King Sejong's National Referendum on Tax Reform (R-Base Plot)

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Loading Data

원자료는 세종실록 (http://sillok.history.go.kr/id/kda_11208010_005), 요약표는 오기수 교수의 논문에서.

```
knitr::opts_chunk$set(echo = TRUE)
library(knitr)
library(extrafont)
load("sejong_ref_tbl.RData")
str(sejong_ref)
```

Rearrangement

```
vnames_kr <- c("집계", "찬반", "계급", "지역", "관료여부")
kable(sejong_ref[c(4, 3, 5, 2, 1)],
      col.names = vnames_kr[c(4, 3, 5, 2, 1)],
      align = c(rep('c', 4), 'r'))
```

지역	계급	관료여부	찬반	집계
서울	대신 등	관료	찬성	21
서울	대신 등	관료	반대	194
서울	3품이하현직	관료	찬성	259
서울	3품이하현직	관료	반대	393
서울	3품이하전직	관료	찬성	443
서울	3품이하전직	관료	반대	117
유후사	품관촌민	품관촌민	찬성	1123
유후사	품관촌민	품관촌민	반대	71
경기	수령	관료	찬성	29
경기	수령	관료	반대	5
경기	품관촌민	품관촌민	찬성	17076
경기	품관촌민	품관촌민	반대	236
평안	대신 등	관료	반대	1
평안	수령	관료	찬성	6
평안	수령	관료	반대	35

지역	계급	관료여부	찬반	집계
평안	품관촌민	품관촌민	찬성	1326
평안	품관촌민	품관촌민	반대	28474
황해	수령	관료	찬성	17
황해	수령	관료	반대	17
황해	품관촌민	품관촌민	찬성	4454
황해	품관촌민	품관촌민	반대	15601
충청	대신 등	관료	반대	2
충청	수령	관료	찬성	35
충청	수령	관료	반대	26
충청	품관촌민	품관촌민	찬성	6982
충청	품관촌민	품관촌민	반대	14013
강원	수령	관료	찬성	5
강원	수령	관료	반대	10
강원	품관촌민	품관촌민	찬성	939
강원	품관촌민	품관촌민	반대	6888
함길	대신 등	관료	반대	1
함길	수령	관료	찬성	3
함길	수령	관료	반대	14
함길	품관촌민	품관촌민	찬성	75
함길	품관촌민	품관촌민	반대	7387
경상	수령	관료	찬성	55
경상	수령	관료	반대	16
경상	품관촌민	품관촌민	찬성	36262
경상	품관촌민	품관촌민	반대	377
전라	대신 등	관료	반대	2
전라	수령	관료	찬성	42
전라	수령	관료	반대	12
전라	품관촌민	품관촌민	찬성	29505
전라	품관촌민	품관촌민	반대	257

User defined `pos( )`

원형그래프와 막대그래프에서 라벨의 위치를 정하는 사용자 정의함수를 작성한다.

```
b0 <- barplot(as.matrix(3:1, ncol = 1),
              xlim = c(-1, 6),
              ylim = c(0, 7),
              col = "white",
              axes = FALSE)
text(x = -0.6, y = c(3, 5, 6),
     labels = c("x1", "x1 + x2", "x1 + x2 + x3"))
text(x = b0, y = c(1.5, 4, 5.5),
     labels = "x")
text(x = 2.5, y = c(1.5, 4, 5.5),
     labels = c("x1 - x1/2", "x1 + x2 - x2/2", "x1 + x2 + x3 - x3/2"))
```
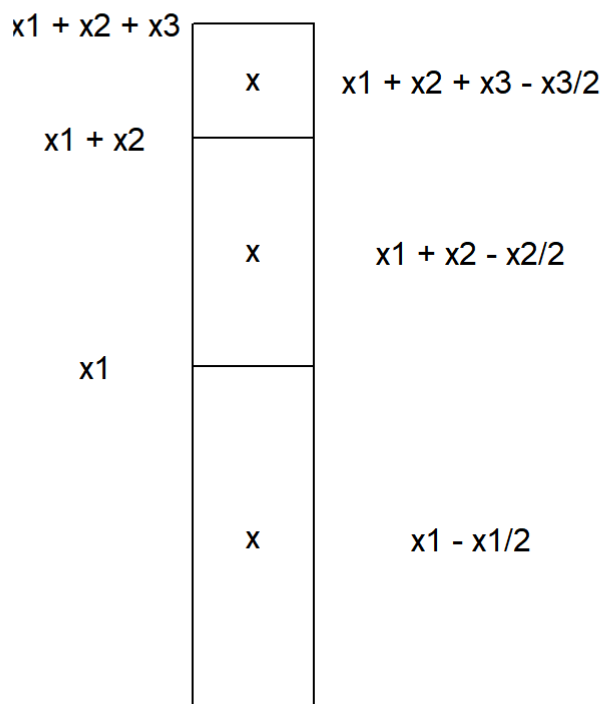

