M46-retail2

LearningSpoonsR

2019-02-10

Background

I. Background

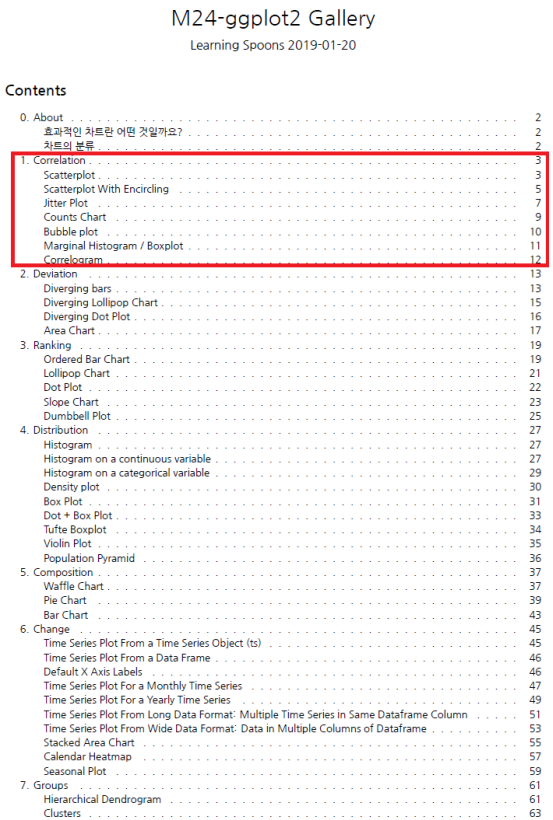
- Continued from **`M43-retail1`**
  1. 배송 기간 분석 (**`Ship Date`**를 기반으로 배송이 가장 오래걸리는 상품은 무엇인가?)
  2. 마진이 가장 많이 남는 상품은 무엇인가?
  3. **`M46`에서는 소비자 별 구매 기록을 분석해보자**
- 맥주와 기저귀
  - Data-driven marketing의 고전적 예제
  - 맥주와 기저귀가 동시에 많이 팔린다.
  - Why? 아이를 위해 기저귀를, 나를 위해 맥주를 사는 아이 아빠들…
  - So what? 두 상품의 진열을 가깝게? 아니면 멀게해서 동선을 확보? 묶음 상품으로?
- Online Commerce?
  - “이 상품을 구매한 사람이 자주 본 물건”
  - “You may also like…”

Goal

II. Goal

목표 결과물 (Target output)

- 이 노트는 제작 과정을 최대한 재현한 노트입니다. 분석가의 생각의 흐름을 느껴보세요.
- From `M24`,
  0. About
  1. **Correlation: 두 변수가 얼마나 상관관계가 있는가?**
  2. Deviation
  3. Ranking
  4. Distribution
  5. Composition
  6. Change
  7. Groups



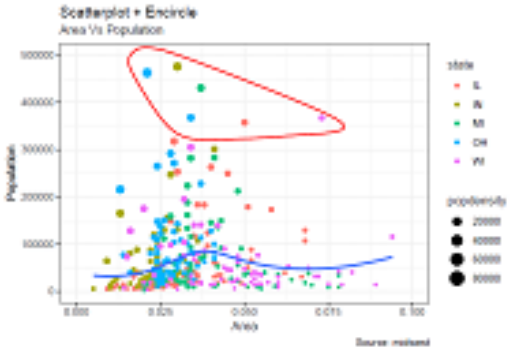
M24-ggplot2 Gallery

Learning Spoons 2019-01-20

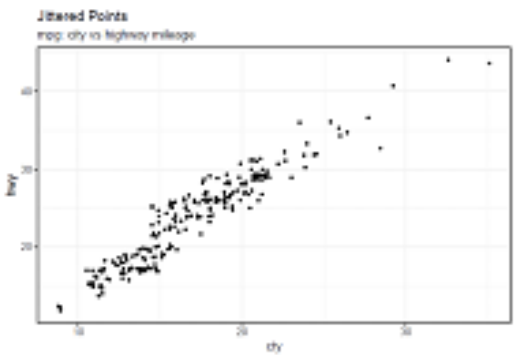
Contents

목표 결과물 (Target output)

