0.3896040      -0.1499158    0.1401824
## [41,]  0.01439992  0.5094822       0.9744527    0.1401824
## [42,] -1.28159290 -0.3896040       0.9744527   -1.0067644
## [43,]  0.01439992  0.5094822      -0.1499158    0.1401824
## [44,]  0.01439992  0.5094822      -0.1499158    1.2871292
## [45,] -1.28159290 -1.2886903       0.9744527    0.1401824
## [46,]  0.01439992  0.5094822      -0.1499158    1.2871292
## [47,]  1.31039274  1.4085684       0.9744527    1.2871292
## [48,]  0.01439992  0.5094822       0.9744527    1.2871292
## [49,] -1.28159290  0.5094822      -0.1499158   -1.0067644
## [50,] -1.28159290 -0.3896040      -1.2742843    0.1401824
## [51,] -1.28159290  0.5094822      -0.1499158   -1.0067644
## [52,]  0.01439992 -2.1877765      -0.1499158    0.1401824
## [53,]  1.31039274  1.4085684       0.9744527    1.2871292
## [54,]  0.01439992 -0.3896040       0.9744527    0.1401824
## [55,]  0.01439992 -0.3896040      -0.1499158    1.2871292
## [56,] -1.28159290 -0.3896040       0.9744527   -1.0067644
## [57,] -1.28159290 -0.3896040      -0.1499158    0.1401824
## [58,]  0.01439992 -0.3896040      -0.1499158    0.1401824
## [59,] -1.28159290  0.5094822       0.9744527   -1.0067644
## [60,]  0.01439992 -0.3896040       0.9744527    1.2871292
## [61,]  1.31039274 -0.3896040       0.9744527    0.1401824
```

```
## [62,]  0.01439992 -0.3896040      -1.2742843   -1.0067644
## [63,]  1.31039274 -2.1877765      -0.1499158   -3.3006580
## [64,]  0.01439992  1.4085684       0.9744527    1.2871292
## [65,] -1.28159290  1.4085684       0.9744527    1.2871292
## [66,] -1.28159290  1.4085684       0.9744527    1.2871292
## [67,] -1.28159290 -0.3896040      -0.1499158    1.2871292
## [68,]  0.01439992 -0.3896040      -0.1499158    1.2871292
## [69,] -1.28159290  0.5094822      -1.2742843    0.1401824
## [70,]  0.01439992  0.5094822      -0.1499158    1.2871292
## [71,]  0.01439992  0.5094822      -0.1499158    1.2871292
## [72,]  0.01439992 -0.3896040      -0.1499158    1.2871292
## [73,]  0.01439992  0.5094822      -0.1499158    0.1401824
## [74,] -1.28159290  0.5094822      -0.1499158    1.2871292
## [75,]  0.01439992 -0.3896040      -0.1499158    0.1401824
## [76,]  0.01439992  1.4085684      -0.1499158    0.1401824
## [77,]  0.01439992  0.5094822      -1.2742843    0.1401824
## [78,]  0.01439992  0.5094822       0.9744527    0.1401824
## [79,]  1.31039274  0.5094822       0.9744527    0.1401824
## [80,] -1.28159290  0.5094822      -1.2742843    0.1401824
## [81,]  0.01439992 -0.3896040      -0.1499158    0.1401824
## [82,] -1.28159290  0.5094822      -0.1499158    1.2871292
## [83,]  0.01439992  1.4085684      -1.2742843    0.1401824
## [84,]  0.01439992 -0.3896040       0.9744527    1.2871292
## [85,]  0.01439992 -0.3896040       0.9744527    1.2871292
## [86,]  1.31039274  0.5094822       0.9744527    0.1401824
## [87,]  0.01439992  0.5094822       0.9744527    0.1401824
## [88,] -1.28159290 -1.2886903      -0.1499158    0.1401824
## [89,]  0.01439992  0.5094822      -0.1499158    1.2871292
## [90,]  0.01439992 -1.2886903      -0.1499158   -1.0067644
## attr(,"scaled:center")
##               Price              Safety      Exterior_Looks       Space_comfort
##            4.166667            4.200000            3.822222            4.000000
##          Technology After_Sales_Service        Resale_Value           Fuel_Type
##            4.155556            4.411111            3.677778            4.088889
##     Fuel_Efficiency               Color         Maintenance          Test_drive
##            3.866667            3.733333            3.988889            3.433333
##     Product_reviews        Testimonials
##            4.133333            3.877778
## attr(,"scaled:scale")
##               Price              Safety      Exterior_Looks       Space_comfort
##           0.5854030           0.6395223           0.8152724           0.6534266
##          Technology After_Sales_Service        Resale_Value           Fuel_Type
##           0.8729533           0.6516090           1.2162549           0.6472838
##     Fuel_Efficiency               Color         Maintenance          Test_drive
##           0.8238032           0.9216497           0.7716092           1.1122404
##     Product_reviews        Testimonials
##           0.8893881           0.8718800
```

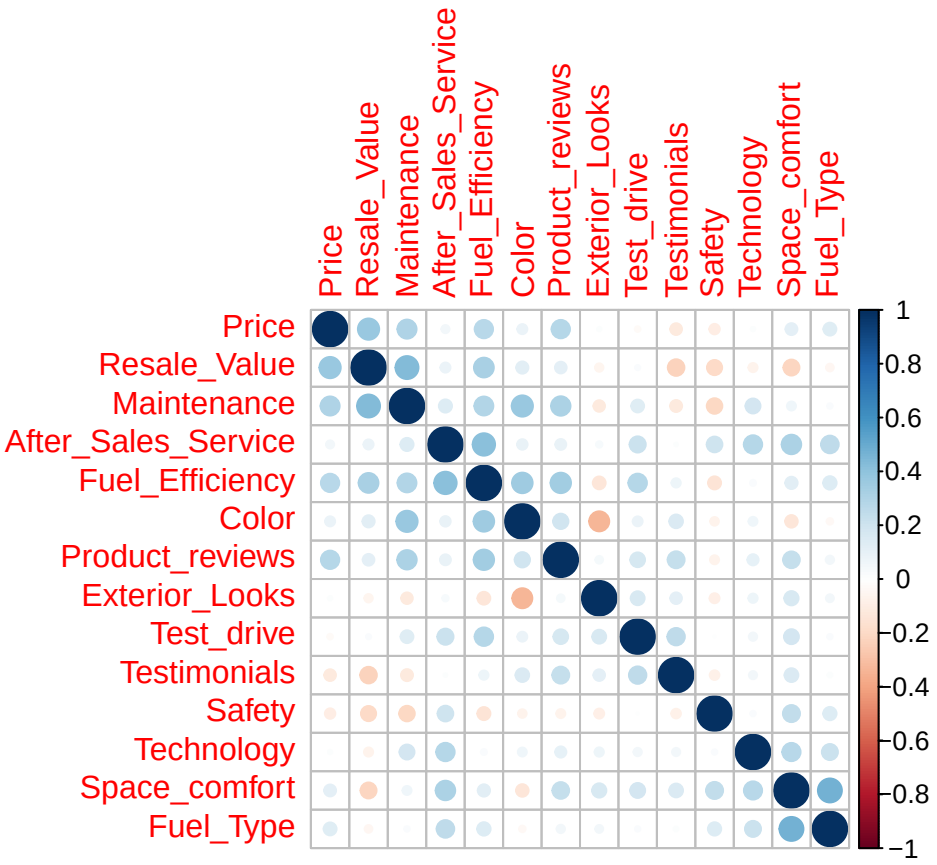
ii) Dapatkan matriks kolerasi dan terangkan berkaitan struktur data.