위의 그림으로부터

```
pos <- function(x){
  cumsum(x) - x / 2
  }
```

전체 찬반

pie

```
par(family = "KoPubWorldDotum Medium")
gray_2 <- gray.colors(12)[c(12, 7)]
rainbow_2 <- rainbow(2)[2:1]
r <- 0.8
pos_total <- pos(prop.table(Vote_total) * 100)
pos_total_x <- r / 2 * cos(2 * pi * pos_total / 100)
pos_total_y <- r / 2 * sin(2 * pi * pos_total / 100)
pie(Vote_total,
    radius = r,
    labels = NA,
    col = rainbow_2)
title(main = "전체 찬반",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "전체 찬반", cex.main = 1.5, family = "KoPubWorldDotum
## Bold"): font family not found in Windows font database
```

```
text(x = pos_total_x, y = pos_total_y,
     labels = paste(names(Vote_total),
                    format(Vote_total, big.mark = ","),
                    sep = ":"))
```

```
## Warning in text.default(x = pos_total_x, y = pos_total_y, labels =
## paste(names(Vote_total), : font family not found in Windows font database
```

전체 찬반

찬성:98,657

반대:74,149
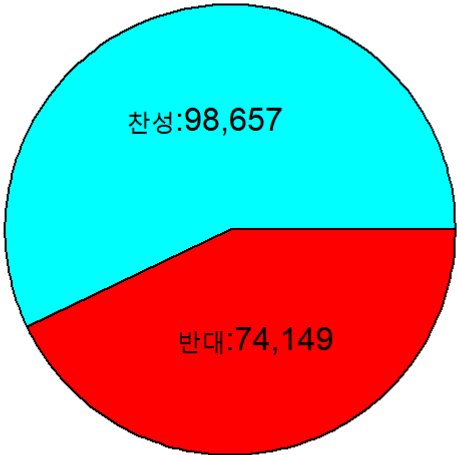
계급별 찬반

pie

```
par(family = "KoPubWorldDotum Medium")
par(mfrow = c(1, 2))
gray_2 <- gray.colors(12)[c(12, 7)]
rainbow_2 <- rainbow(2)[2:1]
r <- 0.8
pos_Class_2 <- apply(prop.table(Vote_Class_2, margin = 2) * 100,
                     MARGIN = 2,
                     FUN = pos)
pos_Class_2_x <- apply(pos_Class_2,
                       MARGIN = 2,
                       FUN = function(x){r / 2 * cos(2 * pi * x / 100)})
pos_Class_2_y <- apply(pos_Class_2,
                       MARGIN = 2,
                       FUN = function(x){r / 2 * sin(2 * pi * x / 100)})
pie(Vote_Class_2[, "관료"],
    radius = r,
    labels = NA,
    col = rainbow_2)
title(main = "관료",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "관료", cex.main = 1.5, family = "KoPubWorldDotum
## Bold"): font family not found in Windows font database
```

```
text(x = pos_Class_2_x[, "관료"],
     y = pos_Class_2_y[, "관료"],
     labels = paste(names(Vote_Class_2[, "관료"]),
                    format(Vote_Class_2[, "관료"], big.mark = ","),
                    sep = ":"))
```

```
## Warning in text.default(x = pos_Class_2_x[, "관료"], y = pos_Class_2_y[, : font
## family not found in Windows font database
```

```
pie(Vote_Class_2[, "품관촌민"],
    radius = r,
    labels = NA,
    col = rainbow_2)
title(main = "품관촌민",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "품관촌민", cex.main = 1.5, family = "KoPubWorldDotum
## Bold"): font family not found in Windows font database
```
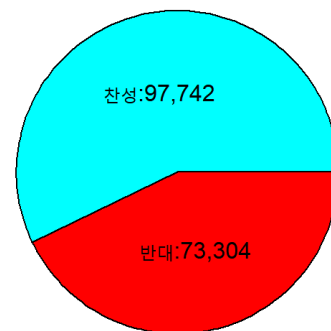
```
text(x = pos_Class_2_x[, "품관촌민"],
     y = pos_Class_2_y[, "품관촌민"],
     labels = paste(names(Vote_Class_2[, "품관촌민"]),
                    format(Vote_Class_2[, "품관촌민"], big.mark = ","),
                    sep = ":"))
```

```
## Warning in text.default(x = pos_Class_2_x[, "품관촌민"], y = pos_Class_2_y[, :
## font family not found in Windows font database
```
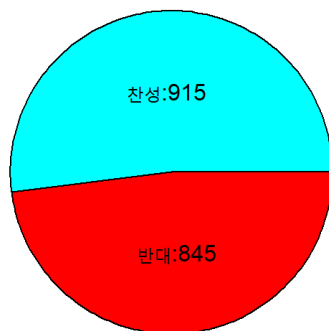
관료   **품관촌민**


```
par(mfrow = c(1, 1))
```