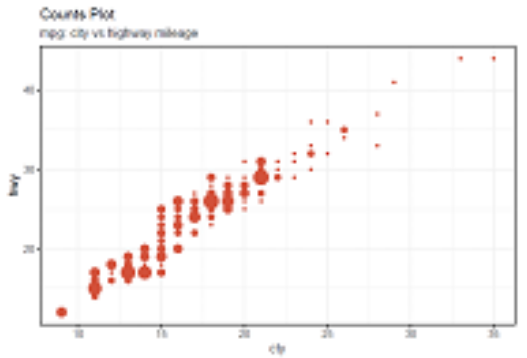
- From `M24. 1. Correlation`,



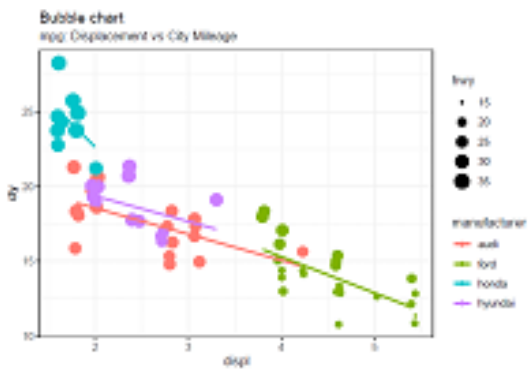
Scatterplot



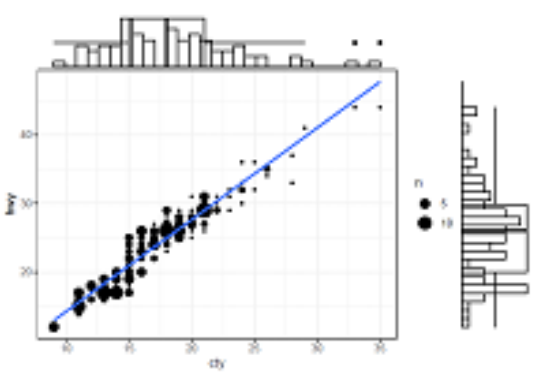
Jittered Plot



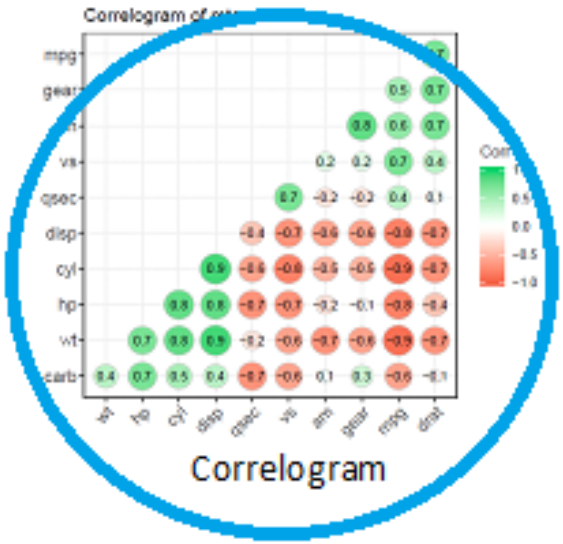
Count Plot



Bubble Chart



+ Histogram



Correlogram

필요한 데이터셋의 구조

We need…

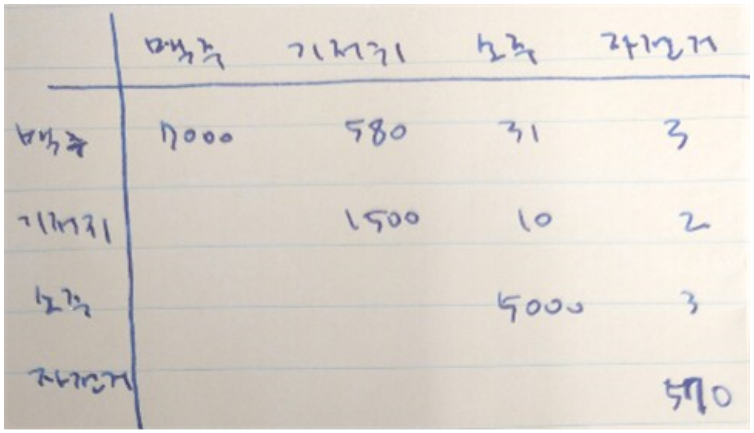


Figure 1: 필요한 데이터 구조

for…

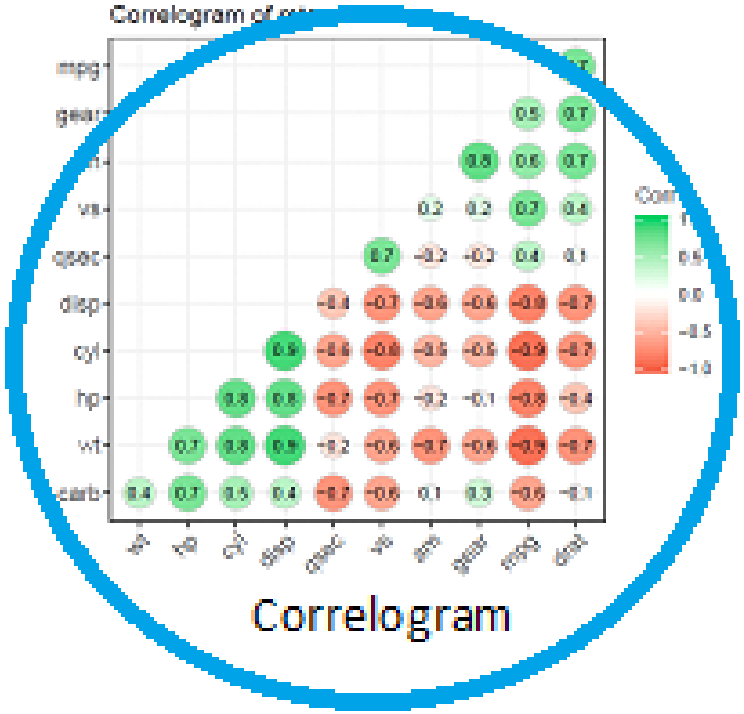


Figure 2: 최종 output 시안

Data Review

III. Data Review

```
library(tidyverse) # dplyr + ggplot2 + tidyr + ...
```

```
## -- Attaching packages ---------------------------------------------------
## v ggplot2 3.1.0     v purrr   0.3.0
## v tibble  2.0.1     v dplyr   0.7.8
## v tidyr   0.8.2     v stringr 1.3.1
## v readr   1.3.1     v forcats 0.3.0
## -- Conflicts ------------------------------------------------------------
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(readxl)
dataset <- read_excel("retail.xlsx")
```

- **tidyverse** 많이도 포함하고 있네요.
- rmarkdown 문서에 r chunk의 아웃풋 출력을 안하려면 **message=FALSE**하면 됩니다.