```
library(corrplot)
```

```
## Warning: package 'corrplot' was built under R version 4.4.2
```

```
## corrplot 0.95 loaded
```

```
corrplot(cor(z_score), order='hclust')
```



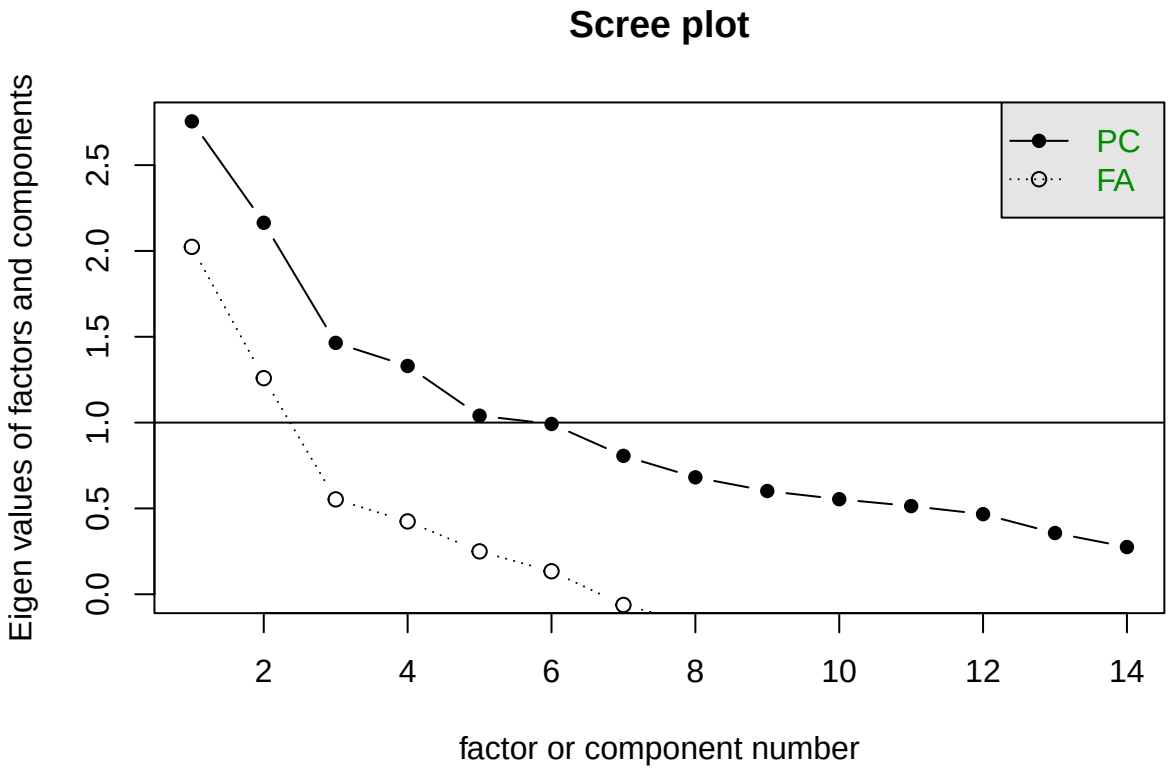

```
cor(z_score)
```

```
##                          Price       Safety Exterior_Looks Space_comfort
## Price                1.00000000 -0.090036923     0.01569499    0.11749470
## Safety              -0.09003692  1.000000000    -0.08189080    0.24199145
## Exterior_Looks       0.01569499 -0.081890804     1.00000000    0.16873315
## Space_comfort        0.11749470  0.241991449     0.16873315    1.00000000
## Technology           0.01465794  0.024151524     0.07086880    0.27577204
## After_Sales_Service  0.05400195  0.204918345     0.03337075    0.31667034
## Resale_Value         0.37611034 -0.190679342    -0.05841954   -0.21207031
## Fuel_Type            0.13837803  0.146572787     0.05157349    0.47817954
## Fuel_Efficiency      0.27958435 -0.140758547    -0.13606685    0.12523940
## Color                0.08330080 -0.061001201    -0.33296343   -0.13060065
## Maintenance          0.30264206 -0.200373172    -0.11034232    0.06685549
## Test_drive          -0.02588497  0.003159262     0.16025775    0.18552216
## Product_reviews      0.28054795 -0.067164826     0.04855372    0.23200808
## Testimonials        -0.11373884 -0.076573972     0.11135180    0.15777800
##                      Technology After_Sales_Service Resale_Value   Fuel_Type
```