지역별 찬반

barplot

```
par(family = "KoPubWorldDotum Medium")
pos_Region <- apply(Vote_Region, MARGIN = 2, pos)
values_Region <- ifelse(Vote_Region >= 1500,
                        Vote_Region, numeric(0))
labels_Region <- ifelse(is.na(values_Region),
                        "",
                        format(values_Region, big.mark = ","))
b1 <- barplot(Vote_Region,
              col = rainbow_2,
              axes = FALSE)
```

```
## Warning in axis(if (horiz) 2 else 1, at = at.l, labels = names.arg, lty =
## axis.lty, : font family not found in Windows font database
```

```
text(x = rep(b1, 2),
     y = c(t(pos_Region)),
     labels = c(t(labels_Region)))
legend("topleft",
       inset = 0.05,
       fill = rainbow_2,
       legend = c("찬성", "반대"))
title(main = "지역별 찬반",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "지역별 찬반", cex.main = 1.5, family = "KoPubWorldDotum
## Bold"): font family not found in Windows font database
```
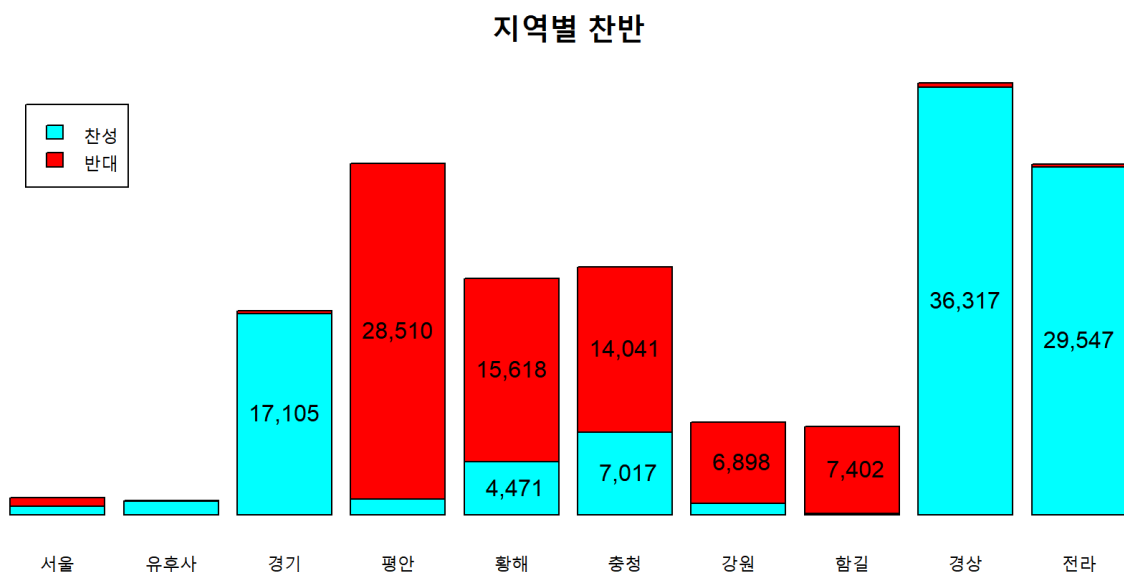
mosaicplot

이름이 겹쳐서 유후사를 제외함.

```
par(family = "KoPubWorldDotum Medium")
mosaicplot(t(Vote_Region[, -2]),
           col = rainbow_2,
           main = "",
           xlab = "계급",
           ylab = "찬반",
           off = c(3, 1))
```

```
## Warning in title(main, sub = sub, xlab = xlab, ylab = ylab): font family not
## found in Windows font database

## Warning in title(main, sub = sub, xlab = xlab, ylab = ylab): font family not
## found in Windows font database
```

```
## Warning in text.default(x = x.l + (x.r - x.l)/2, y = 1000 - 35 * cex.axis/0.66
## + : font family not found in Windows font database
```

```
## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database

## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database

## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database
```

```
title(main = "지역별 찬반",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "지역별 찬반", cex.main = 1.5, family = "KoPubWorldDotum
## Bold"): font family not found in Windows font database
```

King Sejong's National Referendum on Tax Reform (R-Base Plot)