이렇게 생긴 데이터이고…

```
str(dataset)
```

```
## Classes 'tbl_df', 'tbl' and 'data.frame':    9994 obs. of  20 variables:
##  $ Country      : chr  "United States" "United States" "United States" "United States" ...
##  $ Region       : chr  "East" "East" "South" "South" ...
##  $ State        : chr  "Ohio" "Ohio" "Virginia" "Virginia" ...
##  $ City         : chr  "Akron" "Akron" "Alexandria" "Alexandria" ...
##  $ Postal Code  : num  44312 44312 22304 22304 22304 ...
##  $ Category     : chr  "Furniture" "Furniture" "Furniture" "Furniture" ...
##  $ Sub-Category : chr  "Tables" "Furnishings" "Furnishings" "Furnishings" ...
##  $ Segment      : chr  "Corporate" "Consumer" "Corporate" "Home Office" ...
##  $ Product Name : chr  "Chromcraft Rectangular Conference Tables" "Deflect-o Glass Clear
##  $ Manufacturer : chr  "Chromcraft" "Deflect-o" "DAX" "Eldon" ...
##  $ Customer Name: chr  "Ed Braxton" "Ted Trevino" "Andrew Gjertsen" "Shirley Daniels" .
##  $ Order Date   : POSIXct, format: "2014-10-21" "2011-05-18" ...
##  $ Order ID     : chr  "CA-2014-147277" "CA-2011-164224" "CA-2012-104241" "US-2011-1555(
##  $ Ship Date    : POSIXct, format: "2014-10-25" "2011-05-20" ...
##  $ Ship Mode    : chr  "Standard Class" "Second Class" "Standard Class" "Standard Class'
##  $ Discount     : num  0.4 0.2 0 0 0 0.3 0.2 0.32 0.3 0.6 ...
##  $ Profit       : num  -76 4 69 4 31 -31 3 -36 -350 -11 ...
##  $ Profit Ratio : num  -0.27 0.03 0.36 0.36 0.49 -0.13 0.29 -0.18 -0.14 -0.48 ...
##  $ Quantity     : num  2 3 14 3 3 2 2 2 5 3 ...
##  $ Sales        : num  284 149 192 12 63 ...
```

이런 변수들이 있구나…

```
colnames(dataset)
```

```
##  [1] "Country"       "Region"        "State"         "City"
##  [5] "Postal Code"   "Category"      "Sub-Category"  "Segment"
##  [9] "Product Name"  "Manufacturer"  "Customer Name" "Order Date"
## [13] "Order ID"      "Ship Date"     "Ship Mode"     "Discount"
## [17] "Profit"        "Profit Ratio"  "Quantity"      "Sales"
```

관련 데이터는…

```
dataset %>% select(`Product Name`, `Customer Name`) %>% head()
```

```
## # A tibble: 6 x 2
##   `Product Name`                                              `Customer Name`
##   <chr>                                                       <chr>
## 1 Chromcraft Rectangular Conference Tables                    Ed Braxton
## 2 Deflect-o Glass Clear Studded Chair Mats                    Ted Trevino
## 3 DAX Wood Document Frame                                     Andrew Gjertsen
## 4 Eldon Image Series Black Desk Accessories                   Shirley Daniels
## 5 GE General Use Halogen Bulbs, 100 Watts, 1 Bulb per Pack    Shirley Daniels
## 6 Chromcraft Round Conference Tables                          Anna Gayman
```

각각 컬럼의 **unique**한 value의 갯수는…

```
dataset %>% select(`Product Name`, `Customer Name`) %>%
  sapply(function(x) length(unique(x)))
```

```
##  Product Name Customer Name
##          1850            793
```

암튼 **dataset**을 이용해서 Figure 1 모양의 구조를 만드는 preprocessing을 하면 되겠구나!

Preprocessing

Preprocessing 1: Assign IDs

Issue → Solution → Discussion → Implementation

Issue

1. `Customer Name`의 유일성 (uniqueness)
   - `Akron`에 사는 `Barrack Obama` → 기저귀 구매
   - `L.A.`에 사는 `Barrack Obama` → 맥주 구매
   - 그런데 둘은 다른 사람!
2. `Product Name`의 유일성과 value의 길이
   - 마찬가지로 유일성이 담보되지 않음
   - 값이 너무 김
   - ex) `Chromcraft Rectangular Conference Tables`

Discussion

1. ID variable(Key variable)은 데이터를 체계적으로 관리하는 도구
2. 없다면 유일성을 담보할 수 있는 방법으로 만들어 내야 함
3. 체계적으로 준비된 데이터 셋은 `join`및 조회가 용이함

Solution

1. `Customer Name`의 유일성 (uniqueness)
   - 각각 다른 `CustomerID`가 있어야 함
   - `Postal Code`(44312)와 `Customer Name` (Ed Braxton)으로 `CustomerID`를 만들자.
   - `cus01321`와 같은 형식으로 만들자.
2. `Product Name`의 유일성과 value의 길이
   - 각각 다른 `ProductID`가 있어야 함.
   - `Manufacturer`와 `Product Name`으로 `ProductID`를 만들자.
   - `prod08231`와 같은 형식으로 만들자.

Implementation

Step 1. **unique**를 사용해서 유일한 조합을 생성하여 **customerTable**에 저장

```
customerTable <- dataset %>% select(`Postal Code`, `Customer Name`) %>% unique()
customerTable %>% head()
```

```
## # A tibble: 6 x 2
##   `Postal Code` `Customer Name`
##           <dbl> <chr>
## 1         44312 Ed Braxton
## 2         44312 Ted Trevino
## 3         22304 Andrew Gjertsen
## 4         22304 Shirley Daniels
## 5         75002 Anna Gayman
## 6         18103 Caroline Jumper
```

Step 1-1. 구매기록에 몇명의 고객이 있는지 확인

```
dim(customerTable)
```

```
## [1] 4910    2
```

Step 1-2. CustomerID 변수를 만들기

1. 일련 번호 생성
2. google “how to add leading zeros R”

```
library(stringr)
x <- 1:nrow(customerTable) %>% str_pad(5, pad = "0") # make 5-digit string by padding "0"
head(x, 3)
```

```
## [1] "00001" "00002" "00003"
```

3. CustomerID 변수 완성

```
customerTable$CustomerID <- paste0("cus", x)
customerTable %>% head(3)
```

```
## # A tibble: 3 x 3
##   `Postal Code` `Customer Name` CustomerID
##           <dbl> <chr>           <chr>
## 1         44312 Ed Braxton      cus00001
## 2         44312 Ted Trevino     cus00002
## 3         22304 Andrew Gjertsen cus00003
```

Step 2. 같은 방법으로 productTable 만들기

```
productTable <- dataset %>% select(Manufacturer,`Product Name`) %>% unique()
productTable <- productTable %>%
  mutate(ProductID = paste0("prod",
                            1:nrow(productTable) %>% str_pad(5, pad = "0")))
productTable %>% head(3)
```

```
## # A tibble: 3 x 3
##   Manufacturer `Product Name`                              ProductID
##   <chr>        <chr>                                       <chr>
## 1 Chromcraft   Chromcraft Rectangular Conference Tables    prod00001
## 2 Deflect-o    Deflect-o Glass Clear Studded Chair Mats    prod00002
## 3 DAX          DAX Wood Document Frame                     prod00003
```