```
## Price                0.01465794          0.05400195   0.37611034  0.13837803
## Safety               0.02415152          0.20491834  -0.19067934  0.14657279
## Exterior_Looks       0.07086880          0.03337075  -0.05841954  0.05157349
## Space_comfort        0.27577204          0.31667034  -0.21207031  0.47817954
## Technology           1.00000000          0.28136978  -0.06866963  0.21387357
## After_Sales_Service  0.28136978          1.00000000   0.08396205  0.25870042
## Resale_Value        -0.06866963          0.08396205   1.00000000 -0.04884261
## Fuel_Type            0.21387357          0.25870042  -0.04884261  1.00000000
## Fuel_Efficiency      0.02916502          0.41723372   0.32670224  0.14890402
## Color                0.06610285          0.09105182   0.12295497 -0.03515735
## Maintenance          0.18608561          0.14327118   0.43912788  0.02449635
## Test_drive           0.05709010          0.21652949   0.02131848  0.02393058
## Product_reviews      0.10323339          0.09823222   0.11287309  0.05725130
## Testimonials         0.05478557          0.01032813  -0.22827795  0.01946699
##                    Fuel_Efficiency       Color Maintenance   Test_drive
## Price                   0.27958435  0.08330080  0.30264206 -0.025884971
## Safety                 -0.14075855 -0.06100120 -0.20037317  0.003159262
## Exterior_Looks         -0.13606685 -0.33296343 -0.11034232  0.160257751
## Space_comfort           0.12523940 -0.13060065  0.06685549  0.185522158
## Technology              0.02916502  0.06610285  0.18608561  0.057090099
## After_Sales_Service     0.41723372  0.09105182  0.14327118  0.216529487
## Resale_Value            0.32670224  0.12295497  0.43912788  0.021318479
## Fuel_Type               0.14890402 -0.03515735  0.02449635  0.023930578
## Fuel_Efficiency         1.00000000  0.35220668  0.29813872  0.284495798
## Color                   0.35220668  1.00000000  0.37497769  0.081110516
## Maintenance             0.29813872  0.37497769  1.00000000  0.136595696
## Test_drive              0.28449580  0.08111052  0.13659570  1.000000000
## Product_reviews         0.34658011  0.19464404  0.31326502  0.179463899
## Testimonials            0.07091653  0.15474057 -0.11895190  0.252200843
##                    Product_reviews Testimonials
## Price                   0.28054795  -0.11373884
## Safety                 -0.06716483  -0.07657397
## Exterior_Looks          0.04855372   0.11135180
## Space_comfort           0.23200808   0.15777800
## Technology              0.10323339   0.05478557
## After_Sales_Service     0.09823222   0.01032813
## Resale_Value            0.11287309  -0.22827795
## Fuel_Type               0.05725130   0.01946699
## Fuel_Efficiency         0.34658011   0.07091653
## Color                   0.19464404   0.15474057
## Maintenance             0.31326502  -0.11895190
## Test_drive              0.17946390   0.25220084
## Product_reviews         1.00000000   0.23859846
## Testimonials            0.23859846   1.00000000
```

iii) Tentukan bilangan pemboleh ubah pendam yang mungkin sesuai untuk menerangkan data dalam (i)

```
library(psych)
scree(z_score)
```



Berdasarkan scree plot di atas, 6 atau 7 merupakan bilangan pembolehubah pendam yang mungkin sesuai untuk menerangkan data.

iv) Berdasarkan maklumat (iii), jalankan analisis faktor terhadap data dan huraikan berkaitan peratusan varians yang boleh diterangkan menerusi faktor-faktor yang diperolehi.

```
fa6 = factanal(z_score, factors=6, scores='regression', rotation='varimax')
fa6
```

```
##
## Call:
## factanal(x = z_score, factors = 6, scores = "regression", rotation = "varimax")
##
## Uniquenesses:
##               Price              Safety      Exterior_Looks       Space_comfort
##               0.673               0.757               0.521               0.063
##          Technology After_Sales_Service        Resale_Value           Fuel_Type
##               0.820               0.017               0.478               0.720
##     Fuel_Efficiency               Color         Maintenance          Test_drive
##               0.318               0.485               0.005               0.758
##     Product_reviews        Testimonials
##               0.674               0.539
##
## Loadings:
```

```
##                     Factor1 Factor2 Factor3 Factor4 Factor5 Factor6
## Price                0.552   0.126
## Safety              -0.244   0.322  -0.188   0.177
## Exterior_Looks                      0.199          -0.662
## Space_comfort                0.918   0.232          -0.158   0.119
## Technology                   0.229           0.211           0.258
## After_Sales_Service          0.264   0.102   0.942
## Resale_Value         0.656  -0.214  -0.109                   0.160
## Fuel_Type                    0.506           0.123
## Fuel_Efficiency      0.559           0.392   0.320   0.317
## Color                0.100  -0.134   0.277           0.604   0.203
## Maintenance          0.451                           0.211   0.859
## Test_drive                          0.443   0.155
## Product_reviews      0.285   0.139   0.443                   0.158
## Testimonials        -0.250           0.626
##
##                Factor1 Factor2 Factor3 Factor4 Factor5 Factor6
## SS loadings      1.493   1.435   1.183   1.122   0.991   0.949
## Proportion Var   0.107   0.102   0.084   0.080   0.071   0.068
## Cumulative Var   0.107   0.209   0.294   0.374   0.444   0.512
##
## Test of the hypothesis that 6 factors are sufficient.
## The chi square statistic is 12.1 on 22 degrees of freedom.
## The p-value is 0.955
```

```
fa7 = factanal(z_score, factors=7, scores='regression', rotation='varimax')
fa7
```

```
##
## Call:
## factanal(x = z_score, factors = 7, scores = "regression", rotation = "varimax")
##
## Uniquenesses:
##               Price              Safety      Exterior_Looks       Space_comfort
##               0.544               0.005               0.623               0.266
##          Technology After_Sales_Service        Resale_Value           Fuel_Type
##               0.800               0.495               0.473               0.627
##     Fuel_Efficiency               Color         Maintenance          Test_drive
##               0.235               0.456               0.005               0.651
##     Product_reviews        Testimonials
##               0.583               0.549
##
## Loadings:
##                     Factor1 Factor2 Factor3 Factor4 Factor5 Factor6 Factor7
## Price                        0.661
## Safety               0.155  -0.101                   0.971
## Exterior_Looks                                               0.147  -0.590
## Space_comfort        0.779                           0.158   0.227  -0.190
## Technology           0.376  -0.105           0.191
## After_Sales_Service  0.352           0.598           0.131
## Resale_Value        -0.239   0.512   0.241   0.278  -0.107  -0.245
## Fuel_Type            0.582   0.117
## Fuel_Efficiency              0.412   0.665          -0.148   0.175   0.301
## Color                                0.146   0.229           0.233   0.636
```