지역별 찬반

계급
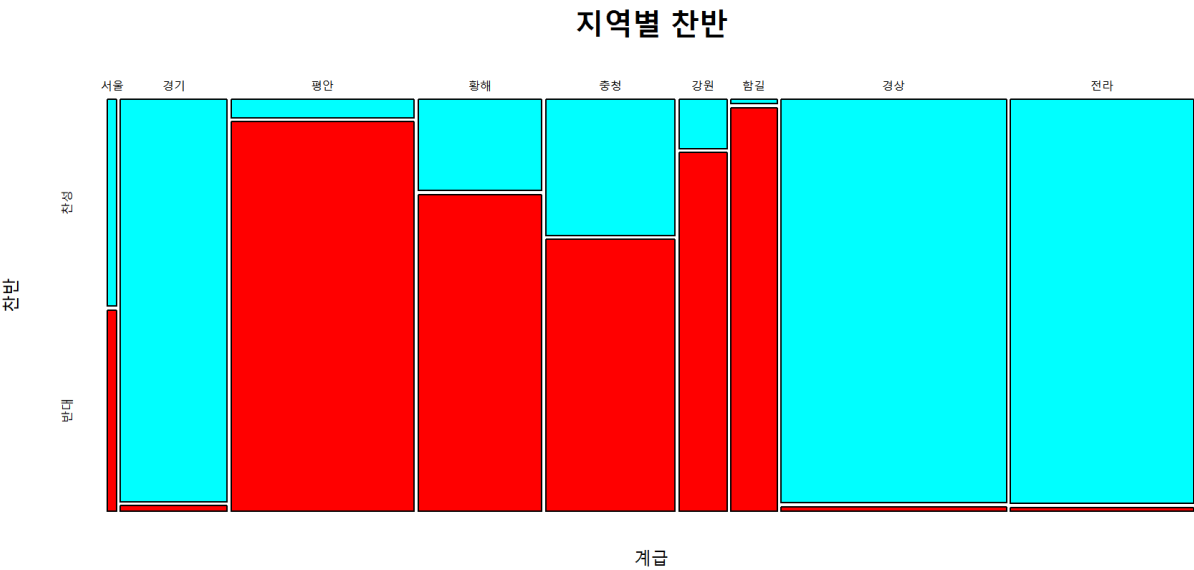
서울의 찬반

## barplot

```
par(family = "KoPubWorldDotum Medium")
pos_seoul_Class <- apply(Vote_seoul_Class, MARGIN = 2, pos)
values_seoul_Class <- ifelse(Vote_seoul_Class >= 100,
                             Vote_seoul_Class, numeric(0))
labels_seoul_Class <- ifelse(is.na(values_seoul_Class),
                             "",
                             format(values_seoul_Class, big.mark = ","))
b2 <- barplot(Vote_seoul_Class,
              col = rainbow_2,
              axes = FALSE)
```

```
## Warning in axis(if (horiz) 2 else 1, at = at.l, labels = names.arg, lty =
## axis.lty, : font family not found in Windows font database
```

```
text(x = rep(b2, 2),
     y = c(t(pos_seoul_Class)),
     labels = c(t(labels_seoul_Class)))
legend("topleft",
       inset = 0.05,
       fill = rainbow_2,
       legend = c("찬성", "반대"))
title(main = "서울의 찬반",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "서울의 찬반", cex.main = 1.5, family = "KoPubWorldDotum
## Bold"): font family not found in Windows font database
```

서울의 찬반
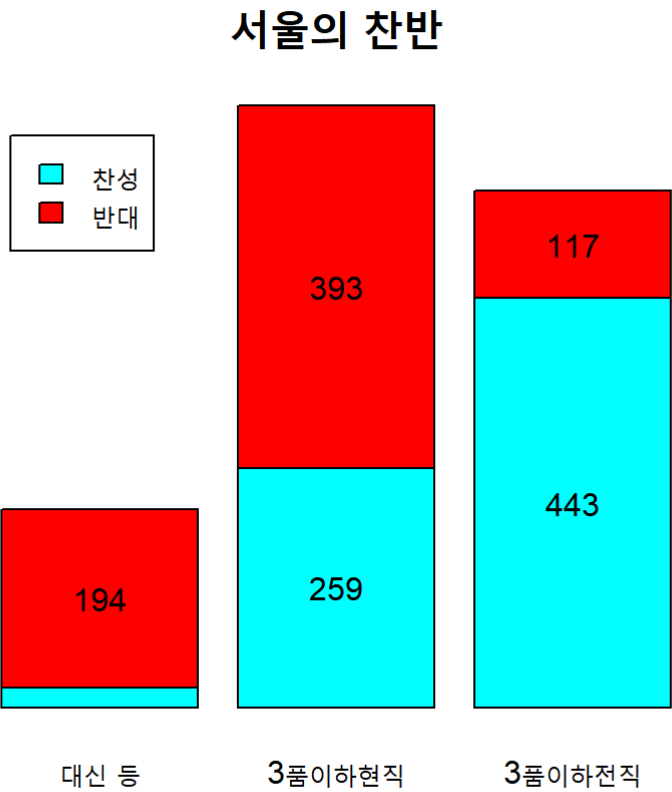
mosaic plot

```
par(family = "KoPubWorldDotum Medium")
mosaicplot(t(Vote_seoul_Class),
           col = rainbow_2,
           main = "",
           xlab = "계급",
           ylab = "찬반",
           off = 1)
```

```
## Warning in title(main, sub = sub, xlab = xlab, ylab = ylab): font family not
## found in Windows font database

## Warning in title(main, sub = sub, xlab = xlab, ylab = ylab): font family not
## found in Windows font database
```

```
## Warning in text.default(x = x.l + (x.r - x.l)/2, y = 1000 - 35 * cex.axis/0.66
## + : font family not found in Windows font database
```

```
## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database

## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database

## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database
```

```
title(main = "서울의 찬반",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "서울의 찬반", cex.main = 1.5, family = "KoPubWorldDotum
## Bold"): font family not found in Windows font database
```