Step 3. 원래 데이터셋에 CustomerID와 ProductID를 부여

Step 3-1. CustomerID 부여

```
head(dataset[,c(5, 11:12)], 2)
```

```
## # A tibble: 2 x 3
##   `Postal Code` `Customer Name` `Order Date`
##           <dbl> <chr>           <dttm>
## 1         44312 Ed Braxton      2014-10-21 00:00:00
## 2         44312 Ted Trevino     2011-05-18 00:00:00
```

```
head(customerTable, 2)
```

```
## # A tibble: 2 x 3
##   `Postal Code` `Customer Name` CustomerID
##           <dbl> <chr>           <chr>
## 1         44312 Ed Braxton      cus00001
## 2         44312 Ted Trevino     cus00002
```

```
dataset <- left_join(x = dataset, y = customerTable,
                     by = c("Postal Code", "Customer Name"))
dataset[c(5, 11:12, 21)] %>% head(2)
```

```
## # A tibble: 2 x 4
##   `Postal Code` `Customer Name` `Order Date`        CustomerID
##           <dbl> <chr>           <dttm>              <chr>
## 1         44312 Ed Braxton      2014-10-21 00:00:00 cus00001
## 2         44312 Ted Trevino     2011-05-18 00:00:00 cus00002
```

성공!

Step 3-2. 같은 방법으로 ProductID 부여

```
dataset <- left_join(x = dataset, y = productTable,
                     by = c("Manufacturer", "Product Name"))
```

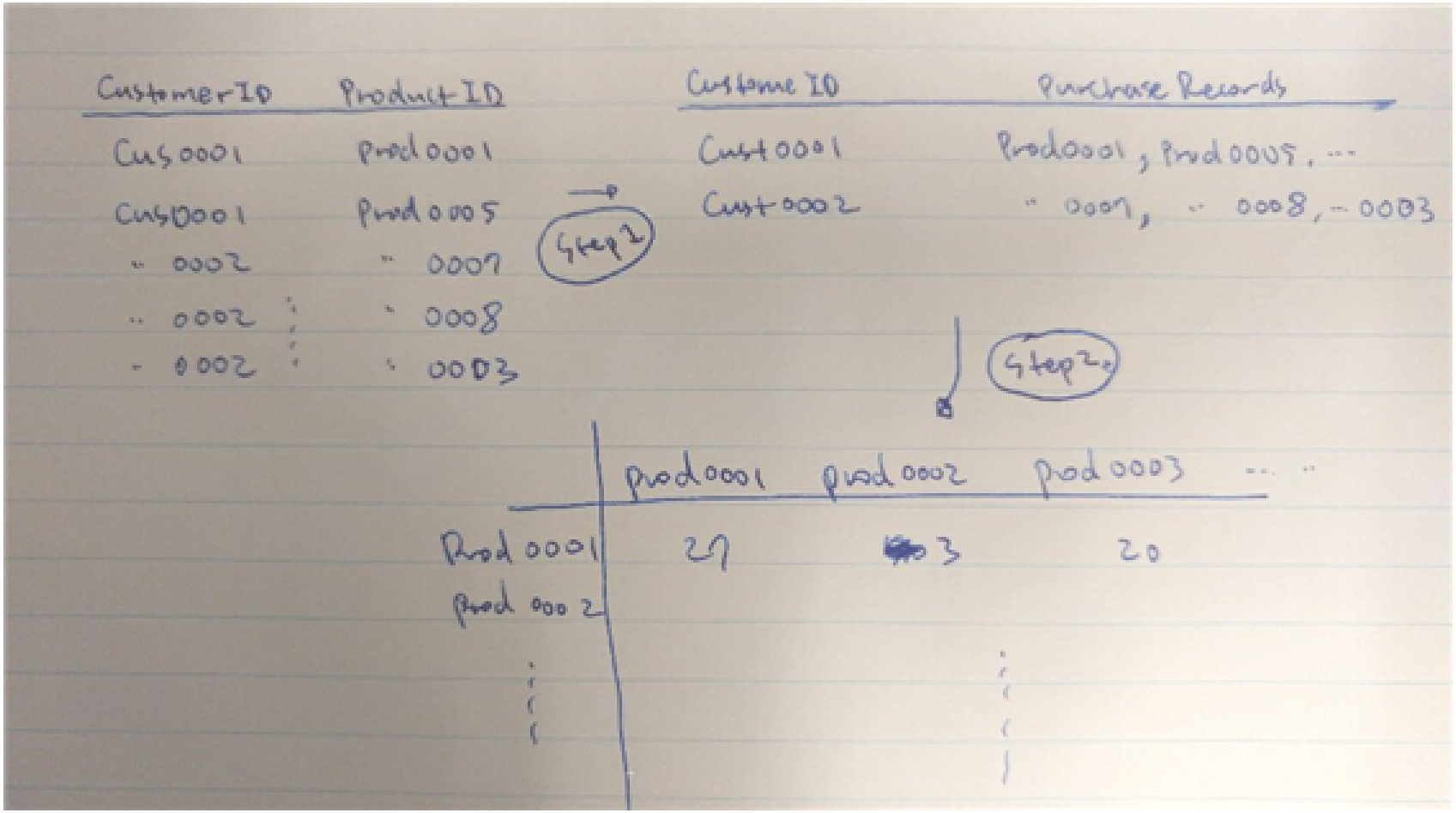
Step 4. 전처리 완료! 필요한 변수만 모아서 dataset2라고 이름 붙임!

```
dataset2 <- dataset %>%
  select(CustomerID, ProductID, `Postal Code`,
         `Customer Name`, Manufacturer, `Product Name`) %>%
  arrange(CustomerID, ProductID)
dataset2[108:110,]
```

```
## # A tibble: 3 x 6
##   CustomerID ProductID `Postal Code` `Customer Name` Manufacturer
##   <chr>      <chr>              <dbl> <chr>           <chr>
## 1 cus00038   prod00047          60505 Barry Franzosi~ Global
## 2 cus00038   prod00543          60505 Barry Franzosi~ Acco
## 3 cus00038   prod00550          60505 Barry Franzosi~ TOPS
## # ... with 1 more variable: `Product Name` <chr>
```