```
## Maintenance          0.100   0.329   0.100   0.899  -0.113           0.215
## Test_drive                           0.392   0.154           0.383  -0.150
## Product_reviews      0.128   0.397           0.166           0.452
## Testimonials                -0.136                           0.645
##
##                Factor1 Factor2 Factor3 Factor4 Factor5 Factor6 Factor7
## SS loadings      1.352   1.202   1.078   1.060   1.046   0.995   0.955
## Proportion Var   0.097   0.086   0.077   0.076   0.075   0.071   0.068
## Cumulative Var   0.097   0.182   0.259   0.335   0.410   0.481   0.549
##
## Test of the hypothesis that 7 factors are sufficient.
## The chi square statistic is 7.42 on 14 degrees of freedom.
## The p-value is 0.917
```

Berdasarkan dapatan di atas, 6 faktor hanya mampu menerangkan 51.2% varians daripada data asal manakala 7 faktor hanya 54.9% sahaja varians yang boleh diterangkan menerusi faktor-faktor yang diperolehi.

v) Berdasarkan keputusan dalam (iv), terangkan sama ada kaedah analisis faktor sesuai untuk menurunkan dimensi dalam dataset FACars.csv.

Berdasarkan keputusan, Analisis Faktor bukanlah suatu kaedah yang sesuai untuk digunakan bagi menurunkan dimensi data dalam dataset *FACars.csv*

Soalan 2

a) Nyatakan objektif utama dalam analisis aturan sekutuan.

Objektif utama dalam analisis aturan sekutuan adalah untuk mencari hubungan yang 'menarik' antara set item.

b) Terangkan kefahaman anda berkaitan tiga ukuran asas bagi suatu data Aturan Sekutuan, iaitu Sokongan, Keyakinan dan Lif.

Sokongan: Perkadaran transaksi dalam data yang mengandungi kedua-dua set item X dan Y.

Keyakinan: Perkadaran transaksi yang mana akan mengandungi Y sekiranya item X dibeli.

Lif: nisbah keyakinan terhadap perkadaran transaksi yang mengandungi Y.

c) Diberi data transaksi pembelian barangan di suatu pasar raya seperti jadual berikut

i) Masukkan data rekod transaksi tersebut ke dalam R

```
data2 <- paste(
  "Buku, Pen, Roti, Susu, Gula",
  "Roti, Gula, Lampin, Soda, Telur",
  "Susu, Lampin, Gula, Soda, Minyak Masak",
  "Roti, Susu, Lampin, Soda, Buku, Pen",
```

```
  "Roti, Susu, Lampin, Gula, Buku",
  sep = "\n"
)
cat(data2)
```

```
## Buku, Pen, Roti, Susu, Gula
## Roti, Gula, Lampin, Soda, Telur
## Susu, Lampin, Gula, Soda, Minyak Masak
## Roti, Susu, Lampin, Soda, Buku, Pen
## Roti, Susu, Lampin, Gula, Buku
```

```
write(data2, file='question2.txt')
library(arules)
```

```
## Warning: package 'arules' was built under R version 4.4.2
```

```
## Loading required package: Matrix
```

```
## Warning: package 'Matrix' was built under R version 4.4.2
```

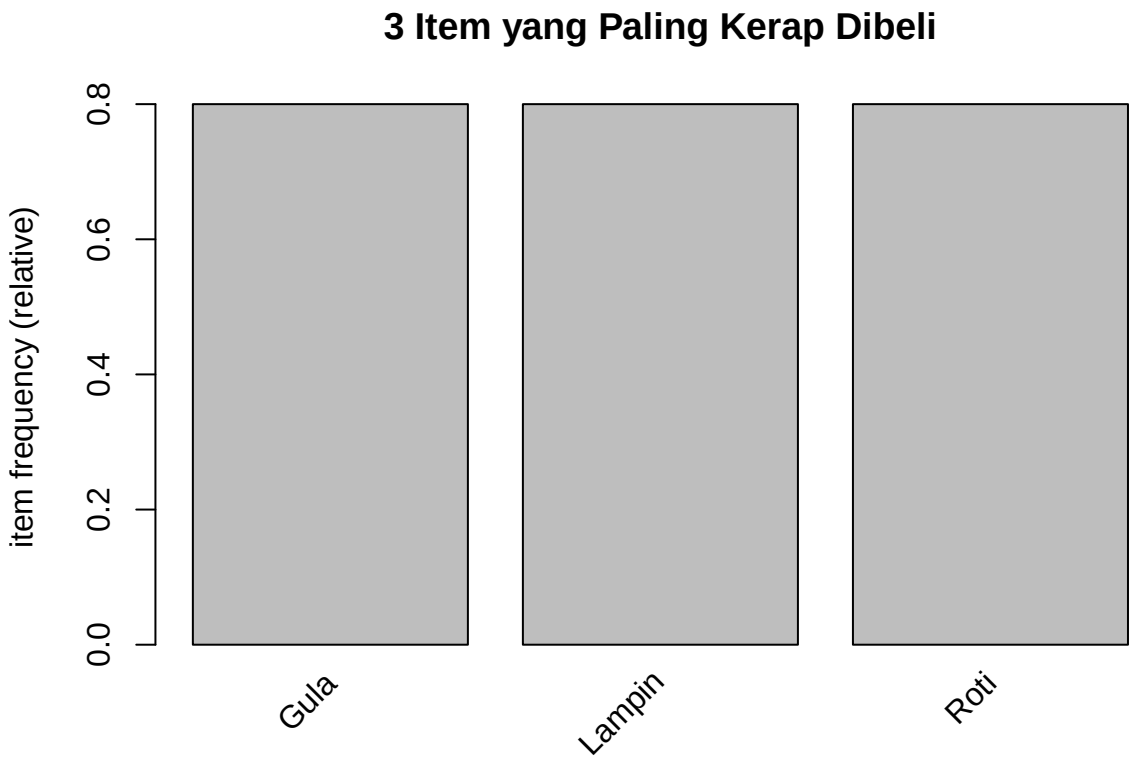
```
##
## Attaching package: 'arules'
```

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

```
tr = read.transactions('question2.txt', format='basket', sep=',')
```

ii) Dapatkan senarai 3 barangan utama yang paling kerap dibeli

```r
itemFrequencyPlot(tr, topN=3, main='3 Item yang Paling Kerap Dibeli')
```



iii) Adakah terdapat set aturan yang memenuhi niali ambang sokongan 0.01? Jika ada, dapatkan set aturan tersebut.