서울의 찬반

계급
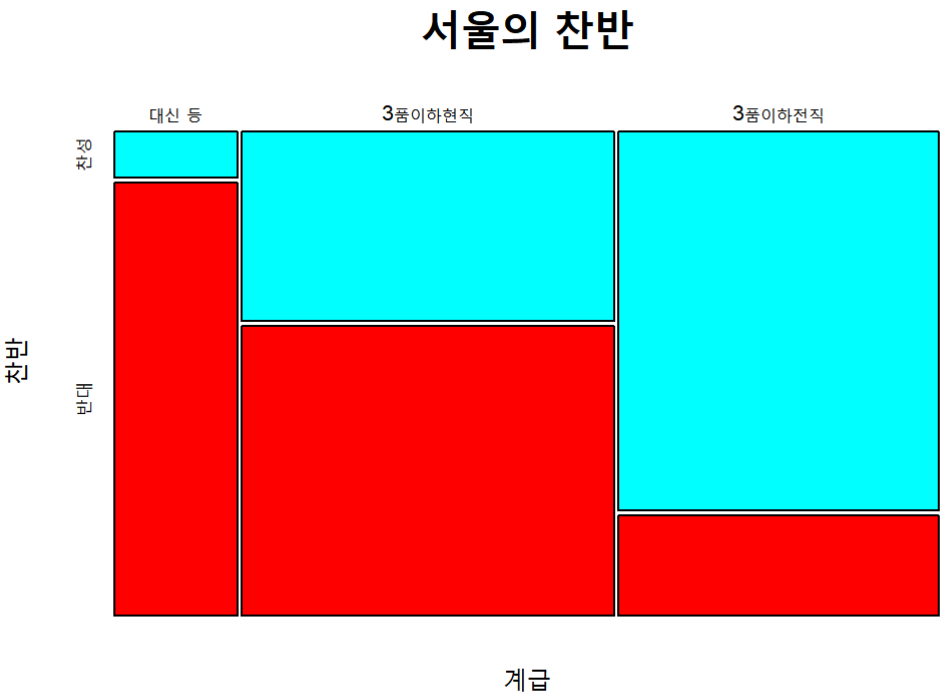
관료의 지역별 찬반 (서울 제외)

barplot

```
par(family = "KoPubWorldDotum Medium")
pos_Region_bureaus <- apply(Vote_Region_bureaus[, -1], MARGIN = 2, pos)
values_Region_bureaus <- ifelse(Vote_Region_bureaus[, -1] >= 5,
                                Vote_Region_bureaus[, -1], numeric(0))
labels_Region_bureaus <- ifelse(is.na(values_Region_bureaus),
                                "",
                                format(values_Region_bureaus, big.mark = ","))
b3 <- barplot(Vote_Region_bureaus[, -1],
              col = rainbow_2,
              axes = FALSE)
```

```
## Warning in axis(if (horiz) 2 else 1, at = at.l, labels = names.arg, lty =
## axis.lty, : font family not found in Windows font database
```

```
text(x = rep(b3, 2),
     y = c(t(pos_Region_bureaus)),
     labels = c(t(labels_Region_bureaus)))
legend("topleft",
       inset = 0.05,
       fill = rainbow_2,
       legend = c("찬성", "반대"))
title(main = "관료의 지역별 찬반",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "관료의 지역별 찬반", cex.main = 1.5, family =
## "KoPubWorldDotum Bold"): font family not found in Windows font database
```

관료의 지역별 찬반
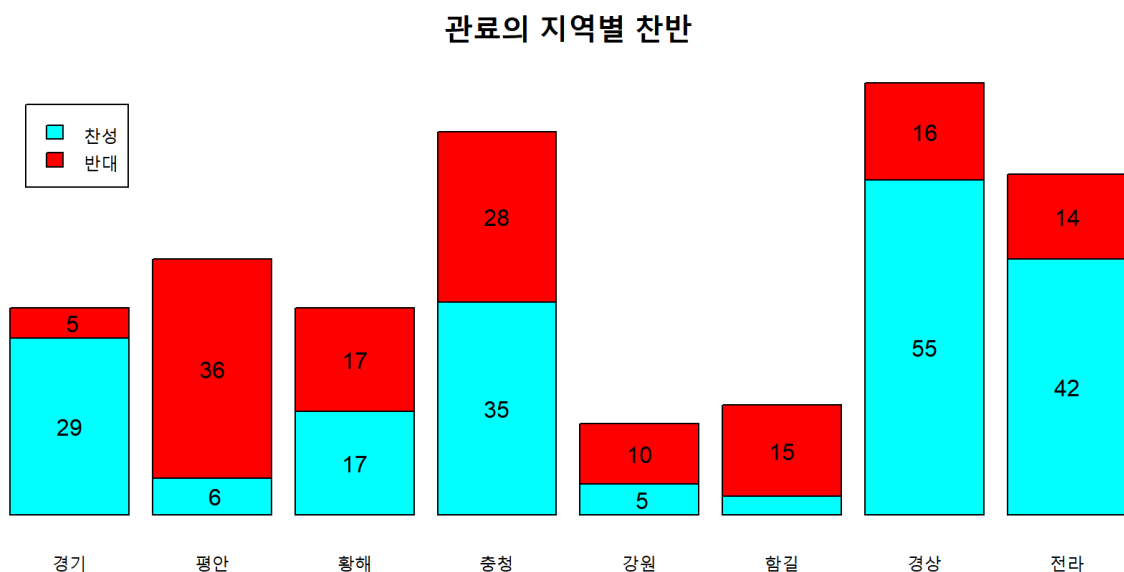
mosaicplot

```
par(family = "KoPubWorldDotum Medium")
mosaicplot(t(Vote_Region_bureaus[, -1]),
           col = rainbow_2,
           main = "",
           xlab = "계급",
           ylab = "찬반",
           off = c(2, 1))
```

```
## Warning in title(main, sub = sub, xlab = xlab, ylab = ylab): font family not
## found in Windows font database

## Warning in title(main, sub = sub, xlab = xlab, ylab = ylab): font family not
## found in Windows font database
```

```
## Warning in text.default(x = x.l + (x.r - x.l)/2, y = 1000 - 35 * cex.axis/0.66
## + : font family not found in Windows font database
```

```
## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database

## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database

## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database
```

```
title(main = "관료의 지역별 찬반(서울 제외)",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "관료의 지역별 찬반(서울 제외)", cex.main = 1.5, : font
## family not found in Windows font database
```