Preprocessing 2

Strategy



Implementation – Step 1

Before

```
dataset2 %>%
  select(CustomerID, ProductID) %>%
  head()
```

```
## # A tibble: 6 x 2
##   CustomerID ProductID
##   <chr>      <chr>
## 1 cus00001   prod00001
## 2 cus00001   prod00384
## 3 cus00002   prod00002
## 4 cus00002   prod00396
## 5 cus00003   prod00003
## 6 cus00004   prod00004
```

After

```
purchase <- dataset2 %>%
  group_by(CustomerID) %>%
  summarise(
    Purchases =
      paste(ProductID, collapse = " "))
head(purchase)
```

```
## # A tibble: 6 x 2
##   CustomerID Purchases
##   <chr>      <chr>
## 1 cus00001   prod00001 prod00384
## 2 cus00002   prod00002 prod00396
## 3 cus00003   prod00003
## 4 cus00004   prod00004 prod00005 prod00411
## 5 cus00005   prod00006 prod00415
## 6 cus00006   prod00007 prod00417
```

Implementation – Step 2

Prepare an empty matrix, **purchaseCount**

```
uProductID <- unique(dataset2$ProductID)
purchaseCount <-
  array(0, c(length(uProductID),length(uProductID)))
colnames(purchaseCount) <- uProductID
rownames(purchaseCount) <- uProductID
purchaseCount[1:4,1:3]
```

```
##           prod00001 prod00384 prod00002
## prod00001         0         0         0
## prod00384         0         0         0
## prod00002         0         0         0
## prod00396         0         0         0
```

And with **purchase$Purchase**

```
purchase$Purchases %>% head(3) %>% t() %>% t()
```

```
##      [,1]
## [1,] "prod00001 prod00384"
## [2,] "prod00002 prod00396"
## [3,] "prod00003"
```

Fill purchaseCount

```
library(stringr)
a <- Sys.time()
for (i in 1:nrow(purchaseCount)) {
  for (j in 1:nrow(purchaseCount)) {
    purchaseCount[i,j] <-
      sum(
        str_detect(purchase$Purchases, uProductID[i]) &
        str_detect(purchase$Purchases, uProductID[j]))
  }
}
b <- Sys.time()
save.image(file = "M46_middle.Rdata")
library(beepr)
beep()
```

```
purchaseCount[1:4,1:3]
```

```
##           prod00001 prod00384 prod00002
## prod00001         9         1         0
## prod00384         1         5         0
## prod00002         0         0         7
## prod00396         0         0         1
```

```
a
```

```
## [1] "2019-01-21 15:16:40 KST"
```

```
b
```

```
## [1] "2019-01-21 18:16:16 KST"
```

```
b-a
```

```
## Time difference of 2.993472 hours
```

- Code Review
  - 시간이 오래걸린 작업이므로 `save.image(file = "M46_middle.Rdata")`로 현재 메모리 상태 저장
  - `load("M46_middle.Rdata")`를 이용하면 저장된 메모리 상태 불러올 수 있음
  - 소요시간 확인을 위해서 `a`와 `b`를 기록
  - `library(beepr)`, `beep()`으로 소리를 내어서 작업 완료를 알려줌 (기다리면서는 무엇을 하나요? ~~카톡~~)
- Discussion
  - 속도를 빠르게 하려면 어떻게 해야할까요?
  - Hint?

Results

Result 1

Step. 1. 각 `ProductID`별로 pair 구매 건수를 집계하고 정렬

- `purchaseCount`의 각 column의 합을 구하고…
- 해당 제품 구매 건수를 빼주면 pair 구매 건수가 집계됨
- 그것을 내림차순으로 정렬하면 `pairCount`완성

```
pairCount <- colSums(purchaseCount) - diag(purchaseCount)
pairCount <- sort(pairCount, decreasing = TRUE)
head(pairCount)
```

```
## prod00579 prod00445 prod00423 prod00116 prod00156 prod00018
##       104        90        80        48        46        43
```

Step. 2. pair 구매가 많았던 8개 `ProductID`만 골라서 8 by 8 표로 표현

- `mat_size`를 8로 지정
- `pairCount[1:mat_size]`의 `names`들이 `productID` 형식으로 표현되어 있으므로…
- `names()`를 이용해서 `purchaseCount`를 subsetting함!!

```
mat_size <- 8
pair_mat <- purchaseCount[names(pairCount[1:mat_size]),
                          names(pairCount[1:mat_size])]
pair_mat %>% head()
```

```
##           prod00579 prod00445 prod00423 prod00116 prod00156 prod00018
## prod00579        46         0         1         2         0         0
## prod00445         0        48         1         1         0         0
## prod00423         1         1        46         0         0         0
## prod00116         2         1         0        18         0         0
## prod00156         0         0         0         0        14         1
## prod00018         0         0         0         0         1        14
##           prod00469 prod00476
## prod00579         0         0
## prod00445         0         0
## prod00423         0         1
## prod00116         0         0
## prod00156         1         0
## prod00018         0         0
```

Figure 1 완성!!!