```r
rule1 = apriori(tr, parameter=list(supp=0.01))
```

```
## Apriori
##
## Parameter specification:
##  confidence minval smax arem  aval originalSupport maxtime support minlen
##         0.8    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: 0
##
## set item appearances ...[0 item(s)] done [0.00s].
```

```
## set transactions ...[9 item(s), 5 transaction(s)] done [0.00s].
## sorting and recoding items ... [9 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 5 6 done [0.00s].
## writing ... [199 rule(s)] done [0.00s].
## creating S4 object  ... done [0.00s].
```

```
inspect(rule1)
```

```
##       lhs                                rhs            support confidence
## [1]   {}                              => {Gula}         0.8     0.8
## [2]   {}                              => {Roti}         0.8     0.8
## [3]   {}                              => {Susu}         0.8     0.8
## [4]   {}                              => {Lampin}       0.8     0.8
## [5]   {Telur}                         => {Soda}         0.2     1.0
## [6]   {Telur}                         => {Gula}         0.2     1.0
## [7]   {Telur}                         => {Roti}         0.2     1.0
## [8]   {Telur}                         => {Lampin}       0.2     1.0
## [9]   {Minyak Masak}                  => {Soda}         0.2     1.0
## [10]  {Minyak Masak}                  => {Gula}         0.2     1.0
## [11]  {Minyak Masak}                  => {Susu}         0.2     1.0
## [12]  {Minyak Masak}                  => {Lampin}       0.2     1.0
## [13]  {Pen}                           => {Buku}         0.4     1.0
## [14]  {Pen}                           => {Roti}         0.4     1.0
## [15]  {Pen}                           => {Susu}         0.4     1.0
## [16]  {Soda}                          => {Lampin}       0.6     1.0
## [17]  {Buku}                          => {Roti}         0.6     1.0
## [18]  {Buku}                          => {Susu}         0.6     1.0
## [19]  {Soda, Telur}                   => {Gula}         0.2     1.0
## [20]  {Gula, Telur}                   => {Soda}         0.2     1.0
## [21]  {Soda, Telur}                   => {Roti}         0.2     1.0
## [22]  {Roti, Telur}                   => {Soda}         0.2     1.0
## [23]  {Soda, Telur}                   => {Lampin}       0.2     1.0
## [24]  {Lampin, Telur}                 => {Soda}         0.2     1.0
## [25]  {Gula, Telur}                   => {Roti}         0.2     1.0
## [26]  {Roti, Telur}                   => {Gula}         0.2     1.0
## [27]  {Gula, Telur}                   => {Lampin}       0.2     1.0
## [28]  {Lampin, Telur}                 => {Gula}         0.2     1.0
## [29]  {Roti, Telur}                   => {Lampin}       0.2     1.0
## [30]  {Lampin, Telur}                 => {Roti}         0.2     1.0
## [31]  {Minyak Masak, Soda}            => {Gula}         0.2     1.0
## [32]  {Gula, Minyak Masak}            => {Soda}         0.2     1.0
## [33]  {Minyak Masak, Soda}            => {Susu}         0.2     1.0
## [34]  {Minyak Masak, Susu}            => {Soda}         0.2     1.0
## [35]  {Minyak Masak, Soda}            => {Lampin}       0.2     1.0
## [36]  {Lampin, Minyak Masak}          => {Soda}         0.2     1.0
## [37]  {Gula, Minyak Masak}            => {Susu}         0.2     1.0
## [38]  {Minyak Masak, Susu}            => {Gula}         0.2     1.0
## [39]  {Gula, Minyak Masak}            => {Lampin}       0.2     1.0
## [40]  {Lampin, Minyak Masak}          => {Gula}         0.2     1.0
## [41]  {Minyak Masak, Susu}            => {Lampin}       0.2     1.0
## [42]  {Lampin, Minyak Masak}          => {Susu}         0.2     1.0
## [43]  {Pen, Soda}                     => {Buku}         0.2     1.0
## [44]  {Buku, Soda}                    => {Pen}          0.2     1.0
```

```
## [45]  {Pen, Soda}                    => {Roti}         0.2     1.0
## [46]  {Pen, Soda}                    => {Susu}         0.2     1.0
## [47]  {Pen, Soda}                    => {Lampin}       0.2     1.0
## [48]  {Lampin, Pen}                  => {Soda}         0.2     1.0
## [49]  {Gula, Pen}                    => {Buku}         0.2     1.0
## [50]  {Buku, Pen}                    => {Roti}         0.4     1.0
## [51]  {Pen, Roti}                    => {Buku}         0.4     1.0
## [52]  {Buku, Pen}                    => {Susu}         0.4     1.0
## [53]  {Pen, Susu}                    => {Buku}         0.4     1.0
## [54]  {Lampin, Pen}                  => {Buku}         0.2     1.0
## [55]  {Gula, Pen}                    => {Roti}         0.2     1.0
## [56]  {Gula, Pen}                    => {Susu}         0.2     1.0
## [57]  {Pen, Roti}                    => {Susu}         0.4     1.0
## [58]  {Pen, Susu}                    => {Roti}         0.4     1.0
## [59]  {Lampin, Pen}                  => {Roti}         0.2     1.0
## [60]  {Lampin, Pen}                  => {Susu}         0.2     1.0
## [61]  {Buku, Soda}                   => {Roti}         0.2     1.0
## [62]  {Buku, Soda}                   => {Susu}         0.2     1.0
## [63]  {Buku, Soda}                   => {Lampin}       0.2     1.0
## [64]  {Gula, Soda}                   => {Lampin}       0.4     1.0
## [65]  {Roti, Soda}                   => {Lampin}       0.4     1.0
## [66]  {Soda, Susu}                   => {Lampin}       0.4     1.0
## [67]  {Buku, Gula}                   => {Roti}         0.4     1.0
## [68]  {Buku, Gula}                   => {Susu}         0.4     1.0
## [69]  {Buku, Roti}                   => {Susu}         0.6     1.0
## [70]  {Buku, Susu}                   => {Roti}         0.6     1.0
## [71]  {Roti, Susu}                   => {Buku}         0.6     1.0
## [72]  {Buku, Lampin}                 => {Roti}         0.4     1.0
## [73]  {Buku, Lampin}                 => {Susu}         0.4     1.0
## [74]  {Gula, Soda, Telur}            => {Roti}         0.2     1.0
## [75]  {Roti, Soda, Telur}            => {Gula}         0.2     1.0
## [76]  {Gula, Roti, Telur}            => {Soda}         0.2     1.0
## [77]  {Gula, Roti, Soda}             => {Telur}        0.2     1.0
## [78]  {Gula, Soda, Telur}            => {Lampin}       0.2     1.0
## [79]  {Lampin, Soda, Telur}          => {Gula}         0.2     1.0
## [80]  {Gula, Lampin, Telur}          => {Soda}         0.2     1.0
## [81]  {Roti, Soda, Telur}            => {Lampin}       0.2     1.0
## [82]  {Lampin, Soda, Telur}          => {Roti}         0.2     1.0
## [83]  {Lampin, Roti, Telur}          => {Soda}         0.2     1.0
## [84]  {Gula, Roti, Telur}            => {Lampin}       0.2     1.0
## [85]  {Gula, Lampin, Telur}          => {Roti}         0.2     1.0
## [86]  {Lampin, Roti, Telur}          => {Gula}         0.2     1.0
## [87]  {Gula, Minyak Masak, Soda}     => {Susu}         0.2     1.0
## [88]  {Minyak Masak, Soda, Susu}     => {Gula}         0.2     1.0
## [89]  {Gula, Minyak Masak, Susu}     => {Soda}         0.2     1.0
## [90]  {Gula, Soda, Susu}             => {Minyak Masak} 0.2     1.0
## [91]  {Gula, Minyak Masak, Soda}     => {Lampin}       0.2     1.0
## [92]  {Lampin, Minyak Masak, Soda}   => {Gula}         0.2     1.0
## [93]  {Gula, Lampin, Minyak Masak}   => {Soda}         0.2     1.0
## [94]  {Minyak Masak, Soda, Susu}     => {Lampin}       0.2     1.0
## [95]  {Lampin, Minyak Masak, Soda}   => {Susu}         0.2     1.0
## [96]  {Lampin, Minyak Masak, Susu}   => {Soda}         0.2     1.0
## [97]  {Gula, Minyak Masak, Susu}     => {Lampin}       0.2     1.0
## [98]  {Gula, Lampin, Minyak Masak}   => {Susu}         0.2     1.0
```