관료의 지역별 찬반(서울 제외)
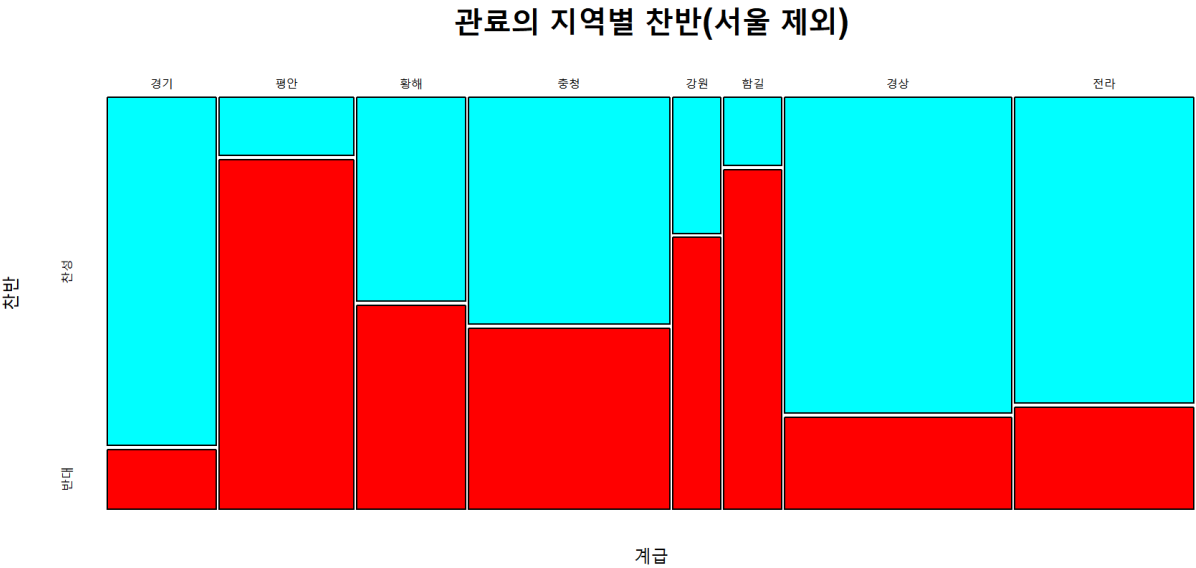
품관촌민의 지역별 찬반

barplot

```
par(family = "KoPubWorldDotum Medium")
pos_Region_commons <- apply(Vote_Region_commons, MARGIN = 2, pos)
values_Region_commons <- ifelse(Vote_Region_commons >= 1500,
                                Vote_Region_commons, numeric(0))
labels_Region_commons <- ifelse(is.na(values_Region_commons),
                                "",
                                format(values_Region_commons, big.mark = ","))
b4 <- barplot(Vote_Region_commons,
              col = rainbow_2,
              axes = FALSE)
```

```
## Warning in axis(if (horiz) 2 else 1, at = at.l, labels = names.arg, lty =
## axis.lty, : font family not found in Windows font database
```

```
text(x = rep(b4, 2),
     y = c(t(pos_Region_commons)),
     labels = c(t(labels_Region_commons)))
legend("topleft",
       inset = 0.05,
       fill = rainbow_2,
       legend = c("찬성", "반대"))
title(main = "품관촌민의 지역별 찬반",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "품관촌민의 지역별 찬반", cex.main = 1.5, family =
## "KoPubWorldDotum Bold"): font family not found in Windows font database
```