- pair_mat의 index들을 productID형식에서 productName형식으로 바꾸려면?
- 먼저 productTable을 이용해서 pair_mat의 ID를 매치시킴

```
pair_mat_name <-
  left_join(data.frame(ProductID = colnames(pair_mat)), productTable)
```

```
## Joining, by = "ProductID"
## Warning: Column `ProductID` joining factor and character vector, coercing
## into character vector
```

```
pair_mat_name %>% head()
```

```
##   ProductID      Manufacturer
## 1 prod00579             Other
## 2 prod00445   Staple envelope
## 3 prod00423 Easy-staple paper
## 4 prod00116                KI
## 5 prod00156             Eldon
## 6 prod00018            Global
##                                    Product Name
## 1                                        Staples
## 2                                Staple envelope
## 3                              Easy-staple paper
## 4                       KI Adjustable-Height Table
## 5                      Eldon Wave Desk Accessories
## 6 Global Wood Trimmed Manager's Task Chair, Khaki
```

- pair_mat의 rownames를 교체

```
rownames(pair_mat) <- pair_mat_name[,"Product Name"] %>% substr(1,20)
pair_mat
```

```
##                      prod00579 prod00445 prod00423 prod00116 prod00156
## Staples                     46         0         1         2         0
## Staple envelope              0        48         1         1         0
## Easy-staple paper            1         1        46         0         0
## KI Adjustable-Height         2         1         0        18         0
## Eldon Wave Desk Acce         0         0         0         0        14
## Global Wood Trimmed          0         0         0         0         1
## Hot File 7-Pocket, F         0         0         0         0         1
## Storex Dura Pro Bind         0         0         1         0         0
##                      prod00018 prod00469 prod00476
## Staples                     0         0         0
## Staple envelope             0         0         0
## Easy-staple paper           0         0         1
## KI Adjustable-Height        0         0         0
## Eldon Wave Desk Acce        1         1         0
## Global Wood Trimmed        14         0         0
## Hot File 7-Pocket, F        0        13         0
## Storex Dura Pro Bind        0         0        17
```

진짜로 Figure 1 완성!!!

Step. 3. pair 구매가 2회 이상이었던 10개 case를 random하게 출력

```
topPair_N <- 10
# Replace diagonals to 0
purchaseCount_offdiag <- purchaseCount
diag(purchaseCount_offdiag) <- 0
# Find >=2 counts and build data.frame
top_indexes <-
  which(purchaseCount_offdiag >= 2, arr.ind = TRUE) %>% data.frame()
top_indexes %>% head()
```

```
##           row col
## prod00543 106  27
## prod00394 212  33
## prod01458  41  35
## prod00270 694  39
## prod00435  35  41
## prod01466  68  64
```

```
colnames(purchaseCount_offdiag) %>% head()
```

```
## [1] "prod00001" "prod00384" "prod00002" "prod00396" "prod00003" "prod00004"
```

```r
Top_N <- data.frame(
  ID_x = apply(top_indexes, 1,
               function(x) colnames(purchaseCount_offdiag)[x[1]]),
  ID_y = apply(top_indexes, 1,
               function(x) colnames(purchaseCount_offdiag)[x[2]]),
  count = apply(top_indexes, 1,
                function(x) purchaseCount_offdiag[x[1], x[2]]),
  stringsAsFactors = FALSE,
  row.names = NULL
)
# replace ID with `ProductID` using `left_join`
Top_N <- Top_N %>%
  left_join(productTable, by = c("ID_x"="ProductID")) %>%
  select(`Product Name`, ID_y, count) %>%
  left_join(productTable, by = c("ID_y"="ProductID")) %>%
  select(`Product Name.x`, `Product Name.y`, count)
```

```
Top_N[,1] <- substr(Top_N[,1], 1, 30)
Top_N[,2] <- substr(Top_N[,2], 1, 30)
Top_N %>% head(2)
```

```
##                   Product Name.x                 Product Name.y count
## 1     Acco Hot Clips Clips to Go         Flat Face Poster Frame     2
## 2 Wilson Jones Active Use Binder GBC Recycled VeloBinder Covers     2
```

Top_N에서 random하게 **topPair_N**개 행을 뽑으면 끝!

```
Top_N[sample(1:nrow(Top_N), topPair_N),]
```

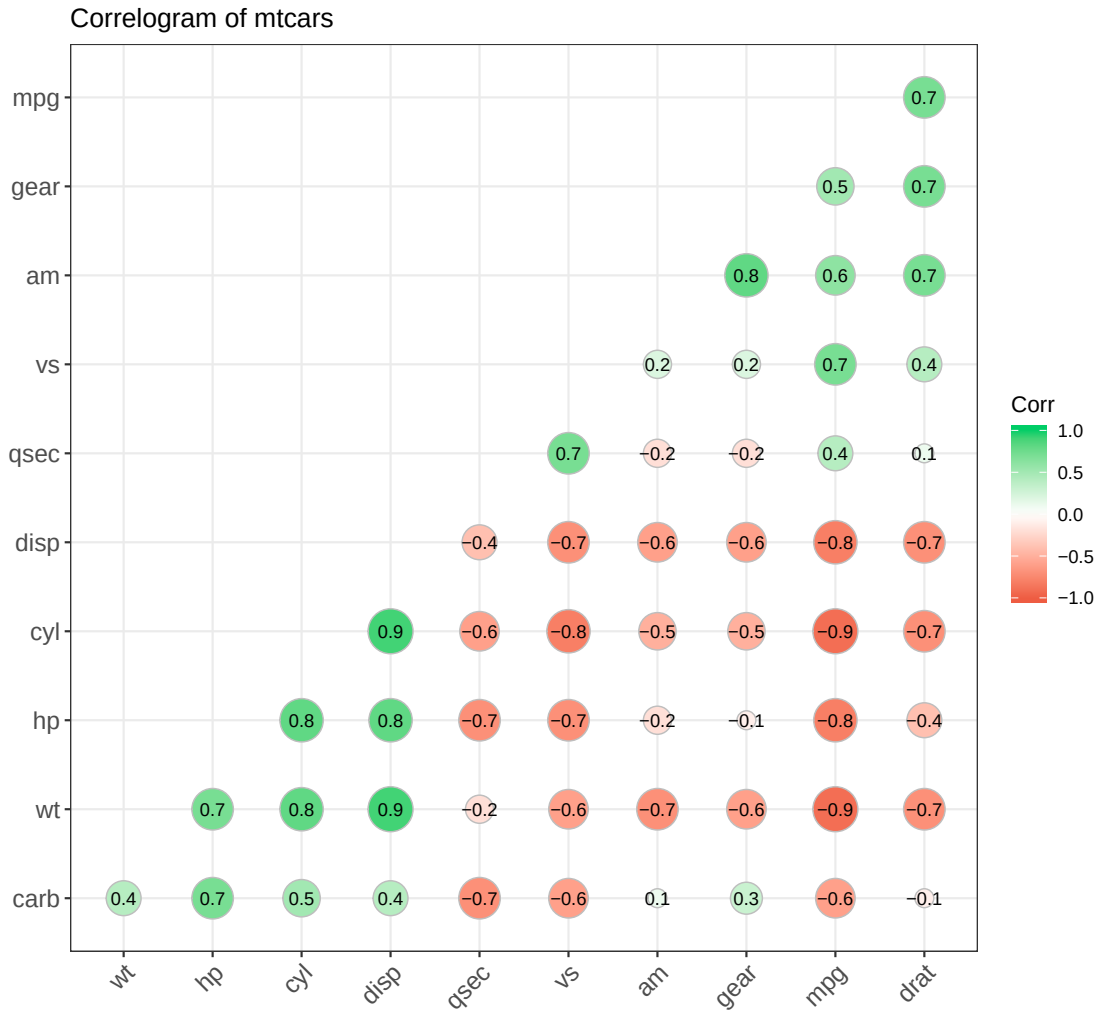
```
##                     Product Name.x                   Product Name.y count
## 62 Avery Fluorescent Highlighter  Acco Side-Punched Conventional     2
## 42 Peel & Stick Add-On Corner Poc              Easy-staple paper     2
## 31                       Newell 34                Staple envelope     2
## 32                     Xerox 1971                Staple envelope     2
## 53 Carina Double Wide Media Stora 1.7 Cubic Foot Compact "Cube"      2
## 9  DMI Eclipse Executive Suite Bo                      Avery 485     2
## 55 1.7 Cubic Foot Compact "Cube"  Carina Double Wide Media Stora     2
## 48 Belkin Premiere Surge Master I SAFCO Optional Arm Kit for Wor     2
## 47                       Xerox 192 X-Rack File for Hanging Folder     2
## 35               OIC Binder Clips    Eldon Wave Desk Accessories     2
```