```
## [99]  {Lampin, Minyak Masak, Susu}      => {Gula}         0.2     1.0
## [100] {Buku, Pen, Soda}                 => {Roti}         0.2     1.0
## [101] {Pen, Roti, Soda}                 => {Buku}         0.2     1.0
## [102] {Buku, Roti, Soda}                => {Pen}          0.2     1.0
## [103] {Buku, Pen, Soda}                 => {Susu}         0.2     1.0
## [104] {Pen, Soda, Susu}                 => {Buku}         0.2     1.0
## [105] {Buku, Soda, Susu}                => {Pen}          0.2     1.0
## [106] {Buku, Pen, Soda}                 => {Lampin}       0.2     1.0
## [107] {Lampin, Pen, Soda}               => {Buku}         0.2     1.0
## [108] {Buku, Lampin, Pen}               => {Soda}         0.2     1.0
## [109] {Buku, Lampin, Soda}              => {Pen}          0.2     1.0
## [110] {Pen, Roti, Soda}                 => {Susu}         0.2     1.0
## [111] {Pen, Soda, Susu}                 => {Roti}         0.2     1.0
## [112] {Roti, Soda, Susu}                => {Pen}          0.2     1.0
## [113] {Pen, Roti, Soda}                 => {Lampin}       0.2     1.0
## [114] {Lampin, Pen, Soda}               => {Roti}         0.2     1.0
## [115] {Lampin, Pen, Roti}               => {Soda}         0.2     1.0
## [116] {Pen, Soda, Susu}                 => {Lampin}       0.2     1.0
## [117] {Lampin, Pen, Soda}               => {Susu}         0.2     1.0
## [118] {Lampin, Pen, Susu}               => {Soda}         0.2     1.0
## [119] {Buku, Gula, Pen}                 => {Roti}         0.2     1.0
## [120] {Gula, Pen, Roti}                 => {Buku}         0.2     1.0
## [121] {Buku, Gula, Pen}                 => {Susu}         0.2     1.0
## [122] {Gula, Pen, Susu}                 => {Buku}         0.2     1.0
## [123] {Buku, Pen, Roti}                 => {Susu}         0.4     1.0
## [124] {Buku, Pen, Susu}                 => {Roti}         0.4     1.0
## [125] {Pen, Roti, Susu}                 => {Buku}         0.4     1.0
## [126] {Buku, Lampin, Pen}               => {Roti}         0.2     1.0
## [127] {Lampin, Pen, Roti}               => {Buku}         0.2     1.0
## [128] {Buku, Lampin, Pen}               => {Susu}         0.2     1.0
## [129] {Lampin, Pen, Susu}               => {Buku}         0.2     1.0
## [130] {Gula, Pen, Roti}                 => {Susu}         0.2     1.0
## [131] {Gula, Pen, Susu}                 => {Roti}         0.2     1.0
## [132] {Lampin, Pen, Roti}               => {Susu}         0.2     1.0
## [133] {Lampin, Pen, Susu}               => {Roti}         0.2     1.0
## [134] {Buku, Roti, Soda}                => {Susu}         0.2     1.0
## [135] {Buku, Soda, Susu}                => {Roti}         0.2     1.0
## [136] {Roti, Soda, Susu}                => {Buku}         0.2     1.0
## [137] {Buku, Roti, Soda}                => {Lampin}       0.2     1.0
## [138] {Buku, Lampin, Soda}              => {Roti}         0.2     1.0
## [139] {Buku, Soda, Susu}                => {Lampin}       0.2     1.0
## [140] {Buku, Lampin, Soda}              => {Susu}         0.2     1.0
## [141] {Gula, Roti, Soda}                => {Lampin}       0.2     1.0
## [142] {Gula, Soda, Susu}                => {Lampin}       0.2     1.0
## [143] {Roti, Soda, Susu}                => {Lampin}       0.2     1.0
## [144] {Buku, Gula, Roti}                => {Susu}         0.4     1.0
## [145] {Buku, Gula, Susu}                => {Roti}         0.4     1.0
## [146] {Gula, Roti, Susu}                => {Buku}         0.4     1.0
## [147] {Buku, Gula, Lampin}              => {Roti}         0.2     1.0
## [148] {Buku, Gula, Lampin}              => {Susu}         0.2     1.0
## [149] {Buku, Lampin, Roti}              => {Susu}         0.4     1.0
## [150] {Buku, Lampin, Susu}              => {Roti}         0.4     1.0
## [151] {Lampin, Roti, Susu}              => {Buku}         0.4     1.0
## [152] {Gula, Roti, Soda, Telur}         => {Lampin}       0.2     1.0
```