품관촌민의 지역별 찬반
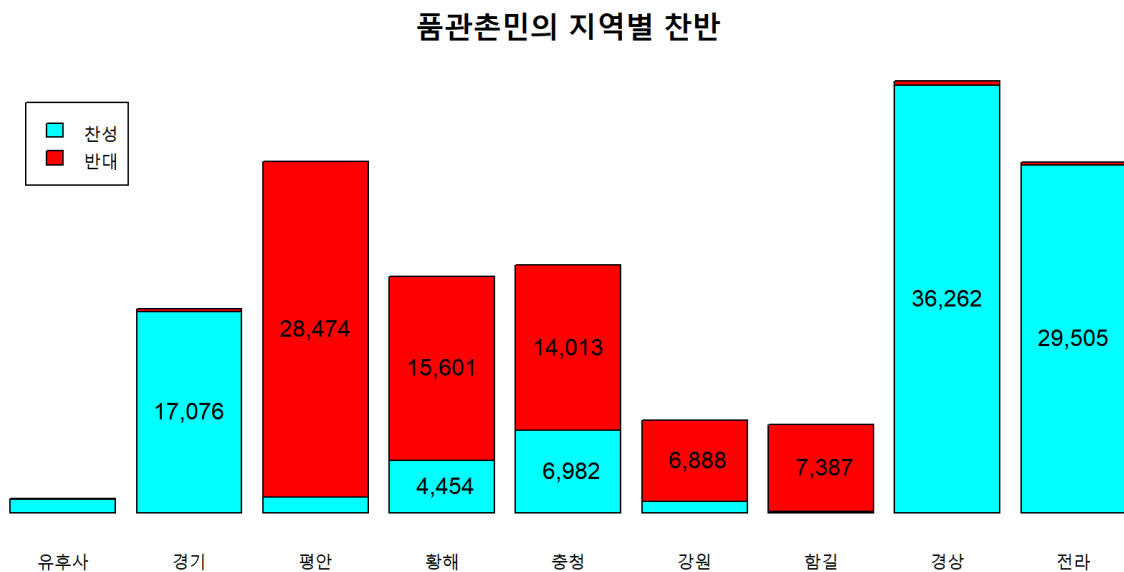
mosaicplot

```
par(family = "KoPubWorldDotum Medium")
mosaicplot(t(Vote_Region_commons),
           col = rainbow_2,
           main = "",
           xlab = "지역",
           ylab = "찬반",
           off = c(2, 1))
```

```
## Warning in title(main, sub = sub, xlab = xlab, ylab = ylab): font family not
## found in Windows font database

## Warning in title(main, sub = sub, xlab = xlab, ylab = ylab): font family not
## found in Windows font database
```

```
## Warning in text.default(x = x.l + (x.r - x.l)/2, y = 1000 - 35 * cex.axis/0.66
## + : font family not found in Windows font database
```

```
## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database

## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database

## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database
```

```
title(main = "품관촌민의 지역별 찬반",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "품관촌민의 지역별 찬반", cex.main = 1.5, family =
## "KoPubWorldDotum Bold"): font family not found in Windows font database
```

품관촌민의 지역별 찬반

지역
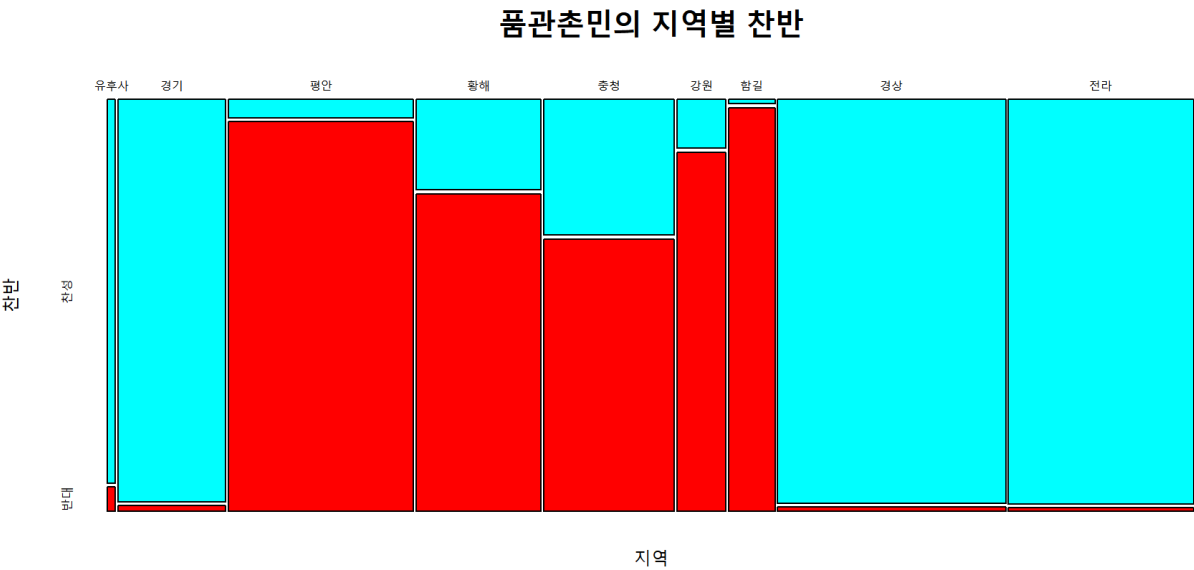
충청의 경우

관료들의 찬반과 품관촌민의 찬반이 다른 곳.

barplot

```
par(family = "KoPubWorldDotum Medium")
pos_chung_Class <- apply(prop.table(Vote_chung_Class, margin = 2) * 100,
                         MARGIN = 2,
                         FUN = pos)
values_chung_Class <- ifelse(prop.table(Vote_chung_Class, margin = 2) * 100 >= 20,
                      Vote_chung_Class, numeric(0))
labels_chung_Class <- ifelse(is.na(values_chung_Class),
                       "",
                       format(values_chung_Class, big.mark = ","))
b5 <- barplot(prop.table(Vote_chung_Class, margin = 2) * 100,
              col = rainbow_2,
              axes = FALSE)
```

```
## Warning in axis(if (horiz) 2 else 1, at = at.l, labels = names.arg, lty =
## axis.lty, : font family not found in Windows font database
```

```
text(x = rep(b5, 2),
     y = c(t(pos_chung_Class)),
     labels = c(t(labels_chung_Class)))
legend("topleft",
       inset = 0.05,
       fill = rainbow_2,
       legend = c("찬성", "반대"))
title(main = "충청의 찬반",
      cex.main = 1.5,
      family = "KoPubWorldDotum Bold")
```

```
## Warning in title(main = "충청의 찬반", cex.main = 1.5, family = "KoPubWorldDotum
## Bold"): font family not found in Windows font database
```