Result 2

Step. 1. 예제 코드를 이용해 Correlogram 그리기 연습

```
library(ggplot2)
library(ggcorrplot)
data(mtcars)
corr <- round(cor(mtcars), 1)
fig_sample <-
  ggcorrplot(
    corr, hc.order = TRUE, type = "lower", lab = TRUE,
    lab_size = 3, method="circle",
    colors = c("tomato2", "white", "springgreen3"),
    title="Correlogram of mtcars", ggtheme=theme_bw)
```

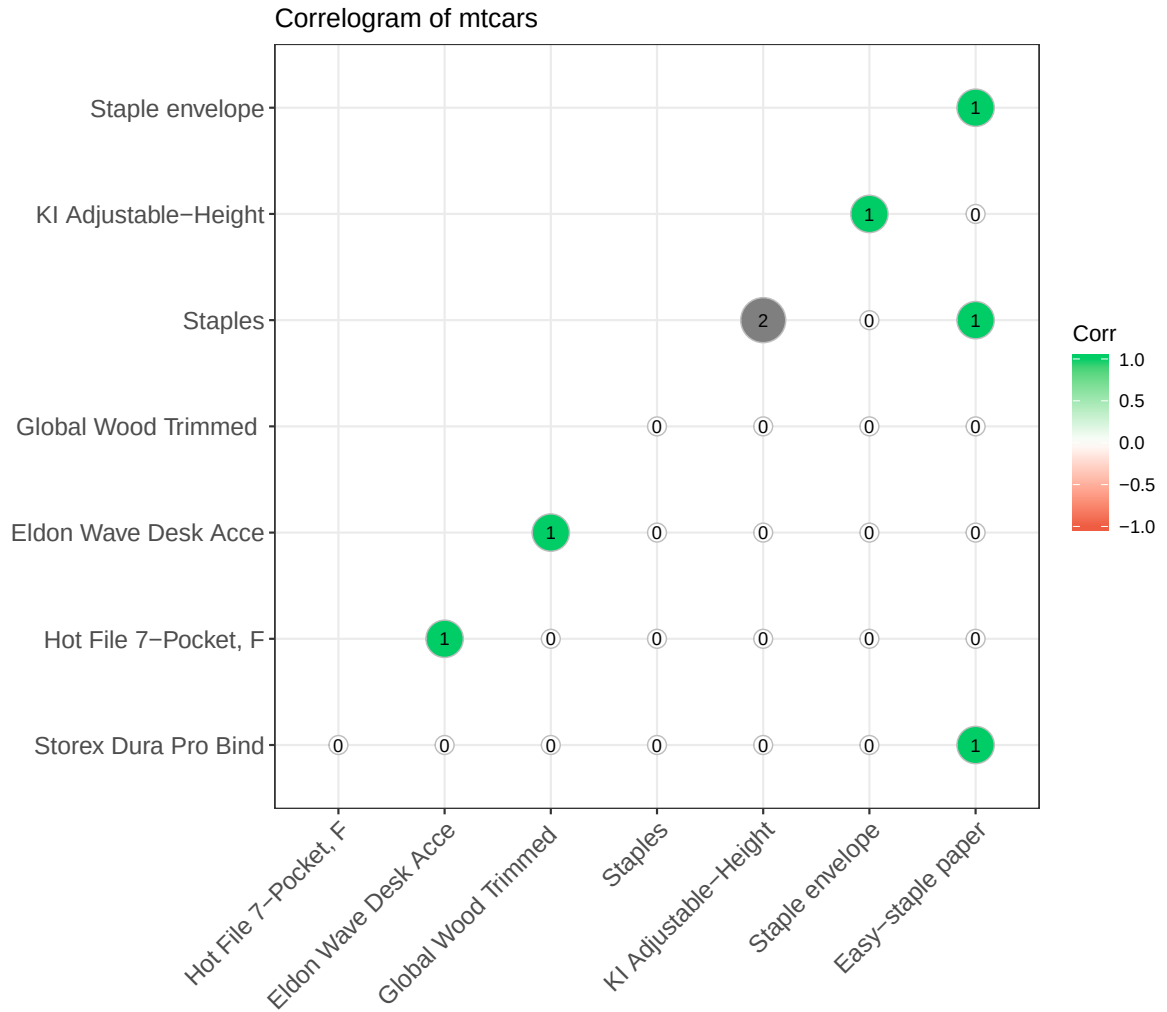
```
fig_sample
```


Correlogram of mtcars
mpg
gear
am
vs
qsec
disp
cyl
hp
wt
carb
wt
hp
cyl
disp
qsec
vs
am
gear
mpg
drat
Corr
1.0
0.5
0.0
−0.5
−1.0