```
## [153] {Gula, Lampin, Soda, Telur}        => {Roti}         0.2     1.0
## [154] {Lampin, Roti, Soda, Telur}        => {Gula}         0.2     1.0
## [155] {Gula, Lampin, Roti, Telur}        => {Soda}         0.2     1.0
## [156] {Gula, Lampin, Roti, Soda}         => {Telur}        0.2     1.0
## [157] {Gula, Minyak Masak, Soda, Susu}   => {Lampin}       0.2     1.0
## [158] {Gula, Lampin, Minyak Masak, Soda} => {Susu}         0.2     1.0
## [159] {Lampin, Minyak Masak, Soda, Susu} => {Gula}         0.2     1.0
## [160] {Gula, Lampin, Minyak Masak, Susu} => {Soda}         0.2     1.0
## [161] {Gula, Lampin, Soda, Susu}         => {Minyak Masak} 0.2     1.0
## [162] {Buku, Pen, Roti, Soda}            => {Susu}         0.2     1.0
## [163] {Buku, Pen, Soda, Susu}            => {Roti}         0.2     1.0
## [164] {Pen, Roti, Soda, Susu}            => {Buku}         0.2     1.0
## [165] {Buku, Roti, Soda, Susu}           => {Pen}          0.2     1.0
## [166] {Buku, Pen, Roti, Soda}            => {Lampin}       0.2     1.0
## [167] {Buku, Lampin, Pen, Soda}          => {Roti}         0.2     1.0
## [168] {Lampin, Pen, Roti, Soda}          => {Buku}         0.2     1.0
## [169] {Buku, Lampin, Pen, Roti}          => {Soda}         0.2     1.0
## [170] {Buku, Lampin, Roti, Soda}         => {Pen}          0.2     1.0
## [171] {Buku, Pen, Soda, Susu}            => {Lampin}       0.2     1.0
## [172] {Buku, Lampin, Pen, Soda}          => {Susu}         0.2     1.0
## [173] {Lampin, Pen, Soda, Susu}          => {Buku}         0.2     1.0
## [174] {Buku, Lampin, Pen, Susu}          => {Soda}         0.2     1.0
## [175] {Buku, Lampin, Soda, Susu}         => {Pen}          0.2     1.0
## [176] {Pen, Roti, Soda, Susu}            => {Lampin}       0.2     1.0
## [177] {Lampin, Pen, Roti, Soda}          => {Susu}         0.2     1.0
## [178] {Lampin, Pen, Soda, Susu}          => {Roti}         0.2     1.0
## [179] {Lampin, Pen, Roti, Susu}          => {Soda}         0.2     1.0
## [180] {Lampin, Roti, Soda, Susu}         => {Pen}          0.2     1.0
## [181] {Buku, Gula, Pen, Roti}            => {Susu}         0.2     1.0
## [182] {Buku, Gula, Pen, Susu}            => {Roti}         0.2     1.0
## [183] {Gula, Pen, Roti, Susu}            => {Buku}         0.2     1.0
## [184] {Buku, Lampin, Pen, Roti}          => {Susu}         0.2     1.0
## [185] {Buku, Lampin, Pen, Susu}          => {Roti}         0.2     1.0
## [186] {Lampin, Pen, Roti, Susu}          => {Buku}         0.2     1.0
## [187] {Buku, Roti, Soda, Susu}           => {Lampin}       0.2     1.0
## [188] {Buku, Lampin, Roti, Soda}         => {Susu}         0.2     1.0
## [189] {Buku, Lampin, Soda, Susu}         => {Roti}         0.2     1.0
## [190] {Lampin, Roti, Soda, Susu}         => {Buku}         0.2     1.0
## [191] {Buku, Gula, Lampin, Roti}         => {Susu}         0.2     1.0
## [192] {Buku, Gula, Lampin, Susu}         => {Roti}         0.2     1.0
## [193] {Gula, Lampin, Roti, Susu}         => {Buku}         0.2     1.0
## [194] {Buku, Pen, Roti, Soda, Susu}      => {Lampin}       0.2     1.0
## [195] {Buku, Lampin, Pen, Roti, Soda}    => {Susu}         0.2     1.0
## [196] {Buku, Lampin, Pen, Soda, Susu}    => {Roti}         0.2     1.0
## [197] {Lampin, Pen, Roti, Soda, Susu}    => {Buku}         0.2     1.0
## [198] {Buku, Lampin, Pen, Roti, Susu}    => {Soda}         0.2     1.0
## [199] {Buku, Lampin, Roti, Soda, Susu}   => {Pen}          0.2     1.0
##       coverage lift     count
## [1]   1.0      1.000000 4
## [2]   1.0      1.000000 4
## [3]   1.0      1.000000 4
## [4]   1.0      1.000000 4
## [5]   0.2      1.666667 1
## [6]   0.2      1.250000 1
```

```
## [7]   0.2      1.250000 1
## [8]   0.2      1.250000 1
## [9]   0.2      1.666667 1
## [10]  0.2      1.250000 1
## [11]  0.2      1.250000 1
## [12]  0.2      1.250000 1
## [13]  0.4      1.666667 2
## [14]  0.4      1.250000 2
## [15]  0.4      1.250000 2
## [16]  0.6      1.250000 3
## [17]  0.6      1.250000 3
## [18]  0.6      1.250000 3
## [19]  0.2      1.250000 1
## [20]  0.2      1.666667 1
## [21]  0.2      1.250000 1
## [22]  0.2      1.666667 1
## [23]  0.2      1.250000 1
## [24]  0.2      1.666667 1
## [25]  0.2      1.250000 1
## [26]  0.2      1.250000 1
## [27]  0.2      1.250000 1
## [28]  0.2      1.250000 1
## [29]  0.2      1.250000 1
## [30]  0.2      1.250000 1
## [31]  0.2      1.250000 1
## [32]  0.2      1.666667 1
## [33]  0.2      1.250000 1
## [34]  0.2      1.666667 1
## [35]  0.2      1.250000 1
## [36]  0.2      1.666667 1
## [37]  0.2      1.250000 1
## [38]  0.2      1.250000 1
## [39]  0.2      1.250000 1
## [40]  0.2      1.250000 1
## [41]  0.2      1.250000 1
## [42]  0.2      1.250000 1
## [43]  0.2      1.666667 1
## [44]  0.2      2.500000 1
## [45]  0.2      1.250000 1
## [46]  0.2      1.250000 1
## [47]  0.2      1.250000 1
## [48]  0.2      1.666667 1
## [49]  0.2      1.666667 1
## [50]  0.4      1.250000 2
## [51]  0.4      1.666667 2
## [52]  0.4      1.250000 2
## [53]  0.4      1.666667 2
## [54]  0.2      1.666667 1
## [55]  0.2      1.250000 1
## [56]  0.2      1.250000 1
## [57]  0.4      1.250000 2
## [58]  0.4      1.250000 2
## [59]  0.2      1.250000 1
## [60]  0.2      1.250000 1
```