충청의 찬반
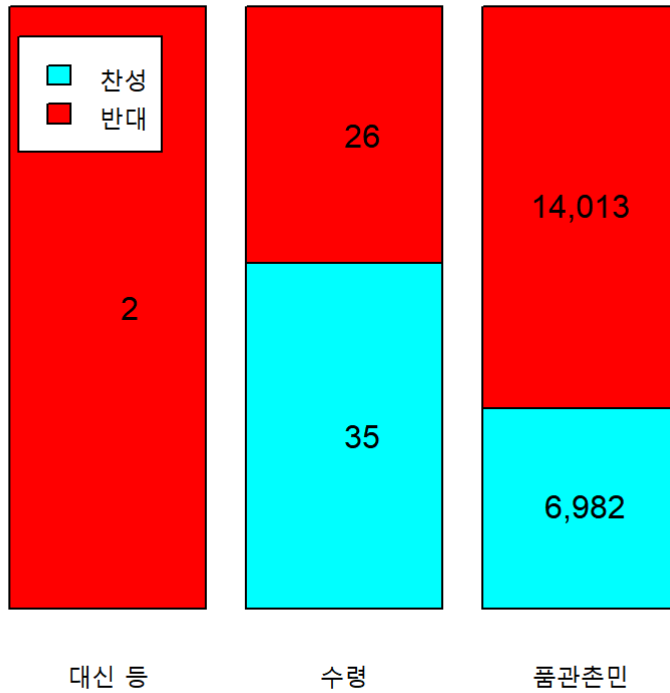
mosaicplot

수효의 차이가 너무 커서 비교하기 어려워서 '대신 등'을 제외하고 작업한다.

```
par(family = "KoPubWorldDotum Medium")
mosaicplot(t(Vote_chung_Class[, -1]),
          col = rainbow_2,
          main = "",
          xlab = "계급",
          ylab = "찬반",
          off = 1)
```

```
## Warning in title(main, sub = sub, xlab = xlab, ylab = ylab): font family not
## found in Windows font database

## Warning in title(main, sub = sub, xlab = xlab, ylab = ylab): font family not
## found in Windows font database
```

```
## Warning in text.default(x = x.l + (x.r - x.l)/2, y = 1000 - 35 * cex.axis/0.66
## + : font family not found in Windows font database
```

```
## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database

## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database

## Warning in text.default(x = 35 * cex.axis/0.66 - 20 * cex.axis/0.66 * (lablevy
## - : font family not found in Windows font database
```

```
title(main = "충청도의 찬반")
```

```
## Warning in title(main = "충청도의 찬반"): font family not found in Windows font
## database
```

충청도의 찬반
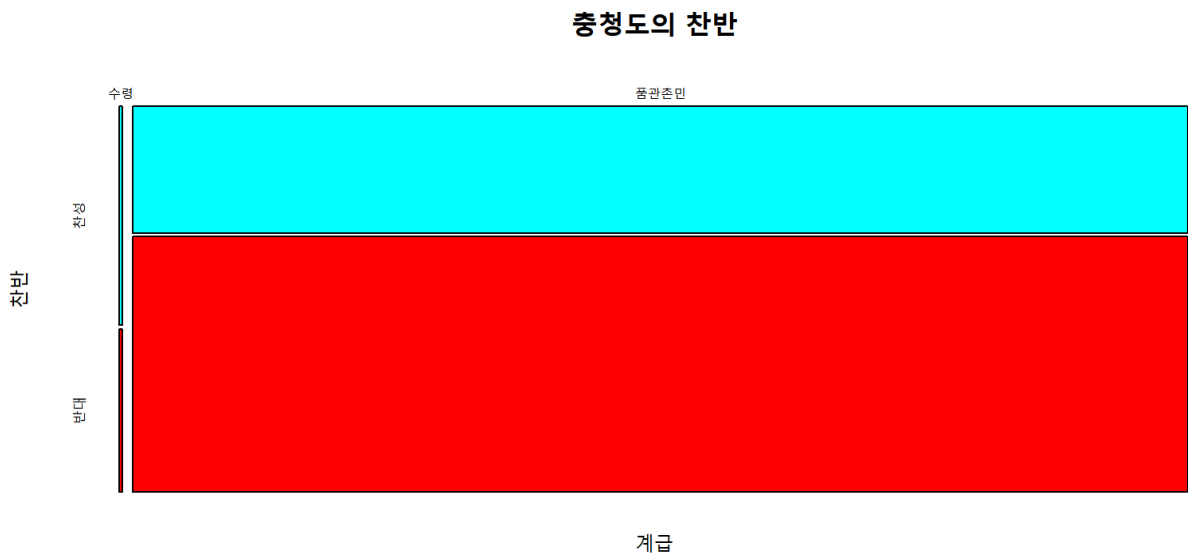
작업 디렉토리 이미지 저장

```
save.image(file = "sejong_Base.RData")
```