Step. 2. pair_mat를 이용해 correlogram 그리기

```
colnames(pair_mat) <- rownames(pair_mat)
fig_corr <-
  ggcorrplot(
    pair_mat, hc.order = TRUE, type = "lower", lab = TRUE,
    lab_size = 3, method="circle",
    colors = c("tomato2", "white", "springgreen3"),
    title="Correlogram of mtcars", ggtheme=theme_bw)
```

```
fig_corr
```


Correlogram of mtcars
Staple envelope
KI Adjustable-Height
Staples
Global Wood Trimmed
Eldon Wave Desk Acce
Hot File 7-Pocket, F
Storex Dura Pro Bind
Hot File 7-Pocket, F
Eldon Wave Desk Acce
Global Wood Trimmed
Staples
KI Adjustable-Height
Staple envelope
Easy-staple paper
Corr
1.0
0.5
0.0
−0.5
−1.0

Summary

Summary

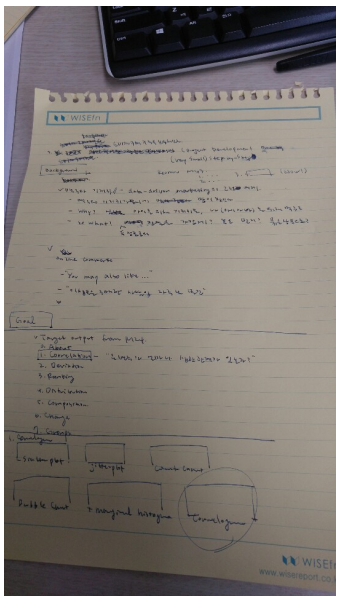
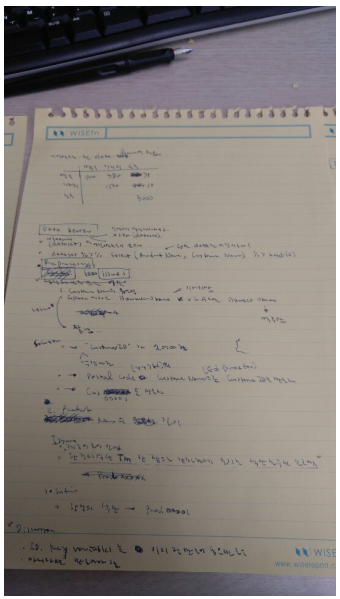
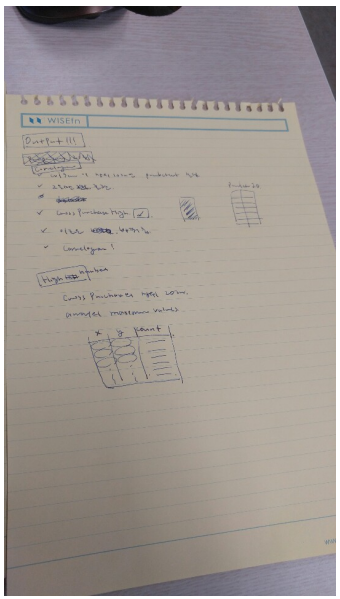
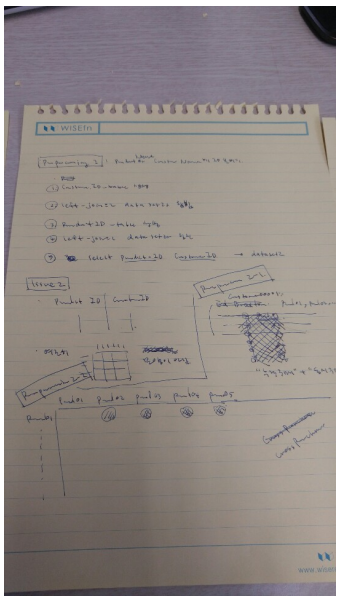
```
save.image("M46_final.Rdata")
```

- Result1
  - Step. 2.
    - `pair_mat`
    - pair 구매가 많았던 8개 `ProductID`만 골라서 8 by 8 표로 표현
  - Step. 3.
    - `Top_N`
    - pair 구매가 2회 이상이었던 10개 case를 random하게 출력
- Result2
  - Step. 2.
    - `fig_corr`
    - `pair_mat`를 이용해 correlogram 그리기

Shiny Presentation

1. `load("M46_final.Rdata")`를 이용해서 데이터를 불러옵니다.
2. 위의 8과 10을 사용자의 인풋으로 받아서 다음 작업을 수행합니다.
3. Correlogram
   - `input$mat_size`를 `seq(from = 8, to = 14, by = 2)`에서 선택
   - `pair_mat` 만들기 (from `purchaseCount` and `productTable`)
   - `fig_corr` 만들기 (from `pair_mat`)
4. `Top_N` table
   - `input$topPair_N`를 `seq(from = 10, to = 30, by = 5)`에서 선택
   - `Top_N` 만들기 (from `purchaseCount` and `productTable`)
5. flexdashboard + shiny로 다음을 포함한 대시보드를 만들어 보세요.
   - 사용자 인풋창
   - 3번 결과물
   - 4번 결과물
6. 결과물
   - https://learningspoonsr.shinyapps.io/M46-retail2-correl/

Sketch Notes

- Verumtamen oportet me bodie et cras et sequenti die ambulare.
- 오늘도 내일도 그 다음날도 계속해서 내 길을 가야 한다.