```
## [61]  0.2      1.250000 1
## [62]  0.2      1.250000 1
## [63]  0.2      1.250000 1
## [64]  0.4      1.250000 2
## [65]  0.4      1.250000 2
## [66]  0.4      1.250000 2
## [67]  0.4      1.250000 2
## [68]  0.4      1.250000 2
## [69]  0.6      1.250000 3
## [70]  0.6      1.250000 3
## [71]  0.6      1.666667 3
## [72]  0.4      1.250000 2
## [73]  0.4      1.250000 2
## [74]  0.2      1.250000 1
## [75]  0.2      1.250000 1
## [76]  0.2      1.666667 1
## [77]  0.2      5.000000 1
## [78]  0.2      1.250000 1
## [79]  0.2      1.250000 1
## [80]  0.2      1.666667 1
## [81]  0.2      1.250000 1
## [82]  0.2      1.250000 1
## [83]  0.2      1.666667 1
## [84]  0.2      1.250000 1
## [85]  0.2      1.250000 1
## [86]  0.2      1.250000 1
## [87]  0.2      1.250000 1
## [88]  0.2      1.250000 1
## [89]  0.2      1.666667 1
## [90]  0.2      5.000000 1
## [91]  0.2      1.250000 1
## [92]  0.2      1.250000 1
## [93]  0.2      1.666667 1
## [94]  0.2      1.250000 1
## [95]  0.2      1.250000 1
## [96]  0.2      1.666667 1
## [97]  0.2      1.250000 1
## [98]  0.2      1.250000 1
## [99]  0.2      1.250000 1
## [100] 0.2      1.250000 1
## [101] 0.2      1.666667 1
## [102] 0.2      2.500000 1
## [103] 0.2      1.250000 1
## [104] 0.2      1.666667 1
## [105] 0.2      2.500000 1
## [106] 0.2      1.250000 1
## [107] 0.2      1.666667 1
## [108] 0.2      1.666667 1
## [109] 0.2      2.500000 1
## [110] 0.2      1.250000 1
## [111] 0.2      1.250000 1
## [112] 0.2      2.500000 1
## [113] 0.2      1.250000 1
## [114] 0.2      1.250000 1
```

```
## [115] 0.2      1.666667 1
## [116] 0.2      1.250000 1
## [117] 0.2      1.250000 1
## [118] 0.2      1.666667 1
## [119] 0.2      1.250000 1
## [120] 0.2      1.666667 1
## [121] 0.2      1.250000 1
## [122] 0.2      1.666667 1
## [123] 0.4      1.250000 2
## [124] 0.4      1.250000 2
## [125] 0.4      1.666667 2
## [126] 0.2      1.250000 1
## [127] 0.2      1.666667 1
## [128] 0.2      1.250000 1
## [129] 0.2      1.666667 1
## [130] 0.2      1.250000 1
## [131] 0.2      1.250000 1
## [132] 0.2      1.250000 1
## [133] 0.2      1.250000 1
## [134] 0.2      1.250000 1
## [135] 0.2      1.250000 1
## [136] 0.2      1.666667 1
## [137] 0.2      1.250000 1
## [138] 0.2      1.250000 1
## [139] 0.2      1.250000 1
## [140] 0.2      1.250000 1
## [141] 0.2      1.250000 1
## [142] 0.2      1.250000 1
## [143] 0.2      1.250000 1
## [144] 0.4      1.250000 2
## [145] 0.4      1.250000 2
## [146] 0.4      1.666667 2
## [147] 0.2      1.250000 1
## [148] 0.2      1.250000 1
## [149] 0.4      1.250000 2
## [150] 0.4      1.250000 2
## [151] 0.4      1.666667 2
## [152] 0.2      1.250000 1
## [153] 0.2      1.250000 1
## [154] 0.2      1.250000 1
## [155] 0.2      1.666667 1
## [156] 0.2      5.000000 1
## [157] 0.2      1.250000 1
## [158] 0.2      1.250000 1
## [159] 0.2      1.250000 1
## [160] 0.2      1.666667 1
## [161] 0.2      5.000000 1
## [162] 0.2      1.250000 1
## [163] 0.2      1.250000 1
## [164] 0.2      1.666667 1
## [165] 0.2      2.500000 1
## [166] 0.2      1.250000 1
## [167] 0.2      1.250000 1
## [168] 0.2      1.666667 1
```

```
## [169] 0.2      1.666667 1
## [170] 0.2      2.500000 1
## [171] 0.2      1.250000 1
## [172] 0.2      1.250000 1
## [173] 0.2      1.666667 1
## [174] 0.2      1.666667 1
## [175] 0.2      2.500000 1
## [176] 0.2      1.250000 1
## [177] 0.2      1.250000 1
## [178] 0.2      1.250000 1
## [179] 0.2      1.666667 1
## [180] 0.2      2.500000 1
## [181] 0.2      1.250000 1
## [182] 0.2      1.250000 1
## [183] 0.2      1.666667 1
## [184] 0.2      1.250000 1
## [185] 0.2      1.250000 1
## [186] 0.2      1.666667 1
## [187] 0.2      1.250000 1
## [188] 0.2      1.250000 1
## [189] 0.2      1.250000 1
## [190] 0.2      1.666667 1
## [191] 0.2      1.250000 1
## [192] 0.2      1.250000 1
## [193] 0.2      1.666667 1
## [194] 0.2      1.250000 1
## [195] 0.2      1.250000 1
## [196] 0.2      1.250000 1
## [197] 0.2      1.666667 1
## [198] 0.2      1.666667 1
## [199] 0.2      2.500000 1
```